Hempstead Union Free School District (HUFSD): 21stCentEd's Curriculum and STEM Unit Guide

Overview: Hempstead Union Free School District will use the 4 Shifts Protocol and STEM Unit Guide below to integrate STEM education for grades K-12. This guide will serve as a roadmap for Teachers and/or FaciliMentors, who will engage their students in high-level, inquiry-based STEM experiences. **This Unit Guide is a template that can be used as the instructional framework for 21stCentEd's STEM courses and district-level curriculum.** These STEM courses are grounded in the Next Generation Science Standards and provide the educator and learner with real-life, hands-on STEM experiences that will prepare all students for a global workforce, economy, and world.

Directions: Teachers and/or Facilimentors in grades K-12 will engage students in STEM education during each marking period for the 2022-2023 school year, using the engineering design process. In addition, instructors will use the template below to map out their **"STEM Units of Study"** that will enhance teaching and learning in the classroom and lead to higher student achievement.

Shift 1: How will this unit of study foster deeper thinking & learning?

Unit Objective(s):

Description: Unlike a goal, an objective is rooted in intention and planning. It's not something you hope to achieve, it's something you actively plan to achieve.

Objective 1: In this unit, students will investigate concepts related to the foundation of computer literacy. Students will be exposed to a broad range of technology concepts from basic computer hardware/software to computer systems, the Internet, and safe online habits.

Objective 2: Students will learn critical and analytical thinking, problem solving skills, as well as how

Unit Outcome(s):

Description: Although outcome and objective are similar, the outcome is the finish line for an objective.

Outcome 1: The learner will understand and gain knowledge about how computers function and how to use them. They will gain familiarity and experience with hardware, software, and computer systems and basic understanding of network principles.

Outcome 2: The learner will create and analyze computer algorithms while demonstrating problem-solving skills.

Outcome 3: The learner will create and analyze computer algorithms so they can design their own programs.

Resource: A Complete Definition of College & Career Readiness (see "Academic Performance" outcomes, top of page 3).

to use various forms of technology to effectively communicate their ideas. Students will understand how information can be collected, used, and presented with computing devices or digital tools.

Objective 3:
Students will also learn the basics of programming, algorithms, cybersecurity, and cryptography. Students will apply the concepts they learned to design and analyze computer programming and apply advanced problem solving.

Resource 1: Bloom's Taxonomy
Resource 2: Depth of Knowledge

Engineering Design Standards (EDS):
K-2 EDS: (link)
3-5 EDS: (link)
MS EDS: (link)
HS EDS: (link)
Grade 5 & 8 Science Tests (link)

ELA Next Generation Standards: Cross-curricular (link)

HUFSD Framework & NYSED Standards
Description: List your power standard(s) and interdisciplinary theme(s) here.
- **Power Standard(s):** Interdistrict, grade-level learning goals that are essential for students to master by the end of a specific unit of study, course, or grade level. These standards should be content-specific.

ISTE Standards:
1. Creativity and innovation
Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology.
a. Apply existing knowledge to generate new ideas, products, or processes
b. Create original works as a means of personal or group expression
c. Use models and simulations to explore complex systems and issues
d. Identify trends and forecast possibilities

3. Research and information fluency

Students apply digital tools to gather, evaluate, and use information.
a. Plan strategies to guide inquiry
b. Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media
c. Evaluate and select information sources and digital tools based on the appropriateness to specific tasks
d. Process data and report results

3-5-ETS1 Engineering Design
- Students who demonstrate understanding can:

3-5-ETS1-1.   Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

3-5-ETS1-2.   Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

3-5-ETS1-3.   Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

- **Transdisciplinary (K-5) & Global Context (6-8) Theme(s):** (link)
- **IB Themes & STEM Literacy:** Theme 2- Where We Are In Place and Time (link)

Essential Questions
All students will keep considering...

