

# CAPTSTONE: 2012 Communications

## PHASE 1: DETERMINING THE BIG IDEA

### 1. **Capstone Big Idea:**

The **big idea** of the capstone is clearly articulated in one of the following forms: concept, theme, theory, issue, problem, process, paradox, perspective

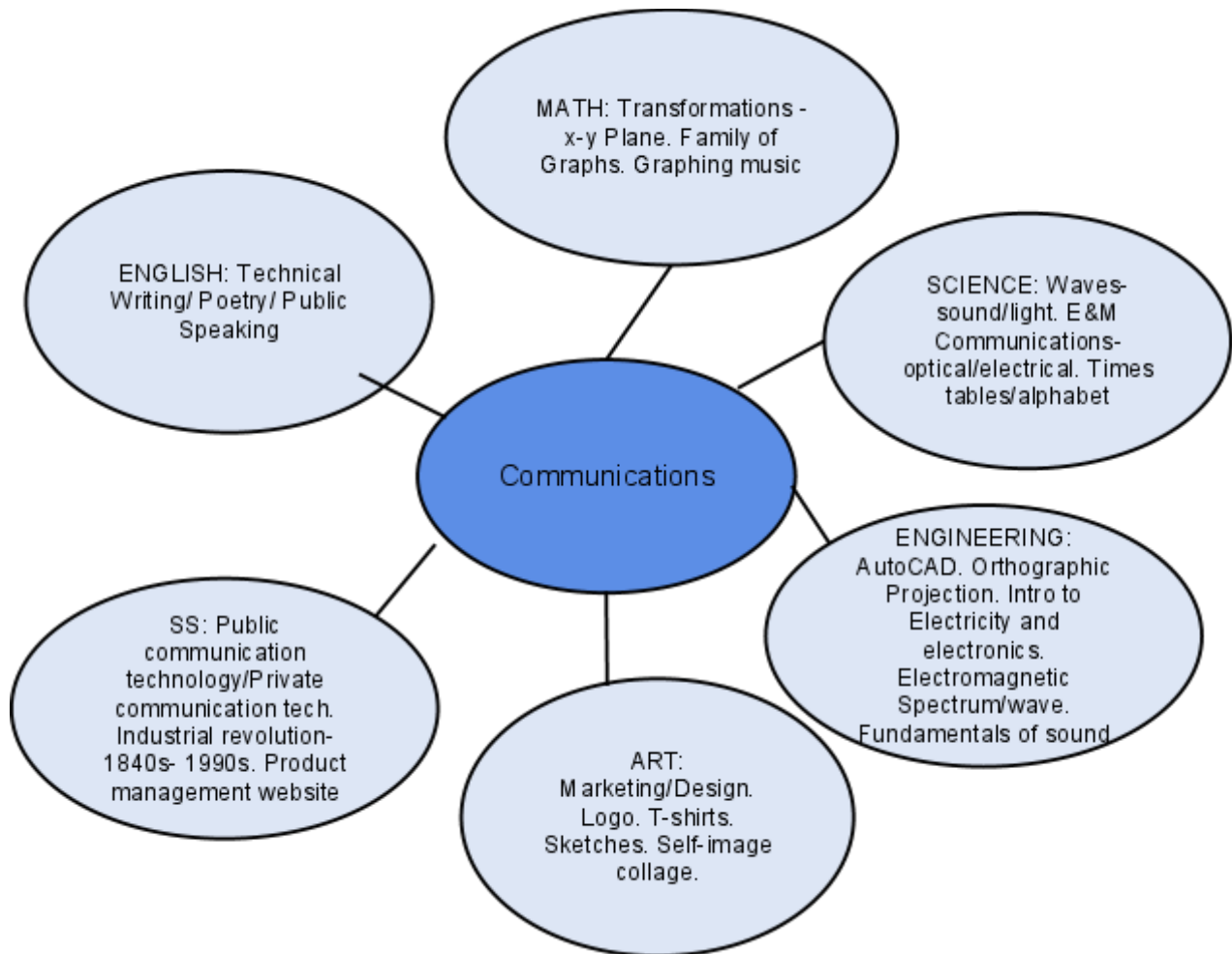
Every person living on Earth, small, weak, powerful or rich is given the opportunity to communicate, but their message isn't always clear. What if you only had one moment, one shot to share your voice with the world? What would you say? What would you wish to tell the world about your life, your expectations, your doubts, your desires, your values, your emotions, your dreams? What would your message be?  
The Communication Capstone is meant to help students define their message and share it with the world.

Students will have an authentic engineering team work experience in which the strengths of each member of the group is utilized for the good of the common product. The groups will be composed of four students that will have specific roles. The groups will work over a 10 week period to complete three major construction components to a sound system. First the groups will design and construct an amplifier. Next, students will create a housing unit that will hold the amplifier and a speaker. Lastly, students will use software to write an original piece of music and may also incorporate instruments and live vocals if they so choose. Students will also be creating a light display that will be a visual interpretation of the music they have created. The groups will give a "performance" using their constructed sound system in which they play their original piece of music through the speaker and amplifier, showcase the light display and marketing components.



## 2. Trans-disciplinary Curriculum Web:

Identify the team members that will participate on the creation of the Capstone / Big Idea. This should consist of building level disciplines but may extend other grade level courses. (Ex. Government, American History and Government)



