Tech Apps and Coding

Middle School (155 Contact Hours)

Course Overview and Goals

The Tech Apps and Coding course introduces students to programming, computing, and digital citizenship while building toward a deeper understanding of artificial intelligence. Students learn to code with Karel the dog, then apply their skills to design games, build websites, and analyze data. They also explore how the internet works and examine AI from how it functions to how generative AI is changing society.

Learning Environment

The course utilizes a blended classroom approach. The content is a mix of web-based and physical activities. Each module of the course is broken down into lessons. Lessons are composed of short video tutorials, interactive learning pages, quizzes, explorations, and free-response prompts.

Technology Requirements

To complete this course, students will need access to the following third-party AI tools:

- ChatGPT, Gemini, and/or Copilot
  Students will need access to an LLM for many of the activities in this course. The activity instructions are designed so they can be completed with ChatGPT, Gemini, Copilot, but other LLMs could work as well.
- Google Teachable Machine
  This tool allows students to create machine learning models without any coding or technical expertise. Without this tool, several lessons will need to be modified.

See the course whitelist for a list of all third-party websites:
codehs.com/lms/course_whitelist/tech_apps_coding

Prerequisites

This course is designed for complete beginners with no previous background in computer science or AI, but can be taken by students who have experience with these fields.

More Information

Browse the content of this course at https://codehs.com/course/28384/overview

Course Breakdown

Module 1: Karel Adventures 1 (10 hours/2 weeks)

Students learn the basics of JavaScript as they follow Karel the Dog on two fun-filled adventures.

Browse the full content of this unit at https://codehs.com/course/28384/explore/module/41275

Topics Covered	• Sequencing • Syntax • Commands • Debugging • Conditionals • Conditional Statements • While loops

Example Assignments	• Debug #1
	  ○ In this program, Karel should move forward 4 times, but there are some errors. Use the error messages to help find and fix the bugs!
	• Riley the Troublemaker
	  ○ Protect the tennis balls from Riley the Rabbit (he's just a gray square in Karel's world) by building a wall around the bucket!
	• Asteroid Field
	  ○ It looks like there is an asteroid field in between Karel and Mars! Help Karel to destroy each asteroid. Program Karel to use if statements and conditions to paint each asteroid (orange square) black.
	• Tracking Tracy
	  ○ Tracy left a trail through the sand. Follow the trail to find Tracy! You can nest different code structures together by putting if statements, if/else statements, and while loops inside each other.

Module 2: Karel Adventures 2 (10 hours/2 weeks)

Students learn the basics of JavaScript as they follow Karel the Dog on another fun-filled adventure.

Browse the full content of this unit at https://codehs.com/course/28384/explore/module/41292

Topics Covered	• Syntax • Commands • Conditional Statements • Control Statements • Functions • Top-Down Decomposition • Loops

Example Assignments	• Karel Clean Up
	  ○ For this exercise, you are going to help Karel pick up all the dropped balls to take them to the park and hide them for the scavenger hunt. There are multiple Karel worlds of different sizes, so you will need to use a “while” loop to get you to the end, and inside the while loop you will need an “if” statement to pick up a ball if one is present.
	• Find the Park
	  ○ Karel needs to set up the scavenger hunt in the park. You need to help Karel navigate the city streets to make it to the park. Watch out for the cars (black squares)! Karel needs to go around these squares on the way to the park. Once at the park, Karel should grab the tennis ball and finish facing east.
	• Making Custom Colors
	  ○ For this activity, you are going to create 4 squares with custom colors. The first will be all red, the second all green, and the third all blue. The fourth color can be any color you choose!
	• Collect the Tennis Balls
	  ○ In this challenge, you will combine all of the coding skills you have learned with Karel to write a program that has Karel pick up all of the tennis balls. Your program should work in all three worlds.

Module 3: Exploring Computing (10 hours/2 weeks)

Students explore different technologies and the impact they have on our world.

Browse the full content of this unit at https://codehs.com/course/28384/explore/module/41290

Topics Covered	• History of Computing • How Software Works • Computer Hardware • Cloud Computing • Internet of Things • Ethics and Legal Considerations • The Future of Computing

Example Assignments	• History of Computing
	  ○ *Jigsaw: Computer Interaction Over the Decades:* In this activity, students are going to work in small groups to research what it was like to interact with computers over the various decades. For each section, students will want to consider what was typical for most computers. For example, GUI interfaces were first used in the 1970s, but they were not typical until the 1980s.
	• Ethics and Legal Considerations
	  ○ *Bias in Machine Learning:* Students learn about the basics of how machine learning works and how these types of algorithms can be

	biased. This activity includes a short video, a matching game to check for understanding, a case study example, and reflection questions. ● Computer Hardware ○ *Assistive Technology Peripherals:* Students explore the concept of input and output through examples of assistive devices that connect to computers. Students consider different types of data, how people send and receive data when interacting with computers, and how these interactions can be different for different people.

