Lift-Off with CodeX – TEKS Technology Applications Grade 8 Curriculum

The curriculum for Technology Applications Grade 8 consists of programming CodeX missions using a peripherals kit and completing lessons in computer science topics. The CodeX is a specialized micro:bit with integrated speaker, accelerometer, LEDs, display screen and several buttons for input. Using a physical device for coding dramatically increases engagement and interest over traditional computer science instructional methods that focus on math problems or manipulating on-screen elements. The peripherals kit offers even more physical devices to interact with while programming in Python and learning about computer science.

Our educational program creates real-world learning experiences for students. This is achieved through the use of:

- Open-ended physical hardware, used to implement meaningful projects
- Open-ended software, integrating development tools with instructional content, with the possibility of students to directly apply the tools well beyond the scope of what is covered in the curriculum
- Python, the fastest growing major programming language used in Industry
- An integrated learning environment that includes instructions, a source code editor with syntax highlighting and intelligent code completion, a built-in debugger and REPL.

All standards are met by completing the missions and lessons. The amount of time needed to complete the curriculum is flexible; it can be used once or twice a week up to an entire semester (or more).

Lift-Off with CodeX / TEKS Technology Applications Grade 8 Curriculum Crosswalk

Beginning of Course

Lesson/Mission	Outline of lesson	Standards
Typing *(approx. 30 min)*	This is the start of the Data & Trends lesson. Students are introduced to a typing program and start typing practice for about 10 minutes 2-3 times a week. Students keep track of their words per minute on a table that they will use later on to create a chart and make inferences. Final Project: in the Data and Trends lesson	(12) D
(Optional) Pre-Mission Assignment	Students may benefit from reviewing the foundations of computational thinking. Discuss algorithms, variables and constants, functions, loops and conditional statements. Go over debugging strategies. Review basics of Python coding, like indenting, use of capitalization, importing libraries, etc.	(1) C, E (2) A (4) C

Missions

Lesson/Mission	Outline of lesson	Standards
Mission 1 *(approx. 30-60 min)*	**Welcome to Lift-off with CodeX** Students will receive the Mission Briefing about their trip to outer space. They explore the different peripherals in their kit, and connect their first peripheral - the red LED light. No final project (short lesson)	(4) A, B, C (12) A
Mission 2 *(approx. 45-75 min)*	**Lift-Off** This mission is all about getting the rocket ship off the ground. Students will create a power switch for the engines, a countdown sequence for personnel and a launch button for Mission Control. Ideally students will refresh their Python knowledge as they get the mission to Mars underway. Final Project: Students complete an extension or cross-curricular project	(1) A, B, C, E, F (2) C (3) A, B (7) A (12) E, F
Mission 3 *(approx. 45-75 min)*	**Conserve Energy** Mars is a hike! In this lesson, students work with three different peripherals to detect motion, simulate a light source, and control the activation and brightness of the lights after motion has been detected. This project combines digital and analog sensors. Final Project: Students complete an extension or cross-curricular project	(1) A, B, C, E, F (2) A, B, C (3) A, B (7) A (12) E, F