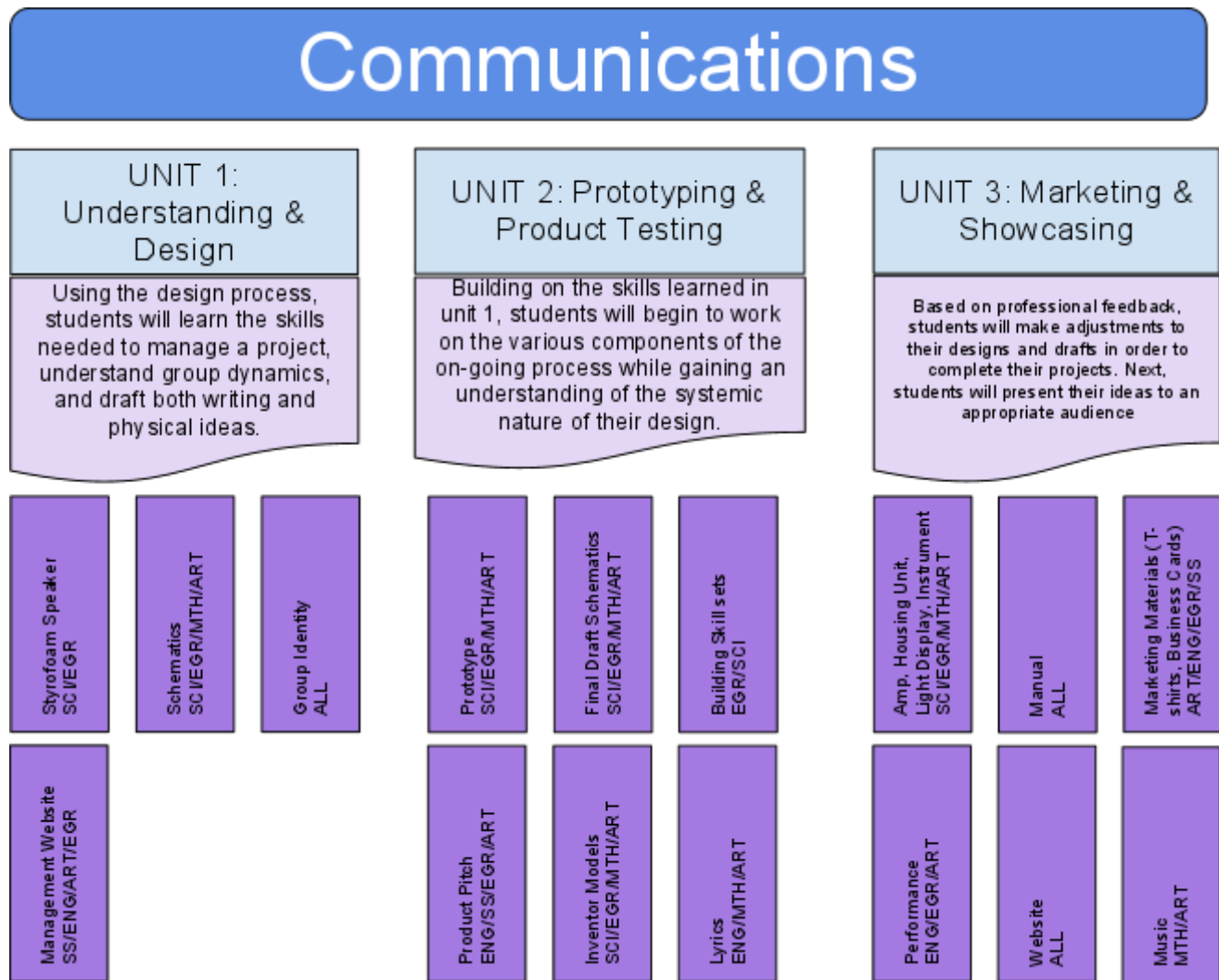
### 3. Essential Questions

What Essential Questions/ Critical Problem encourages students to uncover/probe deeper into knowledge in all six disciplines? How do we engage our students around the concept of \_\_\_\_\_? Should be evident in all the Units.

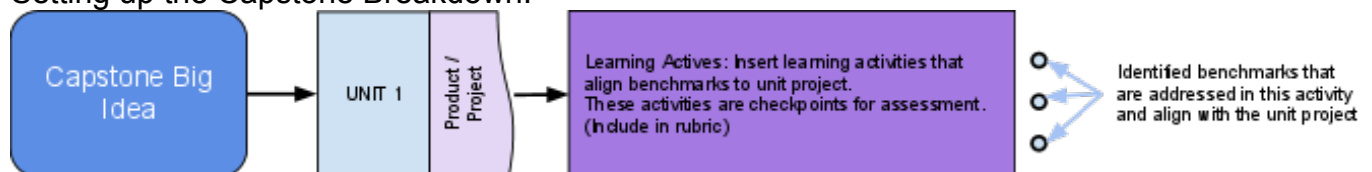
Selected Questions	Questions to consider (Brainstorm)
<ul style="list-style-type: none"><li>What's your message</li></ul>	<ul style="list-style-type: none"><li>What would you say if you had a limited amount of time?</li><li>How does time affect the message?</li><li>Why is it important to adjust your communication style in different situations?</li><li>Why can the same message be interpreted in different ways and what are the variables?</li><li>Can the message be lost in the medium?</li><li>Can the message change the universe?</li><li>Can you hear but not listen?</li><li>How does art direct your message?</li><li>Can your message have color?</li><li>Is the medium the message?</li><li>Can you send your message without using words?</li></ul>

## 4. Capstone Breakdown

Pencil in titles that would break down the Big Ideas into smaller Project Based Units. The units would have individual end products/projects that each has essential questions, specified subject area benchmarks, mastery learning goals, project rubrics, and learning activities.



Setting up the Capstone Breakdown:



## 5. Subject Matter Goals:

Develop subject matter goals for the capstone. How does your content connect to the big idea?

### Example: English Language Arts:

Reading: Reading comprehension on metaphorical light through short fiction

Writing: Display Description Panel, Lesson Plan

Speaking: Lesson Teaching, Timing, Public Speaking

Listening: GE Presentations on light

### English Language Arts:

- Discourse through public speaking and professional communication
- Figurative language and literary interpretation through poetry
- Technical writing through the composition of a manual for building a functional speaker

### Math Goals:

- Music Structure: Identifying and manipulating the structure of music as fractional elements of the whole
- Music Composition: Using transformative properties of matrix mathematics as a method to modify sounds and create new sounds
- Sound System: Applying mathematics to the processes of specifying, designing and building, including measurement, scaling, statistics, and size calculations
- Technical Manuals: Communicating by expressing processes through mathematical language used appropriately in context
- Students will understand graph families and graphing music

### Science Goals

- Sound: Physical characteristics of vibration waves.
- Novel creation of Vibration Waves: Design of unique instrument.
- Electricity and Magnetism: Basic overview of electric and magnetic forces.
- Electromagnets: Using electricity to create a magnetic field.
- Electromagnetic Energy in Light: Combining electric and magnetic forces to generate electromagnetic waves.
- Antennas: Creating devices to receive radio signals
- Novel Uses of Vibration Waves and Electromagnetic Waves: Research, Design, and Creation as time permits.

### Engineering Goals

- Fundamentals of electronics
- Electromagnetic theory and its function in the production of sound
- Electrical theory including Ohm's Law, polarity, AC/DC and series/parallel
- Fundamentals of sound production as it relates to electrical impulses
- Characteristics of sound waves and application to calculating delay lines
- Specific electronic components: Capacitors, resistors, transistors, etc.
- Fundamentals of technological communications: Orthographics, 3-view, CAD
- Fundamentals of Media communications: Sound engineering, Elect. Comm.
- Fundamentals of precise measuring tools: Dial caliper, micrometer

### **Social Studies Goals**

- Students will understand the first amendment and their own first amendment rights
- Students will learn about speech and the power of well-written, historical speech patterns
- Students will learn basic economics, production, and supply and demand theory
- Students will understand the evolution of communication including public vs. private communication
- Students will research and understand the industrial revolution

### **Art Goals**

- Students will engage in art forums/practice to learn style and structure of painting and film their message. "Painting the plate" & "the art of expression with words" & Film Making: Art Expression w Paint/Music/Film
- Students will write an aesthetic paper using the elements of art to explain how their message defines works of art.
- Students will construct images and demonstrate learned principles of art in/for their manual, brochure and poster. Marketing Art: Branding Brochure & Posters



# PHASE 2: Operationalizing

## 6. Benchmark Alignment/ Trans-disciplinary Project Based Units

Content Standards and Benchmarks that were identified for the CAPSTONE that have natural disciplinary connections and are overlapping in theme, ideas, topics, etc.

The benchmarks codes will be concatenated together and placed in the first column of the unit rubric.

Example:

Benchmark(s) (Code)	Mastery Learning Goals	Exceeding 4	Mastery 3	Reaching 2	Basic 1
SCI INQR 9-10 A SCI KNWG 9-10 D SCI KNWG 11-12 C		Phase 3	Phase 3	Phase 3	Phase 3

### ELA - English Language Arts

Unit Title	Benchmark Code	Benchmark
c	ELA 8-10 COMM D	Demonstrate an understanding of effective speaking strategies by selecting appropriate language and adjusting presentation techniques.
c	ELA 8-10 COMM E	Give informational presentations that present ideas in a logical sequence, include relevant facts and details from multiple sources and use a consistent organizational structure.
c	ELA 8-10 COMM G	Give presentations using a variety of delivery methods, visual displays and technology.
c	ELA 8-10 WRTA C	Produce letters (e.g., business, letters to the editor, job applications) that follow the conventional style appropriate to the text, include appropriate details and exclude extraneous details and inconsistencies.
c	ELA 8-10 WRTP F	Prepare writing for publication that is legible,
c	ELA 8-10 VOCB A,	Use context clues and text structures to determine the meaning of new vocabulary.
c	ELA 8-10 VOCB F	Use multiple resources to enhance comprehension of vocabulary.
c	ELA 8-10 CNCP A	Apply reading comprehension strategies to understand grade-appropriate text.
c	VOCB 8-10 B	Examine the relationships of analogical statements to infer word meanings.
c	VOCB 8-10 C	Recognize the importance and function of figurative language.
c	CNCP 8-10 A	Apply reading comprehension strategies to understand grade-appropriate text.

