Unit 1: Designing and Creating a City of the Future

Content Area: **Technology**
Course(s): **Engineering**
Time Period: **Week 1**
Length: **Ongoing**
Status: **Published**

Unit Overview

Students will learn about the engineering design process and how to: identify problems and brainstorm solutions; build their designs, test and retest; and share their results. They will also learn team-building strategies while appling the design process to design and build a sustainable city of the future and input that design into a virtual simulation world.

Standards

TECH.8.1.5	Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
TECH.8.1.5.A	Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.
TECH.8.1.5.A.1	Select and use the appropriate digital tools and resources to accomplish a variety of tasks including solving problems.
TECH.8.1.5.A.CS1	Understand and use technology systems
TECH.8.1.5.B	Creativity and Innovation: Students demonstrate creative thinking, construct knowledge and develop innovative products and process using technology.
TECH.8.1.5.B.CS1	Apply existing knowledge to generate new ideas, products, or processes.
TECH.8.1.5.B.CS2	Create original works as a means of personal or group expression.
TECH.8.1.5.C	Communication and Collaboration: Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.
TECH.8.1.5.C.CS1	Interact, collaborate, and publish with peers, experts, or others by employing a variety of digital environments and media
TECH.8.1.5.C.CS4	Contribute to project teams to produce original works or solve problems
TECH.8.1.5.D	Digital Citizenship: Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior.
TECH.8.1.5.D.3	Demonstrate an understanding of the need to practice cyber safety, cyber security, and cyber ethics when using technologies and social media.
TECH.8.1.5.D.CS1	Advocate and practice safe, legal, and responsible use of information and technology.
TECH.8.1.5.E	Research and Information Fluency: Students apply digital tools to gather, evaluate, and use information.
TECH.8.1.5.E.CS1	Plan strategies to guide inquiry.
TECH.8.1.5.F	Critical thinking, problem solving, and decision making: Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.

TECH.8.1.5.F.CS1	Identify and define authentic problems and significant questions for investigation.
TECH.8.1.5.F.CS2	Plan and manage activities to develop a solution or complete a project.
TECH.8.1.5.F.CS3	Collect and analyze data to identify solutions and/or make informed decisions.
TECH.8.1.5.F.CS4	Use multiple processes and diverse perspectives to explore alternative solutions
TECH.8.2.5	Technology Education, Engineering, Design, and Computational Thinking - Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.
TECH.8.2.5.A	The Nature of Technology: Creativity and Innovation: Technology systems impact every aspect of the world in which we live.
TECH.8.2.5.A.2	Investigate and present factors that influence the development and function of a product and a system.
TECH.8.2.5.A.CS1	The characteristics and scope of technology.
TECH.8.2.5.B.CS2	The effects of technology on the environment.
TECH.8.2.5.C	Design: The design process is a systematic approach to solving problems.
TECH.8.2.5.C.1	Collaborate with peers to illustrate components of a designed system.
TECH.8.2.5.C.4	Collaborate and brainstorm with peers to solve a problem evaluating all solutions to provide the best results with supporting sketches or models.
TECH.8.2.5.C.5	Explain the functions of a system and subsystems.
TECH.8.2.5.C.7	Work with peers to redesign an existing product for a different purpose.
TECH.8.2.5.C.CS1	The attributes of design.
TECH.8.2.5.C.CS2	The application of engineering design.
TECH.8.2.5.C.CS3	The role of troubleshooting, research and development, invention and innovation and experimentation in problem solving.
TECH.8.2.5.D	Abilities for a Technological World: The designed world is the product of a design process that provides the means to convert resources into products and systems.
TECH.8.2.5.D.1	Identify and collect information about a problem that can be solved by technology, generate ideas to solve the problem, and identify constraints and trade-offs to be considered.
TECH.8.2.5.D.2	Evaluate and test alternative solutions to a problem using the constraints and trade-offs identified in the design process to evaluate potential solutions.
TECH.8.2.5.D.4	Explain why human-designed systems, products, and environments need to be constantly monitored, maintained, and improved.
TECH.8.2.5.D.5	Describe how resources such as material, energy, information, time, tools, people and capital are used in products or systems.
TECH.8.2.5.D.7	Explain the impact that resources such as energy and materials used in a process to produce products or system have on the environment.
TECH.8.2.5.D.CS1	Apply the design process.