Mission 4 *(approx. 45-75 min)*	**Hatch Lock** Now that the crew has a way to conserve energy on the way to Mars, they need to make sure they can successfully dock with a supporting craft that was launched ahead of the mission. With 8 locks that need to be successfully engaged, this project supports mathematical conversations about failure rates along with the percentages and statistics related to them. Students will generate random numbers to simulate the hatch locks. Final Project: Students complete an extension or cross-curricular project	(1) A, B, C, E, F (2) A, B, C (3) A, B (7) A (12) E, F
Mission 5 *(approx. 60-90 min)*	**Alert System** Being on another planet can get lonely sometimes. With no neighbors to check on the crew, they'll need a good alarm system. In this project students will consider the technical dangers a crew can encounter on the ship. Students will convert raw data to Celsuis and use an averaging calculation. Final Project: Students complete an extension or cross-curricular project	(1) A, B, C, E, F (2) A, C (3) A, B (6) A (7) A (12) C, E, F
Mission 6 *(approx. 30-60 min)*	**Life Support** It doesn't matter how safe the crew is if they can't breathe. Ensuring consistent air quality is key to the success of this mission. Students will be using a servo to make sure the air circulates throughout the spacecraft. Final Project: Students complete an extension or cross-curricular project	(1) A, B, C, E, F (2) A, B, C (3) A, B (6) A (7) A (12) C, E, F
Mission 7 *(approx. 45-75 min)*	**Solar Tracking** For this project the crew needs a way to generate energy from the sun. Learners will use a light sensor to determine when to rotate the solar panels to follow the path of the sun. Final Project: Students complete an extension or cross-curricular project	(1) A, B, C, E, F (2) A, B, C (3) A, B (6) A (7) A (12) C, E, F
Mission 8 *(approx. 45-75 min)*	**Prepare Lander** To land safely on Mars, a complete ground sensing system will be constructed using several peripherals. The object sensor will be used to detect the nearing of the surface, the NeoPixel ring will be used to alert the crew, and the microswitch will be used to indicate the surface contact. Also, the servo will be used to simulate landing gear. Final Project: Students complete an extension or cross-curricular project	(1) A, B, C, E, F (2) A, B, C (3) A, B (6) A (7) A (12) C, E, F
Mission 9 *(approx. 30-60 min)*	**Automatic Garden** The crew wants to automate the growing of their food after they land on Mars. Students will construct a system to sense soil moisture levels and then automatically water the garden. Students will use a relay and water pump to complete the task. Final Project: Students complete an extension or cross-curricular project	(1) A, B, C, F (2) A, C (3) A, B (6) A (7) A (12) C, E, F

Mission 10 *(approx. 60-90 min)*	**Exploring the Surface** Now that your Mars habitat is set up, it's time to fire up the Martian Rover to explore the surface. But all around the landing zone, there are large boulders that could damage the Rover. During this mission students use salvaged parts and a breadboard to build an "Obstacle Detection and Navigation" system for the rover. Final Project: Students complete an extension or cross-curricular project	(1) A, B, C, E, F (2) A, B, C (3) A, B (6) A (7) A (12) C, E, F
Final Project *(approx. 60-90 min)*	**Final Project** For the final project, students will come up with their own idea for the Mars mission, using several peripherals from the kit. The final project allows students to use their creativity to design, build and program their own project. Students will use the design process, create a flowchart, and resolve design challenges during the creation of their program. Students can use previous missions as a starting point for their project. This is an excellent opportunity to have students work in a team and develop collaboration and leadership skills. Final Project: Completed program ● Create a presentation and show to class or other identified audience ● Show program run in a video to include in presentation ● Optional -- create a web page for the final remix	(1) A, B, C, D, E, F (2) A, B, C (3) A, B (6) A (7) A (12) C, E, F, H

Additional Lessons

Lesson/Mission	Outline of lesson	Standards
What is computer science? *(approx. 90-120 min)*	The lesson is ideal for either the beginning or end of the course. Students will watch videos of careers that use computer science. They learn to envision themselves as being computer scientists. Final Project: Create a digital artifact on computer science ● Could be on computer science in general or a specific topic ● Could be on a career in computer science ● Digital artifact ideas: Web page, poster, slide show, booklet, in-person presentation	(4) A, B (7) A (12) H
Technology & Global Trends *(approx. 90-120 min)*	The lesson discusses changes in technology throughout history. Students will discuss global trends, and predict where the future of technology will go. Final Project: Create a digital artifact on a global trend (Poster)	(4) A, B (7) A (11) A (12) A, C, F, H
Data & Trends *(approx. 90-120 min)*	This lesson culminates the typing practice with a graph and chart. At the beginning of the course, students started a typing program and practiced typing 2-3 times a week, recording their words per minute. Students will graph by hand their typing progress on a paper. Then recreate their graph using digital software, such as Google Sheets or Excel.	(4) C (6) A (7) A (11) A (12) A, C, D, F, H