### SCIENCE

Unit Title	Benchmark Code	Benchmark
c	SCI-PHY-11-12-C	Describe how atoms and molecules can gain or lose energy only in discrete amounts.
c	SCI-PHY-9-10-H	Trace the historical development of scientific theories and ideas, and describe emerging issues in the



		study of physical sciences.
c	SCI-PHYS-11-12-E	Summarize the historical development of scientific theories and ideas within the study of physical sciences.
c	SCI-KNWG-11-12-A	Explain how scientific evidence is used to develop and revise scientific predictions, ideas or theories.
c	SCI-PHYS-9-10-G	Demonstrate that waves (e.g., sound, seismic, water and light) have energy and waves can transfer energy when they interact with matter.
c	SCI-TECH-9-10-A	Predict how human choices today will determine the quality and quantity of life on Earth.

## MATH

UNIT Title	Benchmark Code	Benchmark
c	Math CC.9-12.F.IF.1	Understand the definition of function.
c	Math CC.9-12.F.IF.2	Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
c		
c	Math CC.9-12.F.IF.4	Interpret key features of graphs and tables and sketch graphs showing key features, including symmetry and periodicity.
c	Math CC.9-12.F.IF.5	Relate the domain of a function to its graph and to the quantitative relationship it describes
c	Math CC.9-12.F.IF.7e	Graph trigonometric functions showing period and amplitude.
c	Math CC.9-12.G.C	Experiment with transformations in the plane
c	Math CC.9-12.G.CO.1	Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment.
c	Math CC.9-12.G.CO.2	Represent transformations in the plane using graph paper or geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).
c	Math CC.9-12.G.CO.3	Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.
c	Math CC.9-12.G.CO.4	Develop definitions of rotations, reflections and translations.
c	Math CC.9-12.G.CO.5	Given a geometric figure and a rotation, reflection or translation, draw the transformed figure using graph paper or geom
c	Math CC.9-12.A.CED.3	Represent constraints by equations or inequalities.
c	Math CC.9-12.F.IF	Understand the concept of a function and use function notation
c	Math CC.9-12.G.CO.12	Make formal geometric constructions with a variety of tools and methods.

## ENGINEERING





UNIT Title	Benchmark Code	Benchmark
c	EGR 14.2	Understand and apply geometric constraints in the build of a sound system
c	EGR 15.3	Select the materials and components to complete a functioning three dimensional prototype and list them in a schematics file
c	EGR 15.5	Generate sketches in orthographics and 3-view, and generate a model using CAD software.
c	EGR 3.A	Write and utilize coherent persuasive and focused technical communications
c	EGR 94.1	Understand and explain electrical theory
c	EGR 95.1	Identify and describe electronic components
c	EGR 95.2	Demonstrate and explain soldering and soldering application
c	EGR 95.5	Produce and explain block diagrams, schematics and wiring diagram

## SOCIAL STUDIES

UNIT	Benchmark Code	Benchmark
c	SS ECON 11-12 A	Analyze how scarcity of productive resources affects supply, demand, inflation and economic choices.
c	SS ECON 11-12 E	Explain the use of a budget in making personal economic decisions and planning for the future.
c	SS SKLS 11-12 D	Work in groups to analyze an issue and make decisions.
c	SS PEPL 11-12 A	Analyze how issues may be viewed differently by various cultural groups.
c	SS PEPL 11-12 C	Explain the role of diverse cultural institutions in shaping American society.

## Art

UNIT	Benchmark Code	Benchmark
C	Art Anly: 9-12 C	Engage in ongoing assessment to revise and improve artworks and to produce a portfolio of works.
C	ART EXPR 9.-12 A	Demonstrate mastery of materials, concepts and personal concentration when creating original artworks.
C	Art EXPR: 9-12 B	Create expressive artworks that demonstrate a sense of purpose and understanding of the relationship among form, materials, techniques and subject matter.
C	Art Expr: 9-12 C	Engage in ongoing assessment to revise and improve artworks and to produce a portfolio of works.

## 7. Creation of **Mastery Learning Goals** - Unit

The identified capstone benchmarks should be operationalized as capstone Mastery Learning Goals that describe clearly the expected student performance aligned to the benchmarks. These Mastery Learning Goals will be plugged into the units' project rubrics.

Mastery Learning Goals = What does it look like when students demonstrate mastery of the benchmarks in the project?

Example:



Benchmark(s) (Code)	Mastery Learning Goals	Exceeding 4	Mastery 3	Reaching 2	Basic 1
SCI INQR 9-10 A SCI KNWG 9-10 D SCI KNWG 11-12 C	Students will apply the processes of scientific investigation/inquiry, citizenship, and social action by creating teaching models, lesson plans, and learning activities to teach a class about light, cells, and the energy pyramid.	Phase 3	Phase 3	Phase 3	Phase 3

## 8. Unit - Performance Criteria (Rubrics):

You can use a holistic rubric or a criterion rubric to measure your performance assessment. Insert your rubric below the samples provided. The scale is an example, but you can design the scale and criteria that best fits your intended outcomes. The capstone's mastery learning goals are deconstructed and represented in a rubric that describes clear, scaffolded performance criteria for the demo of mastery learning, as well as, learning that goes beyond mastery, approaches mastery, or is basic to mastery.

Unit 1		
Operational Question	Mastery	Incomplete
<b>Styrofoam Speakers</b>		
<b>SCI-PHYS-9-10-G</b> <b>Demonstrate that waves (e.g., sound, seismic, water and light) have energy and waves can transfer energy when they interact with matter. (Styrofoam Speakers)</b>	Student can evaluate a styrofoam driver for it's frequency range as well as calculate the value of several variables corresponding with speaker performance (decibel level, electrical power requirements, ect...).	Student can only identify basic characteristics of a wave.
<b>Schematics/ Inventor Model</b>		
<b>EGR 94.1 Understand and explain electrical theory. Fundamentals will be applied in the correct wiring of a speaker cabinet and power amplifier.</b>	Thorough understanding of electrical theory, ability to put into practice in working electrical applications. Secifically applying Ohm's Law in determining the proper resistance value of a speaker cabinet in relation to power consumption and output of an amp.	Rudimentary understanding of basic electrical theory. Unable to put into practice. Inability to apply fundamentals in a functioning product.
<b>EGR 95.1 Identify and describe electronic components. Application of knowledge will manifested in the form of a functioning electronic circuit that will light a series of LEDs.</b>	Proficiency in designing and building circuits that correctly employ power supply, switch, potentiometer, resistor, and load. Ability to integrate transistors, capacitors and diodes in sub circuits.	Able to identify some electronic component, unable to explain their function. Able to design a circuit but when built does not function as planned.
<b>EGR 95.5 Produce and explain block diagrams, schematics and wiring diagrams.</b>	Mastery ability to accurately produce schematics and diagrams demonstrating a thorough understanding of electrical and electronic fundamentals.	Ability to produce schematics and block diagrams but understanding of the fundamentals is clearly lacking, evidenced by reversed polarities and components utilized incorrectly doue to lack of understanding of its function.