Module 4: Exploring Code with Karel (10 hours/2 weeks)

Students learn the basics of programming by giving Karel the Dog commands in a grid world.

Browse the full content of this unit at https://codehs.com/course/28384/explore/module/41276

Topics Covered	● Syntax ● Syntax Errors ● Comments ● Debugging ● Functions ● For Loops ● Conditional Statements ● if/else Statements ● While Loops ● Control structures ● Decomposition
Example Assignments	● Karel's Evening Walk ○ Take Karel on a walk around the north side of the pond. Remember the directions Karel can face and write a program to move Karel along the path from one edge of the world to the other. Karel should be facing south at the end of the path. But wait! Karel noticed a missing tennis ball laying on the path. Go ahead and let Karel pick it up along the walk. ● Pick Up Tennis Balls ○ Karel needs help picking up the tennis balls lying around the dog park. Create a program that uses two for-loops and ends with Karel in the lower-right corner facing to the right or east. ● Stay Out of the Lake ○ This program is supposed to train Karel to walk up to a lake at any park, but not to jump in. But right now there is a bug! Help fix the bug so that Karel stops moving when reaching the edge of a lake. ● Path to Dog House

	○ Karel needs to stay on the pathway to get to the dog house. Make sure Karel continues moving until inside the dog house. Use at least 3 functions, 1 while loop, 2 conditionals, 1 if/else statement, and 1 nested if statement.

Module 5: Project: Pair-Programming with Karel Paint! (5 hours/1 week)

Students apply their knowledge of programming with Karel to design a beautiful piece of art!

Browse the full content of this unit at https://codehs.com/course/28384/explore/module/41719

Topics Covered	● Ultra Karel ● Pair-Programming ● Top-Down Design
Example Assignments	● Brainstorm and Discuss ○ In this project, you and your partner (or group) will get to combine the skills you've learned to paint a digital image using Ultra Karel. ○ You'll brainstorm a few ideas for potential final projects, and think about how you might implement them. ● Setting Norms ○ Norms are agreed upon standards and rules that will keep a collaborative team productive and inclusive. With your partner or group, decide on 3-5 norms to follow throughout your project. An example of a norm could be: *All members will have an opportunity to be heard during the decision process.*

Module 6: Exploring the Internet (10 hours/2 weeks)

Students are introduced to network protocols and different strategies used to protect online information.

Browse the full content of this unit at https://codehs.com/course/28384/explore/module/41278

Objectives / Topics Covered	● What is the Internet? ● Need for Protocols ● Impact of the Internet ● Cybersecurity ● CIA Triad ● Encryption ● Steganography
Example Assignments	● Network Simulation ○ In this simulation, there are six devices in a network. Click the green

	RUN button to start the simulation. Clicking on a device will prepare it to send a message. Clicking on a second device will send the message to that device. ● Internet in My Daily Life ○ Envision a normal day, from the time you wake up to the time you go to sleep. In what ways do you use the Internet during your day? For what purposes do you use the Internet? As you go through a normal day in your mind, write down all the ways you use the Internet. Include the device you use and the purpose. ● Cybersecurity ○ Students will learn what is meant by *cybersecurity* and explore a few news worthy cyber attacks. They will also discuss the *Internet of Things* and the increase in connected devices. ● Project: Steganography ○ In the following activity, you will see a picture and the corresponding color codes associated with the pixels. There is a message hidden in the first 12 pixels! Below is the method used to hide the message. Your mission will be to reverse the process and find the secret message!

Module 7: Exploring Digital Citizenship (10 hours/2 weeks)

Students learn about Internet etiquette and how to stay safe on the world wide web.

Browse the full content of this unit at https://codehs.com/course/28384/explore/module/41279

Objectives / Topics Covered	● Digital Footprint ● Cyberbullying ● Internet Safety ● Privacy & Security ● Information Literacy ● Copyright ● Hacking Ethics ● Cyber Hygiene
Example Assignments	● Digital Footprint and Reputation ○ *Building a Positive Digital Footprint:* Spend some time reflecting on you and your friends' social media activity. Give an example of a social media post that builds a positive digital footprint. How does the post build a positive digital footprint? Give an example of a social media post that builds a negative digital footprint. How does the post build a negative digital footprint? Thinking about your digital footprint, are you going to make any changes in what you post on social media? How about what you write to share in a group message? Why or why not?