	Possible warm-up or extension activities for this lesson: ● Poll the students on a topic (age, birth month, favorite dessert, etc.) ● As a class, create a graph and make inferences/look for trends ● Look at graphs and analyze patterns and sequences ● Analyze patterns (compare with other students' charts) and sequences Possible extension: Complete this lesson during the middle of the course and make inferences based on the graph. Then continue typing 2-3 times a week and recording data. Revisit the graph and see how close the predictions are. Final project: Create a graph of typing speed	
The Design Process *(approx. 90-120 min)*	This lesson will explain the design process for software development. The use of flowcharts and pseudocode will be introduced and practiced. The lesson will also look at how the design process is used in various industries. Students will discuss goal setting and personal character traits needed to resolve design challenges. After this lesson, students are expected to create a flowchart or pseudocode for their programs. Final Project: Choose one of the following ● Quiz on interpreting and creating flowcharts, design process ● Poster or slide show presentation	(1) A, B, D, F (2) B (3) A, B, C
File Formats & Management *(approx. 45-75 min)*	The lesson will discuss various file formats of digital information, such as text, graphics, video and audio. Then file management strategies will be taught, such as file naming conventions, local and remote locations, backups, folder structure and file conversions. Emerging digital organizational strategies will be discussed. Students will learn about data storage choices, such as on a server, in the cloud, or using a flash drive. Final project: choose one of the following: ● No final project -- students demonstrate file formats and management strategies throughout the course ● Quiz on vocab, strategies and data storage options ● Poster or slide show or presentation	(11) A (12) A, B, G
Google Searches *(approx. 45-75 min)*	The lesson will have students practice looking for information using a search engine. Students will start with looking at trends based on searches. Then students will use simple searches and get progressively more specific by using keywords, Boolean operators and limiters. Students are required to search for a variety of digital data, including text, images, and audio or video files. Final project: Complete a search engine scavenger hunt (timed or untimed)	(5) A, B (6) A (7) A
Digital information *(approx. 30-60 min)*	The lesson will show students, at a basic level, how data can be represented in binary. Different data types will be discussed, such as integers, strings, Boolean, real numbers and lists, so that students can select the best data type to represent information. Final Project: Demonstration of learning. Could be any of the following ● Binary game for practice	(5) A

	● Kahoot or quiz on binary and data types ● Completion of a worksheet ● Poster or slide show presentation	
Digital Citizenship *(approx. 45-120 min)*	The lesson will show students different styles of digital communication. They will learn that their online actions can have a long term effect. Students will practice digital etiquette and learn how to use digital communication responsibly. Final project: create an artifact to present on this topic ● Suggestion: slide show or poster ● Include peer feedback	(7) A (8) A, B, C (9) A (11) A, B (12) A, C, H
Cybersecurity *(approx. 45-120 min)*	During this lesson students will learn about real-world cybersecurity problems, such as phishing, malware, and hacking. They practice safe, legal and ethical digital behaviors so they are responsible digital citizens. The impact of cyberbullying will also be discussed. Final project: create an artifact to present on this topic ● Suggestion: slide show or poster ● Include peer feedback Final project: Program the CodeX to be password protected ● Press the buttons in a specific order to "unlock" the CodeX) ● Peripherals are not required for this project, but they can be incorporated	(2) C (4) B (7) A (9) A (10) A, B (11) A (12) A, C, H
Intellectual Property *(approx. 45*90 min)*	The lesson defines intellectual property and covers intellectual property laws. Students learn about copyright law, fair use, creative commons, open source and public domain. Students learn how to cite their sources for a variety of digital forms of intellectual property. Final project: create an artifact to present on this topic ● Suggestion: report	(7) A (9) B, C, D (11) A (12) A, C, H

Optional Projects – Extensions and Cross-curricular projects for each Mission

Lesson/Mission	Outline of lesson	Standards
Mission 1	**Extensions and Cross-curricular Projects** ● Light up the CodeX pixel 0 to indicate where the peripheral is connected. ● Use the A and B buttons of the CodeX to turn on/off the red LED. ● Set up and write code for the white LED. Use the CodeX buttons to control the red and white LEDs. ● **LANGUAGE ARTS:** Students write a first-person essay about the impact of technology. ● **SCIENCE:** Students select one peripheral and research how it works or its uses in a science field.	(4) B (5) A