Essential Questions

- What is engineering? What does an engineer do?
- What is the engineering design process and how can it be applied to a simulation tool like MinecraftEdu?
- What will a city of the future look like?
- What services does a city supply to its citizens?
- How can Minecraft help me better understand the world around me?

- What civic responsibilities does a student have in a virtual world?
- How can collaborating help me solve problems?
- How does working collaboratively help me be more creative?

Application of Knowledge: Students will know that...

- City planners and engineers provide well designed and executed services to its citizenship.
- There are rules and goals for playing Minecraft in the classroom.
- Using the engineering design process will aid in planning, designing, and implementing their city of the future.
- Working collectively can help solve problems and increase creativity.

Application of Skills: Students will be able to...

- Collaborate and communicate with peers to design multi-purpose structures and solve problems as they arise.
- Navigate the world of MinecraftEdu and demonstrate advanced competency at building their own content.
- Serve on a Board of City Planners that is tasked with building a "green" city of the future.

Assessments

- City of the Future Design Rubric and Scoresheet
- Student Presentations
- Information from this unit will be included on a locally developed, end of course benchmark assessment that may take the form of a test, performance based project, or other summative assessment.

Suggested Activities

National Science Foundation Presents "What is Engineering?"

Objective: Students will learn that flying cars, Earth-sized atmospheric filters, quick access to clean water, phones with holograms, and more fascinating inventions were designed by engineers. This video will give students an introduction to what engineers do.

https://www.youtube.com/watch?v=FAJGx3zP-Eo&feature=youtu.be

"Survival on the Moon" team-building activity

Objective: Students will learn team-building skills by working together as a team to conduct a NASA exercise that involves team members making decisions together and agreeing on a solution.

http://futurecity.org/form/resources?download=/system/files/resources/files/survival_on_the_moon_-_pmi.pdf

Teambuilding: Generating Ideas Warm Up

Objective: Students stretch their imaginations by looking at a variety of everyday objects and listing possible new uses for the objects. This idea-generation activity focuses on key components of communication, problem solving, and thinking outside of the box, setting the stage for students to work together and manage their own projects.

http://futurecity.org/resource/teambuilding-generating-ideas-warm

What is a City?

Objective: Define the elements that comprise a city. We know that New Dehli, Paris, New York, and Beijing are all cities. But what makes each of them a city? Is it population size, location, presence of government buildings, or social amenities? How do you define a city?

http://futurecity.org/resource/what-city

What is Infrastructure?

Objective: Define the term infrastructure.

http://futurecity.org/resource/what-infrastructure

City Planning Game

Objective: This game helps students learn how to design the placement of city elements within zoning areas.

http://futurecity.org/resource/city-planning-game-basic

City Planning Word Investigation

Objective: Research definitions and create an understanding for the terminology of city planning, zoning, and infrastructure.

http://futurecity.org/resource/city-planning-word-investigation

Brainstorming and Ranking City Features

Objective: Explore how infrastructure helps get goods and services to where they are needed.

http://futurecity.org/resource/brainstorming-and-ranking-city-features

Introduction to Scale

Objective: Students will learn how to draw a design to scale.

http://futurecity.org/resource/introduction-scale

Tower Building Activity

Objective: Apply the engineering design process by building the tallest freestanding structure that supports a marshmellow.

http://futurecity.org/resource/tower-building

Engineering Go-for-it Magazine

Objective: Students will learn about different engineering career choices.

http://students.egfi-k12.org/eGFI-Engineering-Go-For-It-Magazine.pdf

Activities to Differentiate Instruction

Differentiation for special education:

