Randolph Township Schools
Randolph Middle School

Science and Technology Curriculum

"The science of today is the technology of tomorrow."

– Edward Teller

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Randolph Township Schools
Department of Science, Technology, Engineering, and Mathematics
Science and Technology

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Randolph Township Schools

Mission Statement

We commit to inspiring and empowering all students in Randolph schools to reach their full potential as unique, responsible and educated members of a global society.

Randolph Township Schools
Affirmative Action Statement

Equality and Equity in Curriculum

The Randolph Township School district ensures that the district's curriculum and instruction are aligned to the state's standards. The curriculum provides equity in instruction, educational programs and provides all students the opportunity to interact positively with others regardless of race, creed, color, national origin, ancestry, age, marital status, affectional or sexual orientation, gender, religion, disability or socioeconomic status.

N.J.A.C. 6A:7-1.7(b): Section 504, Rehabilitation Act of 1973; N.J.S.A. 10:5; Title IX, Education Amendments of 1972

RANDOLPH TOWNSHIP BOARD OF EDUCATION
EDUCATIONAL GOALS
VALUES IN EDUCATION

The statements represent the beliefs and values regarding our educational system. Education is the key to self-actualization, which is realized through achievement and self-respect. We believe our entire system must not only represent these values, but also demonstrate them in all that we do as a school system.

We believe:
- The needs of the child come first
- Mutual respect and trust are the cornerstones of a learning community
- The learning community consists of students, educators, parents, administrators, educational support personnel, the community and Board of Education members
- A successful learning community communicates honestly and openly in a non-threatening environment
- Members of our learning community have different needs at different times. There is openness to the challenge of meeting those needs in professional and supportive ways
- Assessment of professionals (i.e., educators, administrators and educational support personnel) is a dynamic process that requires review and revision based on evolving research, practices and experiences
- Development of desired capabilities comes in stages and is achieved through hard work, reflection and ongoing growth

Randolph Township Schools
Department of Science, Technology, Engineering, and Mathematics
Science and Technology
Introduction

The Randolph Township School District is committed to excellence. We believe that all children are entitled to an education that will equip them to become productive citizens of the 21st century. We believe that an education grounded in the fundamental principles of science, technology, engineering, and math (STEM) will provide students with the skills and content necessary to become future leaders and lifelong learners.

A sound STEM education is grounded in the principles of inquiry, rigor, and relevance. Students will be actively engaged in learning as they use real-world STEM skills to construct knowledge. They will have ample opportunities to manipulate materials and solve problems in ways that are developmentally appropriate to their age. They will work in an environment that encourages them to take risks, think critically, build models, observe patterns, and recognize anomalies in those patterns. Students will be encouraged to ask questions, not just the "how" and the "what" of observed phenomena, but also the "why". They will develop the ability, confidence, and motivation to succeed academically and personally.

STEM literacy requires understandings and habits of mind that enable students to make sense of how our world works. Scientifically and technologically literate citizens deal sensibly with problems that involve mathematics, evidence, patterns, logical arguments, uncertainty, and problem-solving.

Science & Technology
Introduction

Science and Technology is a marking period course offered to 8th grade students interested in science, technology and engineering. This course navigates through topics in science such as electricity, alternative energy, and structural design by using methods in visual media and intermediate 3D printing. Students practice skills by assessing a product and its impact on the environment, along with proposing new methods of energy consumption. Additionally, students construct code to alter videos by creating filters, safely uploading student's own video and pictures, and custom created graphics. Through these activities, students will develop and apply problem solving, creative and technological skills to create real world solutions. Students discover that as technology continues to advance, scientists and engineers learn more information about how our world functions. By the end of this course, students will leave with a solid understanding of the role technology plays in the advancement of science.