<b>EGR 95.2 Demonstrate and explain soldering and soldering applications. Ability to do general and point-to-point soldering demonstrated.</b>	Mastery ability to solder without cold solders and over-soldering. Point to point soldering skill achieved.	Soldering ability not yet achieved but approaching moderate skill level. Cold solders and over soldering rampant.
ART EXPR 9.-12. A. Demonstrate mastery of materials, concepts and personal concentration when creating original artworks in the creation of a schematic design	Student applies design principles (such as unity, contrast, balance, movement, direction, emphasis, and center of interest) with great skill. Student can accurately name 5 characteristics of the technique being studied and describe how these 5 characteristics are used in his/her own compositions. Class time was used wisely. Much time and effort went into the planning and design of the mask. It is clear the student worked at home as well as at school.	Student applies design principles (such as unity, contrast, balance, movement, direction, emphasis, and center of interest) with fair skill. Student can accurately name 4 characteristics of the technique being studied and describe how these 4 characteristics are used in his/her own compositions. Class time was used wisely. Student could have put in more time and effort at home.
Math CC.9-12.A.CED.3 Represent constraints by equations or inequalities.	Student will identify a solution as a viable or non-viable option.	Student does not recognize the constraints of a design.
<b>Unit 2</b>		
<b>Operational Question</b>	<b>Mastery</b>	<b>Incomplete</b>
<b>Prototype Speakers</b>		
<b>SCI-PHYS-9-10-G</b> <b>Demonstrate that waves (e.g., sound, seismic, water and light) have energy and waves can transfer energy when they interact with matter.</b>	Student can evaluate a sound system (prototype) for its frequency range as well as calculate the value of several variables corresponding with speaker performance (decibel level, electrical power requirements, ect...).	Student can only identify basic characteristics of a wave.
<b>SCI-PHY-11-12-C Describe how atoms and molecules can gain or lose energy only in discrete amounts.</b>	Student can analyze the spectrum of an element. This benchmark will also provide an opportunity for students to examine the discrete relationship between frequency and tube length in situations with open and closed tubes (instrument prototype).	Student can only identify the elements based on atomic number.

<b>Art EXPR: 9-12 B Student will be able to create expressive artworks that demonstrate a sense of purpose and understanding of the relationship among form, materials, techniques and subject matter through the creation of an original piece of artwork inspired by their message to be displayed at the rock n' roll hall of fame.</b>	Mastery student have learned and taken the painting techniques being studied and applied it in a way that is totally his/her own using originality. The student's personality/voice comes through and used for the backgournd of the personal	Student has copied some painting from the source material. There is little evidence of creativity, but the student has done the assignment.
<b>EGR 94.1 Understand and explain electrical theory through the creation of a cohesive, working sound system</b>	Mastery understanding of electrical theory, ability to put into practice in working electrical applications.	Rudimentary understanding of basic electrical theory. Unable to put into practice. Inability to apply functions and laws
<b>EGR 95.1 Identify and describe electronic components contained within the sound system they have built.</b>	Mastery ability to apply knowledge of electronics in building a electronic devices.	Able to identify some electronic component, unable to explain their function.
<b>EGR 95.5 Produce and explain block diagrams, schematics and wiring diagrams.</b>	Mastery ability to accurately produce schematics and diagrams demonstrating a thorough understanding of electrical and electronic fundamentals.	Ability to produce schematics and block diagrams but understanding of the fundamentals is clearly lacking, evidenced by reversed polarities and components utilized incorrecly doue to lack of understanding of its function.
<b>EGR 95.2 Demonstrate and explain soldering and soldering applications through the proficient use of a soldering iron</b>	Mastery ability to solder without cold solders and over-soldering. Point to point soldering skill achieved.	Soldering abilty not yet achieved but approaching moderate skill level. Cold solders and over soldering rampant.
<b>EGR 15.5 Generate sketches in orthographics and 3-view, and generate a model using CAD software.</b>	Mastery ability in producing orthographics, 3-view and CAD renderings. Skill includes ability to transfer objects format to format easily.	Skill level at the approaching mastery level due to lack of full understanding of ANSI standards. Sketches and CAD repre-sentations done but inaccurate in dimensioning and protocol.

SS HIST 11-12 B: PEPL 11-12 A, C: GEOG 11-12 A: Students should be able to use historical interpretations to explain current issues; analyze how issues may be viewed differently by various cultural groups; explain the role of diverse cultural institutions in shaping American society; and explain how the character and meaning of a place reflect a society's economics, politics, social values, ideology and culture	Students should be able to use historical interpretations to explain current issues by choosing a musical and artistic piece which typifies their culture and explains it's significance in their lives today; explain how the character and meaning of a place reflect a society's economics, politics, social values, ideology and culture by writing a three paragraph essay which demonstrates the historical significance of art and music in their respective cultures; and analyze how issues may be viewed differently by various cultural groups by view and discuss the family culture poster of their peers; and explain the role of diverse cultural institutions in shaping American society by participating in a question and answer session during the presentation of cultural posters.	Students are not able to create and or verbalize information demonstrating a historical connection to selected art or musical selection.
--	--	--

### Unit 3

Operational Question	Mastery	Incomplete
Manual		
<b>SCI-PHY-9-10-H, SCI-PHYS-11-12-E, SCI-KNWG-11-12-A</b> <b>Trace the historical development of scientific theories and ideas (evolution of a scientific ideas via the scientific method), and describe emerging issues in the study of physical sciences.</b>	Student can evaluate the effectiveness of certain efforts throughout history to communicate better by utilizing technological innovations and breakthroughs in scientific thought in the Historical Forward of the manual.	Student can only define the scientific method.
<b>SCI-TECH-9-10-A Explain the ways in which the processes of technological design respond to the needs of society.</b>	Student can evaluate the effectiveness of their sound system design in accomplishing the goals described in the Preface of the manual.	Student can only identify the needs of communication in a society.

<p>ELA 8-10 WRTA C, WRTP F, VOCB A, F, CNCP A. Students will use context clues and text structures to determine the meaning of new vocabulary, use multiple resources to enhance comprehension of vocabulary, apply reading comprehension strategies to understand grade-appropriate text, edit to improve sentence fluency, grammar, and usage, apply tools to judge the quality of writing, prepare writing for publication that is legible, follows an appropriate format and uses techniques such as electronic resources and graphics, in order to produce a functional document that reports, organizes and conveys information and ideas accurately, foresees reader problems or misunderstandings, and includes formatting techniques that are user friendly.</p>	<p>All required elements of manual are present and answered in a factual, meaningful manner. Manual includes whether the findings supported, possible sources of error, and what was learned from the experiment. The writer seems to be writing from knowledge or experience.</p>	<p>One required element of manual is missing. Manual includes what was learned from the experiment. The writer relates some of his own knowledge or experience, but it adds nothing to the discussion of the topic.</p>
<p>ELA 8-10 WRTA C, WRTP F, VOCB A, F, CNCP A. Students will use context clues and text structures to determine the meaning of new vocabulary, use multiple resources to enhance comprehension of vocabulary, apply reading comprehension strategies to understand grade-appropriate text, edit to improve sentence fluency, grammar, and usage, apply tools to judge the quality of writing, prepare writing for publication that is legible, follows an appropriate format and uses techniques such as electronic resources and graphics, in order to produce a functional document that reports, organizes and conveys information and ideas accurately, foresees reader problems or misunderstandings, and includes formatting techniques that are user friendly.</p>	<p>All required elements of manual are present and answered in a factual, meaningful manner. Manual includes whether the findings supported, possible sources of error, and what was learned from the experiment. The writer seems to be writing from knowledge or experience.</p>	<p>One required element of manual is missing. Manual includes what was learned from the experiment. The writer relates some of his own knowledge or experience, but it adds nothing to the discussion of the topic.</p>