Description: An open-ended question (written in student friendly language) designed to stimulate thought and provoke student inquiry into a topic. Essential Questions anchor knowledge in larger, more global "buckets" for students. They allow the teacher to connect academic content with broader, real-world application. EQs tap into student's natural curiosity so they engage with the content through inquiry, answering the following questions:
- Are the EQs authentic & age-appropriate for students?
- Do the EQs spark debate, research, or reflection?
- Do the EQs span broader than just this unit?
- Are the EQs connected to the standards?
- Are they formatted as a bulleted list of 2-5 Essential Questions with corresponding unit questions added as sub-bullets if applicable?

Essential Questions

All students will keep considering…
- What is a computer?
- What is software
- What is hardware
- What is an algorithm
- What can humans do that computers can't do (yet)?
- What would my life and the world be like without computers?
- How can we use computers and other forms of technology to demonstrate our learning ?
- How can we demonstrate digital citizenship, what does that look like?
- How can we be safe and keep our private information and data secure online?
- What is the internet ?
- How does the internet work?
- How is being safe when visiting websites similar to staying safe in real life?
- What types of personal information are private?
- How do you create effective usernames that protect your private information?
- What kinds of information are appropriate to be put online?
- How does the information you put online leave a digital footprint?
- How do you know which websites are good for you to visit?

Portrait of a 21st Century Graduate

Description: Captures the way this unit supports students in growing as scholars and global citizens. Only select the statements that are the primary focus of the unit. Teachers and/or FaciliMentors target key 21st Century skills and social-emotional learning competencies that are required for students to engage in and master during this unit of study.

Resource: The Four Keys to College & Career Readiness

Portrait of a 21st Century Graduate

By the end of this unit, 21st Century graduates will have the knowledge and skills to operate and understand the uses and functions of a computer. Students will have knowledge of software, hardware, networking and other various forms of technology as well as become responsible digital citizens. .Students will be able to discuss how to be a good citizen online and how to keep safe by not sharing personal information. Students will be able to identify how people in different jobs use technology in different ways. Students will communicate and collaborate using various technologies,

as well as critically think to problem solve.

Shift 2: How will students engage in authentic work?

F.I.D.S. Model: (link)
Description: Design Thinking-Infused Pedagogical approach to teaching & learning in the classroom that enhances educator effectiveness and increases student achievement.

FEEL
Description: Students identify what bothers them the most; They transform helplessness into empowerment. Use the following questions to engage students in the design thinking process:

- What are the key concepts or content being taught in this unit?
- What are possible topics/challenges students could discuss?
- What real life impact and relevance do these concepts have on the students and others? (also think about career connections)
- How could students explore these topics by gathering data or information? (also think about career connections)
- What data, information, and/or research might they do?

Key Concepts and Content -

How to be a Digital Citizens
How the internet works
Basic hardware, software and networking understanding
How to keep private information and data secure
How to write an algorithm
How to program a basic game

Topics/ Challenges students can discuss-

Students can discuss the challenges of being a digital citizen.
Topics
-    Safety online and on Social Media(Digital Citizenship)
-    Academic Honesty Policy (IB) (Being Principled) - Copyright laws and Plagiarism
-    Password Security - How to create secure passwords and remember them
-    Being principled while online and on social media

- Students will be able to model how to cite images, text and other work taken from the internet in an age appropriate way.
- Students will be able to locate and cite the author and title or Website name and URL (web address).

See/Think/Wonder - Visual Thinking Routine
What do you see?
What do you think?
What do you wonder?

9 Elements of Digital Citizenship

Digital Access
Digital Commerce
Digital Communication
Digital Literacy
Digital Etiquette (netiquette)
Digital Law
Digital Rights and Responsibilities

Digital Health and Wellness
Digital Security

Data/ Research
Students can explore and gather information on these topics by researching each element of digital citizenship
Students can research various types of hardware and software
Students can research and compare old technology to new technology.
How many people had computers in the 80 vs 90s vs 2000 vs now?
How many accounts/data breaches happen a day, a month a year?
What are ways to avoid or protect data breaches?
25 most common passwords

IMAGINE

Description: Students brainstorm ways to take the current situation to a preferred state for self and others. Use the following question to engage students in the design thinking process:

● How might we...[students fill in the question based on the data gathered from the FEEL stage that guides them to a prototype]?