SUGGESTED TIME ALLOTMENT	UNIT NUMBER	CONTENT - UNIT OF STUDY
3 weeks	I	**Audio-Visual Design with Technology**
3 weeks	II	**Alternative Energy**
3 weeks	III	**Task Projects: STEM Fuse Art and Construction**

STANDARDS / GOALS:	ENDURING UNDERSTANDINGS	ESSENTIAL QUESTIONS
NJCCCS Technology **8.1.8.B.1** Synthesize and publish information about a local or global issue or event (ex. telecollaborative project, blog, school web). **8.1.8.C.1** Collaborate to develop and publish work that provides perspectives on a global problem for discussions with learners from other countries. **8.1.8.D.5** Understand appropriate uses for social media and the negative consequences of misuse. **8.2.8.B.5** Identify new technologies resulting from the demands, values, and interests of individuals, businesses, industries and societies. **8.2.8.C.3** Evaluate the function, value, and aesthetics of a technological product or system, from the perspective of the user and the producer.	With the development of technology, communication has progressed to have a significant impact society and the way we act.	• How can the ability to instantly communicate around the world help or hurt society?
	Products can be changed and improved to meet different demands.	• How does the progression of technology affect the way we use products every day?
	As technology advances and our ability to communicate increase, our actions online requires responsible behavior.	• How can the way we act on social media reflect on our own image?
	KNOWLEDGE	**SKILLS**
	Students will know: Design software allows users to create and modify their own images and artwork.	**Students will be able to:** Identify the proper tools used to construct shapes and lines. Apply skills learned in the interface to replicate an existing graphic idea. Design and create an original graphic using proper tools and insert them using code.

		Justify elements of your design to a group of peers.
	JavaScript is a programming language that provides a way to create filters that change the way a video looks.	Recognize simple commands in JavaScript and the interface used.
		Apply a filter to an uploaded original video.
	Values and types designate the amount and attributes of a function and some functions require two arguments.	Analyze the correct values and types to recreate a filter.
	Videos are fast changing pictures that, when ordered correctly, can create the illusion of movement and motion.	Arrange pictures in the correct order to show motion.
	The computer reads the code from the top down and the sequence of a code can result in different products.	Rearrange the same sequence of a code to show different products.
	Digital tools and resources are used to communicate ideas and information to others around the world.	Synthesize a piece of media about an important topic in the world.
		Evaluate the effectiveness of the piece of media.
	VOCABULARY: filter, values, types, arguments, variables, shapes, lines, vectors. **KEY TERMS:** code editor, JavaScript, programming language, tool bar, social media.	

ASSESSMENT EVIDENCE: Students will show their learning by:
- Vectr Basics (Rubric)
- Unit quizzes

KEY LEARNING EVENTS AND INSTRUCTION:
- Intro to Vidcode – How to make things and change them with code

- The Creation Zone
- A Tale of Special Effects
- Conditional Magic

SUGGESTED TIME ALLOTMENT	CONTENT-UNIT OF STUDY	SUPPLEMENTAL UNIT RESOURCES
3 Weeks	**Audio-Visual Design with Technology** Vectr Assignments Vidcode Course 1	BOOKS: None Required Readings taken from various relevant sources Suggested Supplies: Computers Measuring and Drafting tools such as rulers, triangle straight edges, graphing paper Various Objects from around the technology classroom Styluses Suggested Activities: Vectr Graphic Assignment Unit 1: Intro to Vidcode Unit 2: The Creation Zone Unit 3: A Tale of Special Effects Unit 4: Conditional Magic

STANDARDS / GOALS: **NJCCCS Technology**	ENDURING UNDERSTANDINGS	ESSENTIAL QUESTIONS
8.2.8.A.2 Examine a system, consider how each part relates to other parts, and discuss a part to redesign to improve the system. **8.2.8.A.3** Investigate a malfunction in any part of a system and identify its impacts	A system of conductors arranged in a circuit provides a way to transfer information and accomplish tasks with an electrical current.	• How can the setup of a system change the way it works?
8.2.8.C.6 Collaborate to examine a malfunctioning system and identify the step-by-step process used to troubleshoot, evaluate and test options to repair the product, presenting the better solution.	Humans can change the way we obtain and use energy to have positive effects on our environment.	• How can the way we use energy impact others globally?
8.1.8.C.1 Collaborate to develop and publish work that provides perspectives on a global problem for discussions with learners from other countries.	KNOWLEDGE	SKILLS
8.2.8.A.4 Redesign an existing product that impacts the environment to lessen its impact(s) on the environment. **8.2.8.A.5** Describe how resources such as material, energy, information, time, tools, people, and capital contribute to a technological product or system. **8.2.8.B.1** Evaluate the history and impact of sustainability on the development of a designed product or system over time and present results to peers. **8.2.8.B.3** Research and analyze the ethical issues of a product or system on the	**Students will know:** A circuit is a system of conductive substances that allows an electric current to pass.	**Students will be able to:** Arrange a circuit with a load, switch, and power source. Explain the different parts of a circuit and their roles in the system. Modify a circuit to accomplish a task. Construct an original circuit for a designated task.