<b>EGR 3.A Write and utilize coherent persuasive and focused technical communications that support a defined perspective for engineering and science contained within the manual</b>	Manuals and communication showing a clear understanding of subject matter. Written without syntax, semantic or grammatical errors. Strongly supports additional information not required in original assignment.	Written communications written without proofreading and containing faulty information or logic. Not based completely on accepted principles and theories.
SS ECON 11-12 E. Students will explain the use of a budget in making personal economic decisions and planning for the future through their Bill of Materials in their Schematic file.	Bill of Materials is complete with all required elements that are clearly articulated with proper calculations, product names, and proper amounts of each product needed. BOM also provides a cost benefit analysis.	Bill of Materials is complete but is not done correctly. Calculations are incorrect and product names are not articulated clearly.
<b>Sound System</b>		
<b>SCI-PHYS-9-10-G Demonstrate that waves (e.g., sound, seismic, water and light) have energy and waves can transfer energy when they interact with matter.</b>	Student can evaluate a sound system (final product) for its frequency range as well as calculate the value of several variables corresponding with speaker performance (decibel level, electrical power requirements, etc...).	Student can only identify basic characteristics of a wave.
<b>EGR 15.3 Select the materials and components to complete a functioning three dimensional prototype and list them in a schematics file</b>	Deliverables built with fundamentals applied successfully. Creativeness shown in design and execution of product.	Products barely functioning due to lack of quality in build or lack of understanding of fundamentals and principles.
<b>EGR 14.2 Understand and apply geometric constraints in the build of a sound system</b>	Complete understanding of all given constraints. Constraints actually enhance the build or project by improving what may have been a mediocre design.	Some constraints ignored. Product works but not including constraints adds to the lack of performance.
ART EXPR 9.-12. A. Demonstrate mastery of materials, concepts and personal concentration when creating original artworks in the creation of a sound system	Student applies design principles (such as unity, contrast, balance, movement, direction, emphasis, and center of interest) with great skill. Student can accurately name 5 characteristics of the technique being studied and describe how these 5 characteristics are used in his/her own compositions. Class time was used wisely. Much time and effort went into the planning and design of the mask. It is clear the student worked at home as well as at school.	Student applies design principles (such as unity, contrast, balance, movement, direction, emphasis, and center of interest) with fair skill. Student can accurately name 4 characteristics of the technique being studied and describe how these 4 characteristics are used in his/her own compositions. Class time was used wisely. Student could have put in more time and effort at home.



Math CC.9-12.G.CO.12 Make formal geometric constructions with a variety of tools and methods. CC.9-12.A.CED.3 Represent constraints and interpret solutions as viable or non-viable.	Student will construct within constraints for area, volume, circumference and similarity.	Construction does not meet specifications.
<b>Lyrics</b>		
VOCB 8-10 B, VOCB 8-10 C, CNCP 8-10 A SS SKLS 11-12 D. Students will work in groups to analyze an issue and make decisions by voting on the final poem, song, and painting for the Rock Hall performance: Students will examine the relationships of analogical statements to infer word meanings, recognize the importance and function of figurative language, apply reading comprehension strategies to understand grade-appropriate text by writing unique and interesting lyrics surrounding the theme of "what is your message"	Student exhibits advanced understanding of analogical statements and figurative language in a way that is creative and original. Student recognizes multiple dimensions of the term communication and expresses that in poetry.	Student uses simple figurative language. Student recognizes more than one definition of the term communication and expresses that in poetry.
Art Anly: 9-12 C Critique their own works, the works of peers and other artists on the basis of the formal, technical and expressive aspects in the works related to their message through the selection process of the appropriate artwork	Mastery students will accurately produce a storyboard complete with sketches for each scene, detailed notes on titles, transitions, special effects, sound, etc. Storyboard reflects outstanding planning and organization for the visuals in the video using their music and poetry.	Storyboard is relatively complete with sketches for most scenes, and notes on titles, transitions, special effects, sound, etc. Storyboard reflects effective planning and organization for the visuals in the video.
<b>Marketing Materials/ Pitch/ Performance</b>		
Art Expr: 9-12 C Engage in ongoing assessment to revise and improve artworks and to produce a portfolio such as the manual, brochure and the poster encourage by the message.	Student will have reached mastery by demonstrating learned techniques in class to create great images for a manual, brochure and poster and will apply design principles (such as unity, contrast, balance, movement, direction, emphasis, and center of interest) with great skill.	Student applies design principles (such as unity, contrast, balance, movement, direction, emphasis, and center of interest) with fair skill.



<p>ELA 8-10 COMM D, E, G</p> <p>Students will demonstrate an understanding of effective speaking strategies by selecting appropriate language and adjusting presentation techniques, give informational presentation sthat present ideas in a logical sequence, include relevants facts and details from multiple sources and use a consistent organizational structure, and give presentations using a variety of delivery methods, visual displays, and technology by presenting their sound system and all relevant elements of the capstone.</p>	<p>Shows a full understanding of the project. Facial expressions and body language generate a strong interest and enthusiasm about the topic in others. Always (99-100% of time) speaks in complete sentences. Student is completely prepared and has obviously rehearsed. Stands up straight, looks relaxed and confident. Establishes eye contact with everyone in the room during the presentation.</p>	<p>Shows a good understanding of parts of the project. Facial expressions and body language are used to try to generate enthusiasm, but seem somewhat faked. Sometimes (70-80%) speaks in complete sentences. The student is somewhat prepared, but it is clear that rehearsal was lacking. Student leans on furniture/desks and slouches. Does not seem confident. Wondering eyes throughout the room.</p>
<p>ELA 8-10 Students will by writing an Elevator Speech</p>	<p>Facial expressions and body language generate interest and enthusiasm. Student is completely prepared and has obviously rehearsed. The student edited and organized speech based on WIMs directions. Information was clear and precise. (200-130 words). Student accurately told how he/she related to the value being added to the company.</p>	<p>"Facial expressions and body language tried to generate enthusiasm. The student was somewhat prepared, but was clear that rehearsal was lacking. The student edited and organized speech without WIMs directions. Information was unclear and not precise. (99-50 words) Student did not accurately relate to the value added to the company.</p>

SS ECON 11-12 A, E Students will be able to Analyze how scarcity of productive resources affects supply, demand, inflation, and economic choices and explain the use of budget in making personal economic decisions and planning for the future through the creation of a well crafted Product Pitch that includes a short speech and a 6 slide powerpoint presentation.

The group is completely prepared and has obviously rehearsed. This is evidenced by smooth transitions between speakers and length of presentation. Each group member contributes equally during the presentation. Information clearly relates to the main topic of Supply and Demand. It includes several supporting details and/or examples. Information clearly shows how price changes in affect buyer and seller behavior. Information clearly demonstrates how people respond to incentives based upon preference. Information clearly demonstrates how product scarcity affects cost and decision making. Uses at least 5 public speaking strategies. Each strategy is used several times where appropriate. Uses highly focused paragraphs very effectively to organize the speaking by topic and/or idea. Information provided is appealing and works well with the strategies to create a convincing sales pitch. At least 6 slides are present in power point presentation and fewer than 3 errors in spelling, grammar and punctuation are present on power point slides. Revision has been conducted carefully.