	• Internet Safety
	  ○ *Scenario: School Stranger:* You begin to receive direct messages on Instagram from a person you don't recognize. They claim to go to your school, and they know a lot of information about your classes and teachers. They also follow a lot of your classmates, so you believe them. After a bit, they start asking questions about you and your friends. What steps should you take to respond to this situation?
	• Information Literacy
	  ○ *Evaluate the Source 1:* Take a look at this resource, and consider the following questions: What evidence do you see that this source is credible? What evidence do you see that makes you question the source's credibility? Is this a credible source?

Module 8: Exploring Game Design (10 hours/2 weeks)

Students learn the basics of video game design elements, game mechanics, and sprite and world design.

Browse the full content of this unit at https://codehs.com/course/28384/explore/module/41280

Objectives / Topics Covered	• Intro to Games • Unpacking a Game • Categorizing Games • Intro to JavaScript • Variables • Libraries • Program Structure • The Canvas • Your First Sprite • Physics of Sprites

Example Assignments	• Debugging: Hiking App
	  ○ The code in the editor has four bugs that you need to fix in order for the program to run and display the output properly. Try to run this program and see what happens. Use the error messages to help guide you to the line that needs fixing.
	• The Elevator
	  ○ In this exercise, you are going to create a simple elevator animation. The basic program structure has been provided in the starter code. Below is all the code you need to create the animation. You need to copy and paste each code block into the appropriate space in the program. Each space needs only one code block.
	• Exploration: Shapeshifter
	  ○ Read through the starter code and predict what you will see on the

	canvas when you run the program. Run the program and see! Were you right? You need to adjust the code so that a rectangle of width 200 and height 400, filled with any shade of blue, will appear on the canvas instead!

Module 9: Exploring Web Design 1 (10 hours/2 weeks)

Students explore HTML and CSS styling as they work to create their homepage.

Browse the full content of this unit at https://codehs.com/course/28384/explore/module/41281

Objectives / Topics Covered	• HTML • Structure of an HTML Page • Formatting Text • Creating Links • Incorporating Images • Using Lists • Applying Styling • Introduction to CSS Styling • Homepage

Example Assignments	• Creating Your First Webpage
	  ○ It's time to create your first HTML page. Starting with an HTML file, add two sets `h1` tags. Be sure to include both the open tag and closing tag for each! Inside of the tags introduce yourself and say something that you like to do.
	• Wiki Page
	  ○ Have you ever noticed that a Wiki article, such as one you find in Wikipedia, has links to some specific keywords to help give you more details? Those links are just using hyperlinks inside of a paragraph. In this activity, you are going to create a short Wiki article. It can be on any topic you want, but you need to include at least three links integrated into your article. Your article should be one to two paragraphs long and use well-constructed sentences.
	• Styling a List
	  ○ For this exercise, you are given a starter code that has some CSS styling. Your task is to add the styling for the unordered list.

Module 10: Exploring Data and Spreadsheets (10 hours/2 weeks)

Students synthesize all they've learned in this course to complete a project where they use a device to collect and analyze data to find an answer to a question they have.

Browse the full content of this unit at https://codehs.com/course/28384/explore/module/41282

Topics Covered	• Data as a Resource • Using Databases • Introduction to Spreadsheets • Sort and Filter • Statistical Measures • Models • Visualizing Data • Data Storytelling

Example Assignments	• Sort and Filter
	  ○ *Influential Women:* In this exercise, students will learn about remarkable women who have made significant contributions in fields like Science, Literature, and Environmentalism, while having the opportunity to sort and filter data to uncover interesting facts and connections about these inspiring figures.
	• Statistical Measures
	  ○ *Mammal Statistics:* In this exercise, students will explore data on common mammals while calculating the mean, median, and mode of various data points to derive meaningful insights.
	• Visualizing Data
	  ○ *Create a Dashboard:* In this exercise, students will explore running analytics data and create an engaging running dashboard, a powerful tool that consolidates essential information and data visualizations in one place.
	• Project: Tell Your Story
	  ○ *Draft a Design:* For this activity, students will take time to explore data storytelling designs and draft their own story. They can create their infographic directly in the spreadsheet or sketch their design on paper, in PowerPoint, or using a program of their choice.

Module 11: Exploring Web Design 2 (10 hours/2 weeks)

Students will learn the basics of web aesthetics and design principles which will allow them to take their web design skills to the next level. This module culminates in a project that will guide them through the web planning process and create a multi-page website.