	• **MATH:** Many peripherals are digital and only use the values True or False. Review binary numbers.	
Mission 2	**Extensions and Cross-curricular Projects** • Review and practice algorithms with your students and encourage them to see algorithms in their daily lives. • Review and practice the concept of abstraction and encourage them to see abstraction in their daily lives. • Display images of a rocket ship taking off during the lift_off phase. • Add the CodeX pixels as flashing lights during the countdown phase. Use random colors. • Each astronaut may need to indicate they are ready for lift-off. Use the CodeX buttons as inputs for the astronauts to push in sequence to indicate they are ready. • **LANGUAGE ARTS:** Have students write about a time they prepared to leave for somewhere. Or discuss the theme of transitioning with a current book assignment. • **SCIENCE:** Discuss gravity or Newton's Laws and how they relate to the mission to Mars. –OR– include a lesson on space. • **MATH:** Create a chart of the distance traveled by the ship. –OR– Draw a rocket ship trajectory and then find the equation of the line.	(1) A, B, C, D, E, F (2) C (3) A, B (4) A, B, C (7) A (12) A, E, F, H
Mission 3	**Extensions and Cross-curricular Projects** • Use the CodeX to add an indicator in energy-saving mode and energy-wasting mode. Example: sound, pixels, display, etc. • The CodeX also has a built-in light sensor. Use another motion detector to control the other sensor. • **Cross-Curricular:** Talk about a road trip and how they would plan. They can use a map as a geography lesson, calculate distance using the scale of a map, and work on a plan for how much money they will need, how often they will stop, gas mileage, etc. Then have them find the distance to Mars. Have them consider how their plans might change if they knew they were going that far, and how long it will take. Consider conserving energy. Additional **SCIENCE** ideas: • Distance, rate & time • Conserving energy • Artificial vs natural light	(1) A, B, C, D, E, F (2) A, B, C (3) A, B (4) A, B, C (7) A (12) A, E, F, H
Mission 4	**Extensions and Cross-curricular Projects** • Include the disco ball with the hatch lock project. • Use buttons on the CodeX to control the disco ball speed (speed up, slow down). • Add a signal when all 8 hatch locks are successful (sound, image, CodeX pixels, etc.). • **LANGUAGE ARTS:** Have students write about a personal experience where something failed. • **SCIENCE:** Discuss RGB in the context of light. Have a lesson on the science of pixels. • **MATH:** Explore rates (like failure rates) and construct the algorithm for calculating them.	(1) A, B, C, D, E, F (2) A, B, C (3) A, B (4) A, B, C (7) A (12) A, E, F