- General modifications may include:
    - Modifications & accommodations as listed in the student's IEP
    - Assign a peer to help keep student on task
    - Modified or reduced assignments
    - Reduce length of assignment for different mode of delivery
    - Increase one-to-one time
    - Prioritize tasks
    - Think in concrete terms and provide hands-on-tasks
    - Position student near helping peer or have quick access to teacher
    - Anticipate where needs will be

    - Content specific modifications may include:

        - Provide written instructions and Minecraft building guidelines
        - Students will benefit from established routines and seating, and peer-to-peer teamwork that encourage a cooperative learning environment
        - Students who have completed the current project can investigate online Minecraft tutorials for additional creative solutions
        - Students may work at their own pace
        - Reduce/increase assignment requirements

Differentiation for ELL's:

- General modifications may include:
    - Strategy groups
    - Teacher conferences
    - Graphic organizers
    - Modification plan
    - Collaboration with ELL Teacher
- Content specific vocabulary important for ELL students to understand include: engineer, city, street, building, design

Differentiation to extend learning for gifted students:

- Students with an advanced Minecraft skill set may conduct additional Internet research to acquire new mining skills and building techniques.
- Activities to encourage additional exploration of engineering concepts and careers:
    - Select a manufactured item in your home (such as a toy or an appliance) and investigate how and why it works as it does. Find out what engineering activities were needed to create it.
    - Select an engineering achievement that has had a major impact on society. Using resources such as the Internet, books, and magazines, find out about the engineers who made this engineering feat possible, the special obstacles

they had to overcome, and this achievement has influenced the world today.
- Explain the work of six types of engineers. Pick two of the six and explain how their work is related.
- Find out about three career opportunities in engineering. Pick one and research the education, training, and experience required for this profession.
- Trash Sliders activity - http://teachers.egfi-k12.org/category/activities/grades-6-8-activities/

Integrated/Cross-Disciplinary Instruction

Social Studies - Explore real life cities (NYC, Los Angeles, London) and create models of city infrastructure systems.

Math - practice ratio and proportion; geometry and measurement associated with building and design

Science - learn about environmental issues facing the city of the future; explore renewable resources

Language Arts - use writing and communication skills to present information

Architecture - Design and build a model of a building structure

Resources

Youtube videos:

Engineering Defined:

- What is Engineering: https://www.youtube.com/watch?v=bipTWWHya8A
- Inspiring the Next Generation of Female Engineers: Debbie Sterling (Founder of GoldBlox) at TED (17:08): https://www.youtube.com/watch?v=FEeTLopLkEo
- What is Engineering (National Science Foundation): https://www.youtube.com/watch?v=FAJGx3zP-Eo
- NASA for Kids: Intro to Engineering: https://www.youtube.com/watch?v=wE-z_TJyziI
- What's an Engineer? Crash Course Kids #12.1: https://www.youtube.com/watch?v=owHF9iLyxic
- The Engineering Process: Crash Course Kids #12.2: https://www.youtube.com/watch?v=fxJWin195kU

The Engineering Design Process

- http://futurecity.org/resource/engineering-design-process

City Planning

- http://futurecity.org/resource/city-planning-background-information
- http://futurecity.org/resource/city-planning-key-terms-and-concepts

Engineering Go-for-it Magazine

- http://students.egfi-k12.org/eGFI-Engineering-Go-For-It-Magazine.pdf

Engineer Girl Website

- http://www.engineergirl.org/

Sample Virtual City Slideshow

- http://futurecity.org/resource/sample-virtual-city-slideshow

21st Century Skills

CRP.K-12.CRP1.1	Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.
CRP.K-12.CRP2.1	Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.
CRP.K-12.CRP4.1	Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.
CRP.K-12.CRP5.1	Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies, understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and the profitability of the organization.
CRP.K-12.CRP6.1	Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.
CRP.K-12.CRP7.1	Career-ready individuals are discerning in accepting and using new information to make

	decisions, change practices or inform strategies. They use reliable research process to search for new information. They evaluate the validity of sources when considering the use and adoption of external information or practices in their workplace situation.
CRP.K-12.CRP8.1	Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.
CRP.K-12.CRP11.1	Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks-personal and organizational-of technology applications, and they take actions to prevent or mitigate these risks.