Browse the full content of this unit at https://codehs.com/course/28384/explore/module/41283

Topics Covered	• Webpage Aesthetics • Webpage Design • Citing Image Sources • Adding Pages • Creating a Sitemap • Wireframing

Example Assignments	• Fix the Contrast
	  ○ This site in this exercise has a poor use of contrast. Let's improve the contrast by changing the CSS in the `<style>` tag.
	• Redesign the Site
	  ○ The site in this exercise makes poor use of alignment, repetition, and proximity. Let's improve the site by making a few changes.
	• Make a Collage
	  ○ Now that you know how to find and cite images you can use, create a collage containing six images that you find on the internet.
	• Add a Style Sheet
	  ○ Add a CSS file named `style.css` to this project to style this page. Make all of the images 100px by 100px. Give the list items a font size of 24 pixels.

Module 12: What is AI? (10-16 hours/3-4 weeks)

In this module, students will build a foundational understanding of artificial intelligence by exploring what AI is, where it appears in everyday life, and how it differs from other technologies. Through examples, discussions, and interactive activities, they'll examine different types of AI systems. Students train their own mini model and design an original AI helper.

Browse the full content of this unit at https://codehs.com/course/28384/explore/module/41284

Objectives / Topics Covered	• What is AI? • Staying Safe with AI • How AI Learns from Data • Project: Training a Mini-Model • What is Machine Learning? • Types of Machine Learning • Project: Design Your Own AI Helper

Example Assignments	• Train-A-Bot
	  ○ Design and train a virtual AI bot. Choose what it will learn, decide how much data to give it, and test how fair and accurate it is.
	• Unsupervised Learning: Emoji Clusters
	  ○ Sort the emojis into groups in any way that makes sense, then compare to a computer's groupings.

Module 13: Communicating with AI (10-14 hours/3 weeks)

Students will learn how to effectively interact with AI systems by practicing prompt creation, testing chatbot responses, and even fooling AI into giving incorrect responses. Through hands-on projects and guided explorations, they'll see how inputs shape outputs, and how communication strategies can make AI more useful and accurate.

Browse the full content of this unit at https://codehs.com/course/28384/explore/module/41285

Objectives / Topics Covered	• Communicating with AI • Large Language Models (LLMs) • Tool Exploration • Challenging Conversations • Prompt Engineering • Prompt Injections • Can You Stump an AI?

Example Assignments	• Train Your Language System Model
	  ○ Train a model to recognize student-created symbols.
	• Stump an AI
	  ○ Intentionally mislead a chatbot into hallucinating information.

Module 13: Generative AI (12-14 hours/3 weeks)

Students will experiment with generative AI tools that create text, images, music, and more. Through creative projects and guided challenges, they'll explore how generative models combine existing knowledge in new ways, and reflect on both the exciting possibilities and the limitations of AI-driven creativity.

Browse the full content of this unit at https://codehs.com/course/28384/explore/module/41286

Objectives / Topics Covered	• Generative AI • Generative AI Art • Project: Generative AI Art Show • AI and Music Generation • Does AI Know How to Code? • Project: AI-Assisted Coding

Example Assignments	• Campaign Poster Project: The Big AI Art Vote
	  ○ Create a campaign poster in favor of or against using AI-generated art in schools.
	• Generate an AI Beat!
	  ○ Use AI tools to generate original beats.
	• Project: AI-Assisted Coding
	  ○ Make a small app, tool, or project with the help of an AI coding assistant. The AI helps write code, fix mistakes, and add changes.

Module 14: AI's Impacts on Society (12-14 hours/3 weeks)

Students will investigate how AI affects individuals, communities, and the world at large. Through readings, discussions, and reflection activities, they'll examine topics such as bias, fairness, and

ethics in AI, while also considering the benefits, risks, and responsibilities of using AI in everyday life.

Browse the full content of this unit at https://codehs.com/course/28384/explore/module/41287

Objectives / Topics Covered	• AI at Work: Changing Careers • Debate: Should AI Replace Certain Jobs? • Ethics, Bias, and Risks of AI • AI and Accessibility • Case Study: AI Tools for Accessibility • Advising the Mayor: Impacts of AI • Your Future with AI

Example Assignments	• AI Advisor: Letter to the Mayor
	  ○ Research one area where AI is making an impact on the world and then write a clear, helpful letter to the mayor with recommendations.
	• AI for Accessibility
	  ○ Explore real-world AI tools that help people. Find out what problems they solve, who they help, how they work, and why they are important.

Alternative Assignments

The alternative assignments provide low-tech ways for students to engage with each module's content.

Browse the full content of this unit at https://codehs.com/course/28384/explore/module/41288

Objectives / Topics Covered	• What is AI? • Communicating with AI • Generative AI • AI's Impacts on Society

Example Assignments	• Sweden launches AI music licence to protect songwriters
	  ○ Explore how government policies are changing in response to AI.
	• Q&A: How AI affects kids' creativity
	  ○ Consider how AI may affect students' creativity.