environment and report findings for review by peers and /or experts **8.2.8.D.5** Explain the impact of resource selection and the production process in the development of a common or technological product or system. **8.2.8.D.6** Identify and explain how the resources and processes used in the production of a current technological product can be modified to have a more positive impact on the environment.	The energy to produce and electrical charge can have varying sources. Continued use of fossil fuel based energy will reduce the amount of resources and increase the amount of greenhouse gas emitted. Alternative energy sources can include solar, wind, hydro, and geothermal.	Describe the sources of electrical energy and methods of how the energy is stored. Evaluate evidence on fossil fuels impact on the environment. Classify various energy sources, conditions required, and overall efficiency using data. Design a device utilizing alternate energy as a power source. Explain the advantages and disadvantages of your device.
	VOCABULARY: circuit, series, parallel, conductor, insulator, resistor, power source, wind turbine, water turbine, solar panel, voltage, amperage, ohms. **KEY TERMS:** electrical current, fossil fuel, alternative energy, environment.	

ASSESSMENT EVIDENCE: Students will show their learning by:
- Class discussions (See Appendix for rubric)

KEY LEARNING EVENTS AND INSTRUCTION:
- STEM Fuse Electrical Current
- Snap Circuits
- K'Nex: Alternative Energy

SUGGESTED TIME ALLOTMENT	CONTENT-UNIT OF STUDY	SUPPLEMENTAL UNIT RESOURCES
3 Weeks	**Alternative Energy** Introduction to Circuits Alternative Energy	BOOKS: None Required Readings taken from various relevant sources Suggested Supplies: Computers Measuring and drafting tools Suggested Activities: STEM Fuse Electrical Current Snap Circuits K'Nex: Alternative Energy

STANDARDS / GOALS: **NJCCCS Technology**	**ENDURING UNDERSTANDINGS**	**ESSENTIAL QUESTIONS**
8.1.8.B.1 Synthesize and publish information about a local or global issue or event (ex. telecollaborative project, blog, school web).	Creating new products can be simplified and improved by using a coherent design process.	• How does the way something is designed give it more or less value?
8.1.8.F.1 Explore a local issue, by using digital tools to collect and analyze data to identify a solution and make an informed decision. **8.2.8.C.2** Explain the need for optimization in a design process.	Breakthroughs in science allow us to create new technology to solve problems. As technology increases, the scientific study of the natural world becomes easier and more accurate.	• How can a breakthrough in one field cause a negative or positive effect to another field?
8.2.8.C.7 Collaborate with peers and experts in the field to research and develop a product using the design process, data analysis and trends, and maintain a design log with annotated sketches to record the developmental cycle.	**KNOWLEDGE**	**SKILLS**
8.2.8.C.8 Develop a proposal for a chosen solution that include models (physical, graphical or mathematical) to communicate the solution to peers. **8.2.8.D.2** Identify the design constraints and trade-offs involved in designing a prototype (e.g., how the prototype might	**Students will know:** The process which engineers and designers use is called the engineering design process. Evaluating a problem is essential for the construction of an effective solution. Research is an essential step of design that allows us to	**Students will be able to:** Describe the steps of the engineering design process. Apply the steps of the design process to an engineering problem. Identify the problem, evaluating criteria and constraints. Analyze information about the problem and

