Kingsport City Schools
Guiding Tenets

• Vision:
  – Student Focused...World Class

• Goals:
  – Deliver world-class curriculum and instruction
  – Provide committed and innovative educators
  – Furnish safe, appropriate, and well-maintained facilities that support teaching and learning
  – Ensure business operations effectively support teaching and learning
  – Engage families and the community
The Journey thus far to World-Class Science and Technology

**KCS Guiding Tenets, D-B 2.0 Study, “The Vision”**

**Establish Mission and Goals**

**Research** – Data, Site Visits, Current Facilities and Future Needs, Programming, Pedagogy, Community Meetings, Enrollment Projections

**Teacher Task Force** – six D-B science teachers charged with exploring programming and facility needs, and refining practices within our current structure
Mission:

• to create a culture that inspires innovation through Science and Technology

Goals:

• Goal One: Support scientific inquiry and discovery
• Goal Two: Foster creativity and problem-solving
• Goal Three: Offer meaningful career opportunities
• Goal Four: Provide application-based experiences through an integrated curriculum
• Goal Five: Utilize the power and flexibility of technology
PROGRAMMING AND PEDAGOGY
Programming and Pedagogy Goals

• Include post-AP opportunities into the science curriculum
• Involve students in scientific research/mentorship opportunities
• Expand computer science offerings
• Transition instruction towards project-based activities across the curriculum
• Expand engineering opportunities
Current Science/Tech Course Offerings

- Chemistry 1
- Chemistry 1 Honors
- Chemistry 2 Honors
- AP Chemistry
- Physics
- AP Physics 1
- AP Physics C
- AP Computer Science
- Game Programming
- Biology 1A/1B
- Biology 1
- Biology 1 Honors
- Biology 2 Honors
- AP Biology
- Environmental Science
- Earth Science/Geology
- PLTW – Engineering
- App Development
What Other Schools are Offering Beyond “Traditional” Curriculum...

• Gwinnett School of Math, Science, and Technology
  – Appropriate and Alternate Energy
  – Computer Programming
  – Nanotechnology and Materials Engineering
  – 3D Modeling
  – Analytical Forensic Investigation
  – 9th Grade PhysEng
  – Advanced Genetics
  – Biochemical Engineering
  – Mentorship/Research Experience through Business Partnerships
  – Introduction to 3D Animation
  – Advanced Animation/Game and App design
  – Robotics and Mechatronics

• Thomas Jefferson High School for Science and Technology
  – Advanced Astronomy
  – Advanced Marine Biology
  – Bionanotechnology
  – Computational Physics
  – DNA Science
  – Geosystems
  – Optical Systems
  – Organic Chemistry and Instrumental Analysis
  – Neurobiology
  – Relativity, Electrodynamics, and Quantum Mechanics
  – Prototyping Development and Process
  – Mentorship Research Program through 15 Specialized Research Labs
  – Digital/Analog Electronics
  – Microprocessor System Design
  – Conventional/Alternative Energy Systems

KCS Goal #1 – Deliver world-class curriculum and instruction
Pedagogy Considerations

• Instruction that is more inquiry and problem based
  – Inquiry/problem solving activity *drives* learning rather than simply reinforcing concepts

• More effective uses of technology
  – Classroom flipping
  – Engineering design process, 3D printing
  – Virtual/Distance learning opportunities
  – Research

KCS Goal #2 – Provide committed and innovative educators
Pedagogy Considerations

• Individualized learning
  – Differentiating activities based on individual needs
  – Highlight relevance and real-world connections

• Showcase our science talent
  – Science fairs
  – Community projects
  – Competitions
  – Scientific journal publications
Shift in Standards that Support the RSTC – Chemistry 1 Example

**SPI 3221.1.1** Compare and contrast the major models of the atom (i.e., Bohr, and the quantum mechanical model).

**SPI 3221.2.7** Predict how changes in volume, temperature, and pressure affect the behavior of a gas.

**SPI 3221.3.8** Describe radioactivity through a balanced nuclear equation and through an analysis of the half-life concept.

**CHEM1 PS1.1** Develop models of matter through experimentation on properties and communicate scientific information about how and why models of atomic structure have changed over time from before Dalton to the quantum mechanical model.

**CHEM1 PS1.9** Conduct investigations into the behavior of gases and develop models to represent this behavior. Evaluate the relationship (qualitatively and quantitatively) at STP between pressure and volume (Boyle’s law), temperature and volume (Charles’s law), and moles and volume (Avogadro’s law), and evaluate these relationships with respect to kinetic-molecular theory.