How might we be digital citizens?
How might we keep our data and private information safe?
How might we show and explain how a computer works?
How might we visually write out an algorithm?

DO

Description: Students are empowered to do what it takes to bring about change with courage and determination. Use the following questions to engage students in the design thinking process:

● How can students use this data, information, and/or research to create or innovate a prototype?

Students use their data and research to decide which to forms of technology to effectively communicate their ideas. Students will

understand how information can be collected, used, and presented with computing devices or digital tools.

Do Activities
Digital citizenship poster
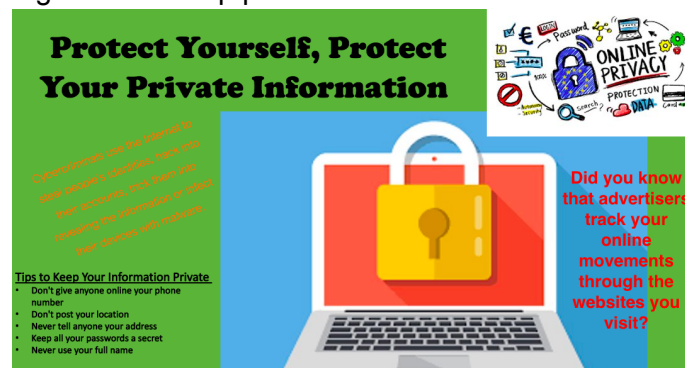
Steps to create a safe and secure password

Steps to keep data and information private online and on social media
Visuals or flowchart on how a computer work
Steps for an algorithm
Activity: 1.1 Maze Algorithm
Activity 1.2: Number Guessing
Activity 1.3: Number 1-300
Activity 1.4: Bagels Game
Activity 1.5: Tower of Hanoi

SHARE

Description: Students share their stories to inspire others to be the change. Use the following questions to engage students in the design thinking process:

- Who is an authentic audience for the students to gain feedback on their innovation? (also think about career connections)
- How can the students present their final plans/prototypes in an authentic manner? (also think about career connections)

	Students will use various forms of technology to effectively communicate their ideas. Buncee and Buncee Boards PowerPoint Presentations Word Documents Padlet - upload a file, take a picture, gif or meme, link, video recording, drawing, ect.

Shift 3: How will this unit of study build student agency & personalization?

STEM Experiences & Activities / Instructional Protocols

Description: Teachers and/or FaciliMentors will develop lessons designed to engage students in STEM experiences. Each activity should build upon one another that guides the students through the four types of inquiry. In order to establish this type of instructional design that personalizes learning for each student, the instructor must implement instructional protocols that fosters cooperative learning, team work, peer feedback, and student agency. When implemented with fidelity, instructional protocols develop a learning environment in the classroom that teaches students how to engage in collaborative inquiry and group work that is needed in STEM activities and projects.

Resource: 5E Lesson Plan Template (optional)

CT= Classroom Talk

QUES= Questioning

CGW= Collaborative Group Work

SCFL= Scaffolding

LG= Literacy Groups

WTL= Writing to Learn

Shift 4: How will this unit of study infuse instructional technology?

Technology Infusion

Description: Technology is more than the bells and whistles of new tablets or laptops in the classroom. The goal should be thinking about using the technology to effectively change or enhance instruction, so that you are doing something greater or more efficiently by using it (Resource link).

- Why do you want to use this technology here?
- Why hasn't the approach that you've been doing in the past worked?
- How do you hope technology will change it?
- Can technology make this idea more relevant to students?
- Can it push the lesson up a notch, or can it enhance things for students by allowing them to do something that they couldn't do without the technology? For example, does the technology allow students to collaborate beyond the classroom walls?
- Is the technology making possible a certain level of transparency for the teacher to assess where students are individually?
- Does the technology provide a platform for students to be creative without overbearing them with gadgets and apps?

Resource 1: What Does A 21st Century Classroom Look Like: Technology Integration (Edutopia, March 31, 2015).
Resource 2: Harnessing Technology for Deeper Learning