fail and how it might be improved) by completing a design problem and reporting results in a multimedia presentation, design portfolio or engineering notebook. **8.2.8.D.3** Build a prototype that meets a STEM-based design challenge using science, engineering, and math principles that validate a solution **8.2.8.D.4** Research and publish the steps for using and maintaining a product or system and incorporate diagrams or images throughout to enhance user comprehension.	learn from mistakes. The way a product is design has a direct impact on the effectiveness of its function. A design is assessed various through tests to determine its effectiveness. A redesign can improve a products ability to meet a problems criteria and constraints. Sharing a design solution can reveal possible shortcomings or opportunities of a product. **VOCABULARY:** prototype, criteria, constraints, entrepreneurship, frequency, wave length, amplitude. **KEY TERMS:** engineering design process.	possible solutions others have constructed. Construct possible solutions of a problem. Justify the design of a product. Model a test to evaluate the design while collecting data. Utilizing the data from the test, redesign the product to better preform a task or function. Defend the final product to others while collecting feedback from others and evaluating competing designs.

ASSESSMENT EVIDENCE: Students will show their learning by:
- STEM Fuse Product Development Quiz
- STEM Fuse Entrepreneurship Quiz
- STEM Fuse Science of Sound Quiz
- Independent Project (Rubric)

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Science and Technology
Unit III: Task Projects: STEM Fuse Art and Construction

SUGGESTED TIME ALLOTMENT	CONTENT-UNIT OF STUDY	SUPPLEMENTAL UNIT RESOURCES
3 Weeks	**Task Projects: STEM Fuse Art and Construction** Entrepreneurship Product Development Science of Sound Independent Project	BOOKS: None Required Readings taken from various relevant sources. Suggested Supplies: Computers Suggested Activities: STEM Fuse Product Development STEM Fuse Entrepreneurship STEM Fuse Science of Sound Independent Project

Resources:

  Text and Electronic Text:

    None

  Suggested Web Addresses:

    www.google.com

      www.tinkercad.com

    www.edmodo.com

    www.globalclassroom.org/rulergame200/index.html

    www.flipagram.com

    http://pbskids.org/designsquad/

    http://tryengineering.org/play-games

  Software Names:

    Microsoft Word

    Microsoft PowerPoint

    Microsoft Excel

      TinkerCAD

    123D-Design

    Retina-Engrave

    Photoshop

    Flipagram

    Internet Sources

Assessments
      Class Discussions Rubric

Rubric for Classroom Discussion

Task Description:	(Teacher may explain specific assignment in this space.)

Criteria	weight	Exemplary	Effective	Minimal	Unsatisfactory
Level of Engagement	50%	☐ Contributes to class activities by offering quality ideas and asking appropriate questions on a regular basis ☐ Actively engages others in class discussions by inviting their comments ☐ Constructively challenges the accuracy and relevance of statements made ☐ Effectively identifies and summarizes main points	☐ Contributes to class activities by offering ideas and asking questions on a regular basis ☐ Often engages others in class discussions by inviting their comments ☐ Challenges the accuracy and relevance of statements made ☐ Identifies and summarizes main points	☐ Occasionally contributes to class activities by offering ideas and asking questions ☐ Sometimes engages others in class discussions ☐ Sometimes has an understanding of main points ☐ Identifies and summarizes some of the main points	☐ Fails to contribute to class activities ☐ Fails to invite comment/opinions from other students ☐ Demonstrates little understanding of main points ☐ Does not identify or summarize main points
Preparedness	25%	☐ Always prepared for class with assignments and required materials ☐ Accurately expresses foundational knowledge pertaining to issues raised during the discussion	☐ Usually prepared with assignments and required materials ☐ Expresses basic foundational knowledge pertaining to class discussions	☐ Seldom prepared with assignments and required materials ☐ Expresses limited foundational knowledge pertaining to class discussions	☐ Consistently unprepared for class ☐ Expresses no relevant foundational knowledge
Attitude	25%	☐ Consistently positive, cooperative attitude during class ☐ Always supportive of other students' ideas	☐ Usually positive and cooperative with classroom projects and discussions ☐ Often supportive of other students' ideas	☐ Seldom actively participates in classroom projects and discussions ☐ Sometimes supportive of other students' ideas	☐ Rarely if ever participates in classroom projects and discussions ☐ Occasional disruptive behavior

Assignment Score _____   +   Bonus _____   =Final Score _____