**CHEM1 PS1.13** Develop models to exemplify radioactive stability and decay. Use models to explain the concept of half-life and its use in determining the age of materials (such as radiometric dating).
Shift in Standards that Support the RSTC – Biology 1 Example

**SPI 3210.4.3** Recognize the interactions between DNA and RNA during protein synthesis.

**SPI 3210.4.5** Apply pedigree data to interpret various modes of genetic inheritance.

**SPI 3210.2.4** Predict how various types of human activities affect the environment.

**BIO1.LS1.4** Research examples that demonstrate the functional variety of proteins that are essential to life and construct an argument based on evidence for the importance of the molecular structure to its function. Plan and carry out a controlled investigation to test predictions about factors (pH and temperature), which should cause an effect on the structure and function of a protein.

**BIO1.LS3.3** Through pedigree analysis, identify patterns of trait inheritance in family tree data to determine the trait’s mode of inheritance and predict family member genotypes. Use mathematical thinking to predict the likelihood of single trait transmission or simultaneous multiple trait transmission to a future generation.

**BIO1.LS4.3** Identify many of the natural world resources used by humans and assess the role of biodiversity in providing ecosystem services. Engage in argument from evidence the role that human activities have on biodiversity and subsequent ecosystem stability.
GEO.ETS2.2 Design, build, and refine a device to reduce or eliminate the effect of weathering, erosion, deposition, or other land-surface changes that could be used by the Army Corps of Engineers, Tennessee Valley Authority, Department of Highways or other agency to improve the road or water systems in Tennessee.

HAP.ETS2.1 Research system disorders to communicate information on the known facts about the disorders and identify technology that has been developed to diagnosis and/or treat the disorders.

SCRE.ETS3.7 Obtain and present information on research protocols including citation formats (APA, MLA, etc.), plagiarism, and copyright and patent laws.

SCRE.ETS3.5 Use online search engines to find sources of scientific information. Develop, share, and revise criteria for evaluating reliability of sources.

BIO2.ETS2.2 Construct an explanation for how biotechnology has allowed us to learn more about organisms with resulting changes in classification schemes based on presumed evolutionary relationships.

GEO.ETS2.3 Plan and carry out an investigation using a computer-based geographical information tool such as Google Earth, ArcGIS, or My NASA Data to examine the impact of human activities on Earth's surface features.

BIO1.ETS2.2 Research examples of current genomics research and explain the importance of computational thinking in these studies.

SCRE.ETS3.11 Carry out an original scientific investigation (experiment or study) after having received approval of a revised research proposal.

BIO1.ETS2.1 Obtain, evaluate and communicate information on how molecular biotechnology may be used in a variety of fields.

EVSC.ETS3.1 Plan and carry out an investigation of a local ecosystem to assess human impacts. Based on your findings, design and evaluate a solution to minimize impacts.

SCRE.ETS3.3 Generate questions and engage in discussion regarding the role of ethics in scientific research and in decision making based on scientific information.

BIO1.ETS2.4 Construct scientific arguments to support the pros and cons of a current societal debate around the application of a specific biotechnology technique such as stem cell usage, in vitro fertilization, or genetically modified organisms.
SCIENCE FACILITIES
Current D-B Science Facilities

- Average approximately 1125 sq. ft. of classroom/lab combined space
- Isolated, does not encourage inquiry based or collaborative learning
- No dedicated lab spaces, collaborative areas, areas for long term projects, or areas for display
- Does not mirror what students would see in college/career environments
- Limited flexibility
Current D-B Science Facilities
Gwinnett School of Math, Science, and Technology Facilities

• Open collaborative spaces
Gwinnett School of Math, Science, and Technology Facilities

• Designated collaborative spaces/project rooms
Gwinnett School of Math, Science, and Technology Facilities

- Classroom space
Gwinnett School of Math, Science, and Technology Facilities

• Science Lab Areas (separate from classroom)
High Tech High Facilities

- Open concept throughout to support collaboration across multiple content areas
“Technology Enhanced Active Learning (TEAL)”

http://scaleup.ncsu.edu/wiki/pages/12m1C9c6/Massachusetts_Institute_of_Technology.html
Facilities Recommendations for RSTC at D-B

- Flexible classrooms where “fixed” furniture is along the walls and everything else is movable
- At least one large, technology enhanced active learning space for collaborative learning
- Several rooms/areas designated for small group collaborative learning
- Designated project rooms and showcase areas
- Designated lab spaces that are separate from the classroom
- Safe storage space for chemicals and lab equipment

KCS Goal #3 – Furnish safe, appropriate, and well-maintained facilities that support teaching and learning
Next Steps

• Continue work with Eastman and WHOI to develop Oceanography class. Anticipate initial offering in Spring 2017. Curriculum refinement meeting scheduled for 12/15.

• Process recommendations from teacher task force regarding course offerings and possible omissions.

• Process credit requirements with ASC/BOE to determine the possibility of four credit requirements in science for graduation.

• Process facility recommendations from teacher task force with our architect/planning partners.

• Reach out to other potential community partners for integration of work-based learning and readiness skills into our day to day coursework.

• Continue to shift instruction to foster a more inquiry-based approach to teaching and learning.

• Implementation of research-based focus for upper-level/post-AP course offerings.