The group is somewhat prepared and has not rehearsed. This is evidenced by rough transitions between speakers, constant referring to cards or powerpoint, and length of presentation. Some group members contribute more during the presentation. Information only somewhat relates to the topic of Supply and Demand. No details and/or examples are given. Information shows at least one of the following concepts: how price changes affect buyer and seller behavior, how people respond to incentives based upon preference, how product scarcity affects cost and decision making. Uses less than 5 public speaking strategies. Each strategy is used only once where appropriate. Information is not ordered logically. Information provided is appealing and works well with the strategies to create a convincing sales pitch. Less than 6 slides are present in power point presentation and more than 3 errors in spelling, grammar and punctuation are present on power point slides.

#### Music

<p>Math CC.9-12.F.IF Understand the concept of a function and use function notation. CC.9-12.F.IF.1 Understand the definition of function. CC.9-12.F.IF.2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. CC.9-12.F.IF.4 Interpret key features of graphs and tables and sketch graphs showing key features, including symmetry and periodicity. CC.9-12.F.IF.5 Relate the domain of a function to its graph and to the quantitative relationship it describes. CC.9-12.F.IF.7e Graph trigonometric functions showing period and amplitude. CC.9-12.G.CO Experiment with transformations in the plane. CC.9-12.G.CO.1 Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment. CC.9-12.G.CO.2 Represent transformations in the plane using graph paper or geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch). CC.9-12.G.CO.3 Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself. CC.9-12.G.CO.4 Develop definitions of rotations, reflections and translations. CC.9-12.G.CO.5 Given a geometric figure and a rotation, reflection or translation, draw the transformed figure using graph paper or geometry software.</p>	<p>Student will graph the geometric pre-image and image of a transformation on an x-y plane. Student will use ordered pairs to describe the mapping from a pre-image to an image. Student will identify the transformation of a quadratic function from a graph. Student will describe the transformation of a modified quadratic function. Student will use geometric terms to describe music samples.</p>	<p>Student incorrectly interprets the mapping rules when graphing a transformation. Student does not write the correct rule from a transformation graph. Student does not name the correct transformation from the graph of a quadratic function. Student fails to describe the transformation from a modified quadratic function.</p>
--	---	--

## 8. Unit – Assessments & Reflection

Formative assessments of student performance on learning activities are designed into the capstone and units to provide data that determines learning activities and their pacing, as well as, the provision of remediation/extension opportunities - to insure successful performance of the mastery learning goals

Units	Group Products	Individual Products
Unit 1	Styrofoam Speakers Management Website	Schematics
Unit 2	Prototype Group Schematics Product Pitch	Inventor Model Lyrics Building Skill Sets
Unit 3	Marketing Materials Performance Website Written Reflection	Manual Sound System Component Music

## PHASE 4: Choreography of Learning

## 9. Unit – Learning Activities

The learning activities within the capstone (as well as their sequence and pacing) provide adequate scaffolding / differentiation to facilitate successful performance of the mastery learning goals in both project time and class time.

**9a. Entry Event:** Launch inquiry, kick-off event, "the hook"

## Video Introduction Group Selection System

**9b. Community Resources and Partnerships:** Mentors, speakers, authentic assessment

### 9c. Capstone Vocabulary:

[illegible]

## 10. Resources Needed:

### Unit 1:

Facilities / Venues	Equipment	Materials	Purchased Supplies
Great Lakes Science Center		Description Price qty	
		100 uF Capacitor 0.3 100	
		220 uF Capacitor 0.35 100	
NASA		.01 uF Capacitor 0.06 100	
		.047 uF Capacitor 0.06 100	
		10 Ohm Resistor 0.16 100	
Rock n' Roll Hall of Fame		100 Ohm Resistor 0.16 100	
		5.1 KOhm Resistor 0.16 100	
		Deluxe Capacitor Kit 14.95 10	
		Resistor Kit 7.5 10	
		9V Battery Clip 0.2 30	
		9V 1 30	
		LM386 IC 0.45 50	
		Solder 33.95 1	
		Soldering Iron Kit 8.9 15	
		1 KOhm Potentiometer 2.75	
		20	
		10 KOhm Potentiometer 2.75	
		40	
		100 KOhm Potentiometer 2.75	
		10	
		1 MOhm Potentiometer 2.75	
		10	
		Micrometer 19.95 2	
		Power Supply 17.5 2	
		6" Utility Dial Caliper 17.95 15	
		Description Price Qty	
		Digital Multimeter 2.99 20	
		Description Price Qty	
		8" full range speakers \$16	
		5- 5 1/2" full range speakers \$8	
		Description Price Qty	
		52 pieces, assorted colors.	

# 11. Project Time Calendar - Sequencing of Instruction

January 2012							
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	1	2	3	4	5	6	7
Capstone		Vacation	Vacation	Vacation	Vacation	Vacation	
Physics		No Teachers	No Teachers	No Teachers	No Teachers	No Teachers	
Algebra II		No Students	No Students	No Students	No Students	No Students	
English							
Social Studies							
Engineering							
Art							
	8	9	10	11	12	13	14
Capstone		Entry event (All students, All teachers)	A- Paper Plate (S) B- Planning Doc (S) C- Poetry (L) Lyric Re D- Planning Doc Waves	A- Planning Doc B- Poetry (L) Lyric Re C- Planning D- Paper Plate (S) Frequency and Wave	A- Poetry (L) Lyric Re B- Circuit (B) C- Paper Plate(S) D-Circuit (A) Frequency and Wave	A- Circuit (B) B- Paper Plate (S) C- Circuit (Sm) D- Poetry (L) Lyric Re Frequency and Wave	
Physics		Waves	Solve linear equations	Word problems: Solve	G Topic 3: Translation	Reflections	
Algebra II		Alg 2 topic 2: Solve li	Intro to Internships	Intro to application essays	resume	resume	
English							
Social Studies		Intro to sound fund.	Driver parts/functions	StyroFoam Drivers	StyroFoam Drivers	StyroFoam Drivers	
Engineering							
Art							
	15	16 MLK Day	17	18	19	20	21
Capstone			All Groups Brainstorm	FAB LAB for remainin	FAB LAB for remainin	All Groups, Role Expl	
Physics			Sound Algebra	Sound Algebra	Doppler Effect	Doppler Effect	
Algebra II			Glide reflections	Rotations	Differentiate types of	Compositions of trans	
English			resume	resume	Portfolio	Interview	
Social Studies							
Engineering			Orthographic Project	Isometrics	Isometrics to 3-view	Isometrics to 3-view	
Art							
	22	23	24	25	26	27	28
Capstone		2 Groups, Lyrics, 2 Groups Music	Individual Diagram (on paper) Bill of Materials	Individual Diagram (on paper) Bill of Materials	(By Role) Expanded Diagram Electronic Diagram -Eagle -Sketch Up -Inkscape	(By Role) Expanded Diagram Electronic Diagram -Eagle -Sketch Up -Inkscape	
Physics		Doppler Effect	Electromagnets	Electromagnets	Paper Plate Speakers	Paper Plate Speakers	
Algebra II		Coordinate notation fo	Find coordinates unde	Isometrics and congru	Lines of symmetry	Identify types of sym	
English		Interview Discourse	1. Intro to ELA Goal of Capstone 2. Language Registers/Code Switching Activity	Essestional Question Prompt, Literary Terms Vocab	Literary Terms Vocab, Start poetry	Analyze Tennyson and Dickinson Guided Questions for homework	
Social Studies		Introduction to Cultural Perspectives	Cultural Perspectives Vocabul	The Partition of India and Pakistan	The Creation of Israel	The Reunification Of Germany	
Engineering		Intro to Electrical The	Intro to electr. theory	Electrical Theory	Electrical Theory	Electricity and Electro	
Art							
	29	30	31				
Capstone		(Role) Draft Prototyping Instrument Analyze	(Role) Draft Prototyping Instrument Build				
Physics		Dilations	Scale drawings				
Algebra II		Collect homework, Analyze Langston Hughes, Naz Dickinson Activity, Biggie Activity.	Poetry Analysis- Imagery, Alliteration, Analyzing Word choice, Theme				
English		Apartheid in South Africa	Cultural Perspectives Summary				
Social Studies		Electricity on Atomic L	Electricity on Atomic L				
Engineering							
Art							
			Notes:				
Capstone							
Physics							
Algebra II							
English							
Social Studies							
Engineering							
Art							