Mission 5	**Extensions and Cross-curricular Projects** ● Change the raw temperature to Fahrenheit. ● Use buttons on the CodeX to use either Celsius or Fahrenheit temperatures. ● Find images that go with the different alerts and display them on the CodeX screen when the alarm is triggered. ● Like a traffic light, add a “warning” period before the alarm is triggered, that alerts the crew to a potential danger before the actual threshold is reached. ● Check for the sound reading two different ways. Below threshold could mean power failure and no electronics are working. Above threshold could mean an explosion. Give a different warning for each situation. ● **LANGUAGE ARTS:** Have students write a poem about a topic from the lesson, or about their coding experience. ● **SCIENCE:** Explore sound waves and sound in space. ● **MATH:** Many applications from this lesson ○ Make a chart of the sensor readings (temp and sound). ○ Practice converting temperatures – Fahrenheit to Celsius, Celsius to Fahrenheit. ○ The lesson uses EMA for the sound average. Compare and contrast other ways to find a weighted average. ● **ART:** Students can draw (or use mixed-media) the interior of their own spacecraft. Discuss the use of color and/or perspective in their artwork.	(1) A, B, C, D, E, F (2) A, C (3) A, B (4) A, B, C (6) A (7) A (12) A, C, E, F, H
Mission 6	**Extensions and Cross-curricular Projects** ● Have multiple speeds for the fan and cycle through the speeds, like a ceiling fan. ● Add a temperature sensor to speed up the fan when the temperature is getting warm. ● Use the computer’s clock to set a timer for keeping the fan on. ● Use the motion detector to turn on the fan. ● Use the potentiometer to make the fan a variable speed. ● Use the CodeX NeoPixels or display screen to show additional information. ● Use the accelerometer to simulate the effects of movement on the air circulation system. Tilt the CodeX to represent changes in the spaceship’s orientation, which could affect airflow and require adjustments. ● **SCIENCE:** Have a lesson on energy and/or DC motors. ● **MATH:** Make your own chart of percents for the servo duty-cycle. Calculate and graph the actual numbers being used by the servo. Use a scale representation.	(1) A, B, C, D, E, F (2) A, B, C (3) A, B (4) A, B, C (6) A (7) A (12) A, C, E, F, H
Mission 7	**Extensions and Cross-curricular Projects** ● Use a temperature sensor to make the solar panels accurately follow the sun by moving when a temperature is past a certain threshold. ● Add more “states” to the finite-state machine. ● Add buttons to manually control the servo position. ● Add Neopixel and/or LEDs to indicate current position. Light up a certain # of LEDs to correspond to a position.	(1) A, B, C, D, E, F (2) A, B, C (3) A, B (4) A, B, C (6) A (7) A (12) A, C, E, F, H

	• **SCIENCE:** Design a garden. What would you grow? How much light and moisture do the plants need? • **SCIENCE:** Have a lesson on solar energy. Compare and contrast solar energy to different types of energy. • **MATH:** The solar panels will generate energy for the craft. Look at graphs that show energy production and interpret the data.	
Mission 8	**Extensions and Cross-curricular Projects** • Add an alert sound when deploying landing gear. • Assign buttons to send communication to Mission Control for various stages of the landing process. For example, Button A could initiate descent, Button B could initiate the prepare phase, and Button D could send a landing message. • Make sure all crew members are strapped in and ready for landing. Use CodeX buttons for crew members to indicate their readiness. When all are ready, start the process. • **SCIENCE:** What is the gravity on Mars? What kind of energy is required to land on Mars? Compare gravity on Mars to gravity on Earth. • **MATH:** Consider different crafts that might land on Mars. Calculate the gravity pull for the different crafts. Create a chart on the various crafts. --OR-- interpret graphs that have already been created.	(1) A, B, C, D, E, F (2) A, B, C (3) A, B (4) A, B, C (6) A (7) A (12) A, C, E, F, H
Mission 9	**Extensions and Cross-curricular Projects** • Add neopixels and LEDs to indicate the status of the soil moisture. For instance, green could indicate optimal moisture, yellow could indicate that watering is needed soon, and red could indicate that watering is immediately needed. • Show the process of watering with a sequence of LED lights to simulate water flow. • Use the LCD screen to display real-time soil moisture levels. • **SCIENCE:** Have a lesson on fluids and their rates of flow. What would be the optimum size of pipe for the automatic garden? • **MATH:** Research the life cycles of plants. Make a graph of the daily or weekly growth of plants.	(1) A, B, C, D, F (2) A, C (3) A, B (4) A, B, C (6) A (7) A (12) A, C, E, F, H
Mission 10	**Extensions and Cross-curricular Projects** • Add a servo to simulate the wheels and adjust the speed of the servo depending on the distance to an object. For example, slow down the “wheels” when in the warning zone and stop the “wheels” when in the danger zone. • Adjust the distance for warning and danger by using the CodeX buttons. • Use the CodeX display screen to show information. • **SCIENCE:** Have a lesson about sonar and how it works. • **SCIENCE:** Have a lesson about electrical resistance and ohms. • **MATH:** Calculate break distances for the varying speeds of the Rover. Create a graph of the data and extrapolate for distances not calculated.	(1) A, B, C, D, E, F (2) A, B, C (3) A, B (4) A, B, C (6) A (7) A (12) A, C, E, F, H