CodeBot – TEKS Fundamentals of Computer Science Curriculum

The curriculum for Fundamentals of Computer Science consists of programming CodeBot projects and completing lessons in computer science topics. CodeBot is an educational robot built for learning Python programming. This 'bot puts the focus on coding, with built-in sensors and programmable controls for endless projects and learning opportunities. 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.

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
- Step by step guided lessons in CodeSpace
- 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
- Programmable built-in sensors, accelerometer, and speakers
- LEDs for status display of all systems, and console log for printing
- Python, the fastest growing major programming language used in Industry

All standards are met by completing the required projects. The amount of time needed to complete the curriculum is flexible. It is recommended that students spend at least 30-45 per class period.

- The CodeBot projects should be completed in order.
- The additional projects can be completed in any order.
- Optional coding projects are available as time permits, but are not required to meet the standards.

Teachers have the option of completing the coding projects and then the additional project units, or intermixing coding with additional computer science content.

Some possible timelines are suggested below. These are not the only options, but show the flexibility of the curriculum to meet the needs of the teacher and class.

Option 1 -- coding followed by additional topics

0	Overview
1	Project 1: First Steps
2	Project 2: Time and Motion
3	Remix 2
4	Project 3: Animatronics
5	Remix 3
6	Project 4: Fence Patrol
7	Remix 4
8	Project 5: Line Follower
9	Remix 5
10	Project 6: Hot Pursuit
11	Remix 6
12	Additional Topic: Technology
13	Additional Topic: Digital Citizenship
14	Additional Topic: Computer Science
15	Additional Topic: Web Pages
16	Final Project

Option 2 --coding intermixed with additional topics

0	Overview
1	Project 1: First Steps
2	Project 2: Time and Motion
3	Remix 2
4	Additional Topic: Technology
5	Project 3: Animatronics
6	Remix 3
7	Project 4: Fence Patrol
8	Remix 4
9	Additional Topic: Digital Citizenship
10	Project 5: Line Follower
11	Remix 5
12	Project 6: Hot Pursuit
13	Remix 6
14	Additional Topic: Computer Science
15	Additional Topic: Web Pages
16	Final Project

CodeX – TEKS Fundamentals of Computer Science Curriculum

Course Coding Projects

Project	Outline of lesson	Standards
Overview *5-7 class periods*	**Intro to Computer Science, CodeBot and CodeSpace** The project allows for time to get to know your students, assess their prior knowledge, and build a foundation of computer science basics. During this project you can guide your students to building a foundation of computational thinking. Dedicate some time for students to learn basic terms, such as algorithm, program and debug. You can also engage students in unplugged activities.	(5) C, E (6) A, B, E
Coding Project 1 *2-3 class periods*	**First Steps** The project gives students a tour of the coding editor CodeSpace and shows how to navigate the lesson panel, project menu, tool box, etc. It discusses input and output, hardware and peripherals. Students explore the CodeBot and learn where to find the buttons, sensors, motors, etc. They attach the CodeBot to their laptop/computer with a USB and write their first program. Students are taught to use descriptive file names and save their file using proper file management.	(1) C (4) B (6) A, B
Coding Project 2 *5 class periods*	**Time and Motion** The project introduces editor short-cuts and the debugger. Students learn about binary numbers and use the concept to turn on LEDs. Students are encouraged to make their code readable by using comments and white space. Students use literal values and variables in their code. The concepts of sequential and selection are introduced. Students turn on the motors and make the robot move in a specific pattern. Finally, they use a button as input.	(1) C, E (2) B (3) B (4) B, C, D, E, F, H, I, L (6) B
Remix Project 2 *5 class periods*	**Time and Motion Remix** For this project students will use what they have learned from project 2 to create their own original program. Suggestions for a remix are included at the end of project 2, or students can be creative and come up with their own ideas. Another suggestion is for students to work in teams and work on employability skills, like time management, leadership, planning, and communication. Students should seek feedback during their remix, and present their project in a variety of ways such as print, monitor display, web pages, or video.	(1) C, D, E, F, H (2) B (3) A, B, C (4) C, D, E, F, H, I, L (6) B
Coding Project 3 *5 class periods*	**Animatronics** The project gives students a real-world application for their robot. Students help develop an algorithm for their application. Students use a counter, the assignment operator, comparison operators, and nested if statements. Iteration is introduced with while loops. The speaker is used to make the robot “speak” and the robot is programmed to move in a specific pattern. The final result is a robot that could be used as a greeter at a theme park.	(1) C, E (2) B (3) B (4) C, D, E, F, G, H, I, J, K, L (6) B, E
Remix Project 3	**Animatronics Remix** For this project students will use what they have learned from project 2 and	(1) C, D, E, F, H (2) B