Calendars by Vertex42.com

# February 2012

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
				1	2	3 3rd Quarter Progress Reports Due 9:00am	4
Capstone				(Role) Draft Prototyping Instrument Build	(Role) Draft Prototyping Sound to Electricity	Friday Assessment	
Physics				Scale drawings	Tessellations	Sound to Electricity	
Algebra II				Work on "The Stayer" Homework	Poetry Analysis- "Ballad of a Landlord", "Summer I was Sixteen" Theme and Imagery, Review for Test.	Poetry Test	
English				Cultural Perspectives Final	Introduction to Cultural Differences	Consequences of Social Oppression and Conflict	
Social Studies				Electronic Components	Electronic Components	Electronic Components	
Engineering							
Art							
	5	6 Parent Teacher Conferences	7	8 Two Hour Early Release (Professional Development)	9	10	11
Capstone		Modifications	Start Cuts	Start Cuts	Start Cuts	Friday Assessment	
Physics		Sound	Sound	Sound	Draft Prototyping	Sound	
Algebra II		Identify symmetries in tessellations	Alg 2 Holt Translation of quadratic equation	Reflection of quadratic	Dilation	General form of transformations	
English		Where I'm From Intro	Where I'm From 1st Draft	Where I'm From Poems Revise and Edit	Where I'm From Poems Final - Team Teach with Art	History and Development of the English Language	
Social Studies		Exploitation of Indigenous People	Genocide and Ethnic Cleansing	Genocide and Ethnic Cleansing	Political Oppression	Political/Economic Oppression	
Engineering		Intro to Schematics	Intro to Schematics	Schematics Symbols	Schematics Symbols	Schematics Symbols	
Art							
	12	13	14	15	16	17 Professional Day (no students)	18
Capstone		Cuts/Wiring/Build	Cuts/Wiring/Build	Cuts/Wiring/Build	Cuts/Wiring/Build		
Physics		Sound	Electromagnetism	Electromagnetism	Light		
Algebra II		Transformations on graphing calculator	Alg 2 Topic 3 Domain and range of relations	Domain and range of functions	Determine domain and range from graphs		
English		History and Development of the English Language	History and Development of the English Language	History and Development of the English Language	History and Development of the English Language Review		
Social Studies		Oppression to Conflict Final	Oppression to Conflict Final	Can History be Rewritten? Historical Interpretation	Can History be Rewritten?		
Engineering		Signal Path	Signal Path	Signal Path	Signal Path		
Art							
	19	20 Presidents Day	21	22	23	24	25
Capstone		Cuts/Wiring/Build	Cuts/Wiring/Build	Cuts/Wiring/Build	Cuts/Wiring/Build	Friday Assessment	
Physics		Light	Light	Light	Light	Light	
Algebra II		Determine if relations are functions	Determine if relations are functions	Determine if functions are one-to-one	Evaluate functions for given values	Evaluate functions for given values	
English		Schematic Writing	Schematic Writing	Schematic Writing	Schematic Writing	Schematic Writing	
Social Studies		Cultural Diffusion Introduction	Advances in Communication	Public Communication	Private Communication	Private Communication	
Engineering							
Art							
	26	27	28	29			
Capstone		Final Build	Final Build	Final Build			
Physics		Light	Antennas	Antennas			
Algebra II		Find compositions of 2 functions	Find compositions of 2 functions	Find inverses of functions			
English		Effects of Immigration	Diffusion Summary	Diffusion Final			
Social Studies		Intro to AutoCAD	Inventor	Inventor			
Engineering							
Art							
			Notes:				
Capstone							
Physics							
Algebra II							
English							
Social Studies							
Engineering							
Art							

Calendars by Vertex42.com





# Engineering Curriculum Overview

<b>Subject:</b> Engineering IED	<b>Capstone:</b> Communication	<b>Time Frame:</b> 12/9/12 - 3/19/12
------------------------------------	-----------------------------------	---

## **Unit Big Idea:**

Every person living on Earth, small, weak, powerful or rich is given the opportunity to communicate, but their message isn't always clear. What if you only had one moment, one shot to share your voice with the world? What would you say? What would you wish to tell the world about your life, your expectations, your doubts, your desires, your values, your emotions, your dreams? What would your message be? The Communication Capstone is meant to help students define their message and share it with the world.

## **Capstone to Classroom Connection**

Students will learn fundamentals of electronics and electrical theory and apply that knowledge to the build of sound amplifiers, speaker cabinets and lighting systems. Students will also learn drafting and CAD programs in order to accurately represent thier designs on drafting paper and AutoCAD computer protocols.

<b>Readings</b>	<b>Materials</b>
Fundamentals of Engineering (textbook)	Pens/Pencils
Web based research and articles.	Notebook
Poetry readings.	Computer
	Microsoft Office
	Chart Paper
	Scissors
	Markers/ Colored Pencils
	Glue
	Calculators
	Graph Paper
	Wood
	Acrylic
	Coil and insulated wire
	Soldering irons and solder
	Electronic Components

## **Unit Objectives**

Fundamentals of electronics  
 Electromagnetic theory and its function in the production of sound  
 Electrical theory including Ohm's Law, polarity, AC/DC and series/parallel  
 Fundamentals of sound production as it relates to electrical impulses  
 Characteristics of sound waves and application to calculating delay lines  
 Specific electronic components: Capacitors, resistors, transistors, etc.  
 Fundamentals of technological communications: Orthographics, 3-view, CAD  
 Fundamentals of Media communications: Sound engineering, Elect. Comm.  
 Fundamentals of precise measuring tools: Dial caliper, micrometer



## Essential Questions

Can your message get lost in the medium?  
Can the medium *be* the message?  
What are the various media used to convey the message?  
What are the steps taken in building a sound system from conception to completion?  
What materials is needed in building a speaker cabinet?  
Is the material a speaker cabinet is made of important to sound resonance?  
What is the significance of baffling and porting in sound reproduction?  
What is the significance of conductance in a circuit?  
What is s signal path?  
What is the function of each component in a circuit?

## Standards

EGR 94.1 Understand and explain electrical theory. Fundamentals will be applied in the correct wiring of a speaker cabinet and power amplifier.  
EGR 95.1 Identify and describe electronic components. Application of knowledge will manifested in the form of a functioning electronic circuit that will light a series of LEDs.  
EGR 95.5 Produce and explain block diagrams, schematics and wiring diagrams.  
EGR 95.5 Produce and explain block diagrams, schematics and wiring diagrams.  
EGR 95.2 Demonstrate and explain soldering and soldering applications. Ability to do general and point-to-point soldering demonstrated.  
EGR 96.1 Understand and explain electrical theory through the creation of a cohesive, working sound system  
EGR 14.2 Understand and apply geometric constraints in the build of a sound system  
EGR 15.3 Select the materials and components to complete a functioning three dimensional prototype and list them in a schematics file  
EGR 15.5 Generate sketches in orthographics and 3-view, and generate a model using CAD software.  
EGR 3.A Write and utilize coherent persuasive and focused technical communications that support a defined perspective for engineering and science contained within the manual.

## Assessments

Students will demonstrate a mastery of electronics by composing schematic representations of circuits.  
Students will demonstrate a mastery of drafting by producing accurate graphic renderings of solid objects in isometrics and orthographic projection.  
Students will show understanding of product life cycle in presentations to the class.  
Students will demonstrate mastery of computer aided drafting (CAD) by producing accurately dimnsioned computer renderings of solid objects.  
Students will design and produce working sound and lighting amplifiers.  
Students will design and produce efficient speaker enclosures.  
Students progress will be assessed in project logs.  
Students progress will be assessed in the form of quizzes and tests.

# MC<sup>2</sup> STEM High School Social Studies Curriculum Planning Template

**Subject:**  
Social Studies

**Capstone:**  
Communications

**Time Frame:**  
01/09/2011- 03/23/2011



### Unit Big Idea:

Every person living on Earth, small, weak, powerful or rich is given the opportunity to communicate, but their message isn't always clear. What if you only had one moment, one shot to share your voice with the world? What would you say? What would you wish to tell the world about your life, your expectations, your doubts, your desires, your values, your emotions, your dreams? What would your message be? The Communication Capstone is meant to help students define their message and share it with the world.

### Capstone to Classroom Connection

Communication is much more than what we say. How we express ourselves is directly related to who we are as a person. Our speech is a product of our environment, our social and economic standing, our culture, our education, and sometimes even our idea of who we would like to be in the eyes of society. During this Capstone we will be exploring the origin our voices, and how our "make-up" determines not only our message, but how we deliver it. During the next three months, you will be constructing a Family Culture Poster which will feature a musical and an art piece which typifies your culture and explaining how these historical pieces speak to you. You will also be formulating a power point to "pitch" the products that you will construct in Engineering.

### Materials

Pens/Pencils  
Notebook  
Computer  
Microsoft Office  
Markers/ Colored Pencils  
Glue  
Poster Paper

### Unit Objectives

- Students will identify artifacts that they feel typify their culture and explain how these pieces express their message.
- Students will analyze the basics of economy, production, and the supply and demand theory.
- Students will create family cultural posters that juxtapose historic cultural artifacts with modern original compositions.
- Students will explore how their environment, class, education, age and ideology effect their message.

### Essential Questions

- What's your message?
- Is your message and how you convey it an expression of who you are as a person?
- How does your message compare to that of your ancestors?
- Should you adjust your communication style or message to suit the situation?

### Standards

Unit Title	Benchmark Code	Benchmark
c	SS HIST 11-12 B	Use historical interpretations to explain current issues.
c	SS PEPL 11-12 A	Analyze how issues may be viewed differently by various cultural groups.



c	SS PEPL 11-12 C	Explain the role of diverse cultural institutions in shaping American society.
c	SS GEOG 11-12 A	Explain how the character and meaning of a place reflect a society's economics, politics, social values, ideology and culture.
c	SS ECON 11-12 A	Analyze how scarcity of productive resources affects supply, demand, inflation and economic choices.
c	SS ECON 11-12 E	Explain the use of a budget in making personal economic decisions and planning for the future.

### Assessments

Students will construct a Family Cultural Poster which will juxtapose historical cultural artifacts an modern original pieces and explain how their message is reflected in each.

Students will deign a power point which will be used as a component of the “product pitch” for models built in Engineering class.

Quizzes and Tests will be included throughout this unit, but will not be calculated in the Capstone Grade.

## MC<sup>2</sup> STEM High School Math Curriculum Planning Template

<b>Subject:</b> Math	<b>Capstone:</b> Communications	<b>Time Frame:</b> 01/09/2012- 03/23/2012
-------------------------	------------------------------------	--

### Unit Big Idea:

The complex connection of music and mathematics exists on many levels, from the concrete to the abstract. The process of composing music can be compared to mathematical problem solving. Studying patterns in math lends insight into pleasing harmonies and melodies. The mechanics of how musical instruments create pitch can be modeled by math. The division of time into musical patterns relates to a set of rules in math. Students will investigate the music and mathematics connection.

### Capstone to Classroom Connection

Students will investigate functions and the graphs of translations, reflections and dilations of functions. They will connect mathematics to music by comparing families of functions to music families. They will classify music melodies as symmetric, a translation, reflective, circular or periodic. During project-time students will explore various elements of music that embody geometric principles. They will use fraction relationships to describel relative durations of sound. They will measure the tempo of music as a rate. Students will fill in polyrhythm charts for a fresh view of multiples and least common multiple.

Readings	Materials
Math and Music Harmonious Connections Ch.1-Ch.3	Pens/Pencils Notebook/Binder Computer



### Unit Objectives

- Student will use ordered pairs to describe the mapping from a pre-image to an image.
- Student will use geometric terms to describe music samples.
- Student will identify geometric translations, reflections and rotations on the x-y plane.
- Student will identify the transformation of a graph as a reflection, translation or dilation.
- Student will identify the type of transformation by comparing the new function to the original function.

### Essential Questions

- What distinguishes random noise from music that captures our ear? And what does mathematics have to do with this?
- Did you ever think of mathematics as being a language, a systematic form of communication? And what about music? Is music also a systematic form of communication?
- How can knowing mathematics help us communicate more effectively about non-mathematics things?

### Common Core Standards

A	CED.3	CC.9-12.A.CED.3 Create equations that describe numbers or relationship. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.*
F	IF.1	CC.9-12.F.IF.1 Understand the concept of a function and use function notation. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If $f$ is a function and $x$ is an element of its domain, then $f(x)$ denotes the output of $f$ corresponding to the input $x$ . The graph of $f$ is the graph of the equation $y = f(x)$ .
F	IF.2	CC.9-12.F.IF.2 Understand the concept of a function and use function notation. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
F	IF.3	CC.9-12.F.IF.3 Understand the concept of a function and use function notation. Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. For example, the Fibonacci sequence is defined recursively by $f(0) = f(1) = 1$ , $f(n+1) = f(n) + f(n-1)$ for $n \geq 1$ ( $n$ is greater than or equal to 1).
F	IF.4	CC.9-12.F.IF.4 Interpret functions that arise in applications in terms of the context. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*
F	IF.5	CC.9-12.F.IF.5 Interpret functions that arise in applications in terms of the context. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function $h(n)$ gives the number of person-hours it takes to assemble $n$ engines in a factory, then the positive integers would be an appropriate domain for the function.*

F	IF.7e	CC.9-12.F.IF.7e Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.*
G	CO.1	CC.9-12.G.CO.1 Experiment with transformations in the plane. Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.
G	CO.2	CC.9-12.G.CO.2 Experiment with transformations in the plane. Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).
G	CO.3	CC.9-12.G.CO.3 Experiment with transformations in the plane. Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.
G	CO.4	CC.9-12.G.CO.4 Experiment with transformations in the plane. Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.
G	CO.5	CC.9-12.G.CO.5 Experiment with transformations in the plane. Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.
G	CO.12	CC.9-12.G.CO.12 Make geometric constructions. Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.

## Assessments

Students will participate in a discussion following the activities that connect math to music.

Students will then have to answer some reflection questions that cause them to look back on the experience of designing and building speakers. The questions will challenge students to look back on the experience of building according to specifications.

Quizzes and Tests will be included throughout this unit, and they will only be used as checkpoints to manage remediation.

Students will create and program a working calculator.

Students will turn in work skills assessment sheets periodically throughout the capstone.



Copyright © 2012. MC2 STEM High School. Cleveland, OH. Used with permission.  
For more information go to: [edutopia.org/stw-college-career-resources](http://edutopia.org/stw-college-career-resources)

Brought to you by

**edutopia**