5 class periods	project 3 to create their own original program. Suggestions for a remix are included at the end of project 3, or students can be creative and come up with their own ideas. Another suggestion is for students to work in teams and work on employability skills, like time management, leadership, planning, and communication. Students should seek feedback during their remix, and present their project in a variety of ways such as print, monitor display, web pages, or video.	(3) A, B, C (4) C, D, E, F, G, H, I, J, K, L (6) B, E
Coding Project 4 *5-7 class periods*	**Fence Patrol** The final project will enable the robot to stay within a "fence" or border. Students will learn about line sensors and their LEDs. Analog and digital data is discussed. Students learn about strings and formatting output in the console log. Students will use abstraction by writing their own functions. Parameters and arguments are reviewed. Students complete worksheets that track data for distance and type of surface.	(1) C, E (2) B (3) B, C (4) B, C, D, E, F, G, H, I, J, L (6) A, B, E
Remix Project 4 *5-7 class periods*	**Fence Patrol Remix** For this project students will use what they have learned from projects 2-4 to create their own original program. Suggestions for a remix are included at the end of project 4, or students can be creative and come up with their own ideas. Another suggestion is for students to work in teams and work on employability skills, like time management, leadership, planning, and communication. Students should seek feedback during their remix, and present their project in a variety of ways such as print, monitor display, web pages, or video.	(1) C, D, E, F, H (2) B (3) A, B, C (4) B, C, D, E, F, G, H, I, J, K, L (6) B, E
Coding Project 5 *5-7 class periods*	**Line Follower** In this project, students continue to learn about and program the robot's sensors. The list data type is introduced and used. Selection with more than two branches is used in the code. Students create several functions, one of which is a "wait" function that uses a button as input. Global and local variables are discussed. Sequence, selection and iteration are used in the program. Students complete worksheets that track data and for reflection.	(1) C, E (2) B (3) B, C (4) C, D, E, F, G, H, I, J, K, L (6) A, B, E
Remix Project 5 *5-7 class periods*	**Line Follower Remix** For this project students will use what they have learned from projects 2-5 to create their own original program. Suggestions for a remix are included at the end of project 5, or students can be creative and come up with their own ideas. Another suggestion is for students to work in teams and work on employability skills, like time management, leadership, planning, and communication. Students should seek feedback during their remix, and present their project in a variety of ways such as print, monitor display, web pages, or video.	(1) C, D, E, F, H (2) B (3) A, B, C (4) C, D, E, F, G, H, I, J, K, L (6) B, E
Coding Project 6 *5-7 class periods*	**Hot Pursuit** In this project, students learn about proximity sensors and their LEDs. Students must use math and math functions to convert data from the sensors into usable information. They format string and data output in the console log. Abstraction is reinforced by creating a function that can be used for several sensors. Students learn about calibration and use a function with a button press to calibrate the robot while the code is running. Students complete worksheets that track data for the sensors, power, and sensitivity, as well as a reflection.	(1) C, E (2) B (3) B, C (4) C, D, E, F, G, H, I, J, L (6) A, B, E

Remix Project 6 *5-7 class periods*	**Hot Pursuit Remix** For this project students will use what they have learned from projects 2-6 to create their own original program. Suggestions for a remix are included at the end of project 6, or students can be creative and come up with their own ideas. Another suggestion is for students to work in teams and work on employability skills, like time management, leadership, planning, and communication. Students should seek feedback during their remix, and present their project in a variety of ways such as print, monitor display, web pages, or video.	(1) C, D, E, F, H (2) B (3) A, B, C (4) C, D, E, F, G, H, I, J, K, L (6) B, E

Additional Computer Science Lessons

Project (Unit)	Outline of lesson	Standards
Technology *5-10 class periods*	This project will teach students about important technology operations, concepts, systems, and operations as they apply to computer science. Basic computer components, such as storage and peripheral devices, will be studied. Students will learn about different operating systems and describe the differences between an application and an operating system. Students will also review system tools, including appropriate file management. Binary numbers will be practiced, allowing students to understand how data is represented in a computer system, convert between binary and decimal numbers, and count in binary. Students will have an opportunity to discuss and give examples of the impact of computing and computing-related advancements on society. **Final Project:** Create a project that summarizes their learning or extends their learning on a specific concept. Students will then publish their project, which could include print, monitor display, web pages, or video.	(3) C (4) B (5) E (6) A, B, C, D, E
Digital Citizenship *5-10 class periods*	This project will teach students about digital citizenship. Students explore and understand safety, legal, cultural, and societal issues relating to the use of technology and information. Privacy and copyright laws are discussed, and students learn to ethically find digital information and cite their sources. They look at acceptable use policies. They learn about keeping their information safe through strong passwords, virus detection and security. Students also analyze how electronic media can affect the reliability of information. Students will have an opportunity to discuss and give examples of the impact of computing and computing-related advancements on society. **Final Project:** Create a project that summarizes their learning or extends their learning on a specific concept. This can be a team project, allowing students to work on employability skills, like time management, leadership, planning, and communication. Students will then publish their project, which could include print, monitor display, web pages, or video.	(3) C (5) A, B, C, D, E, F
Computer Science *5-10 class periods*	This project will enable students to identify various employment opportunities in the computer science field. Students will compare university computer science programs and examine the role of certifications, resumes and portfolios in the computer science profession. They will seek to identify job	(1) A, B, G, I (2) A (3) C (4) E

	and internship opportunities in computer science and explore career opportunities. Students will also demonstrate an understanding of legal and ethical responsibilities in a computer science career. Students will have an opportunity to discuss and give examples of the impact of computing and computing-related advancements on society. **Final Project:** Create a project that summarizes their learning or extends their learning on a specific concept. This can be a team project, allowing students to work on employability skills, like time management, leadership, planning, and communication. Students will then publish their project, which could include print, monitor display, web pages, or video.	
Web Pages *15-25 class periods*	This project will allow students to use their creativity and innovation to develop products and generate new knowledge, understanding, and skills. The focus of the project will be to create web pages. They will use accepted design standards to make their web pages effective and user friendly. The project will include static and interactive pages. Students can include their computer science career research on the web pages. During the project students must use effective communication skills, solve problems and think critically, and demonstrate planning and time-management skills. Students will model ethical acquisition of digital information by citing sources using established methods. **Final Project:** Students will create and publish a website with multiple pages, including static and interactive pages, external objects, and an accepted design standard for fonts, colors and spacing.	(1) D, E, H (2) A, C, D (3) C (4) A (5) A, E
Final CS Project *5-15 class periods*	The final project can be determined by the teacher and the interests of the students. For example, students could: ● create an original program for the robot, then create a video of the robot running the code and embed the video on their web page ● Create a new feature or web page for their website ● Research a computer science topic not yet covered: ○ cyber security ○ how the internet works, or the internet of things ○ artificial intelligence or machine learning ○ digital data and compression ○ data science and representation ○ global impact of computing / future of computing ● Take apart and label the parts of a computer ● Create a presentation or lesson on a computer science topic and teach it to a group of students ● Create a newsletter or video about the class (recruiting tool!)	(1) C, D, E, F, H (3) C (4) C

Optional Coding Projects

Project	Outline of lesson	Standards
Coding Project 7 *7-10 class periods*	**Navigation** In this project students learn about the robot's encoders, which lets them code the robot for a specific speed regardless of surface or battery power. The program involves a lot of math and many functions. Global and local variables are reviewed, as well as parameters and arguments. Students learn a lot more about lists and ways to use and copy them.	(1) C, E (2) B (3) B, C (4) C, D, E, F, G, H, I, J, L (6) A, B, E
Remix Project 7 *7-10 class periods*	**Navigation Remix** For this project students will use what they have learned from projects 2-7 to create their own original program. Suggestions for a remix are included at the end of project 7, or students can be creative and come up with their own ideas. Another suggestion is for students to work in teams and work on employability skills, like time management, leadership, planning, and communication. Students should seek feedback during their remix, and present their project in a variety of ways.	(1) C, D, E, F, H (2) B (3) A, B, C (4) C, D, E, F, G, H, I, J, L (6) B, E
Coding Project 8 *5 class periods*	**All Systems Go** In this project, students learn how to check the battery power and temperature of a robot. They learn how to append a value to a list and use the list to find a total and average. The accelerometer is used for readings in all three directions. The final program has the robot acting like a guard-bot that can detect motion.	(1) C, E (2) B (3) B, C (4) C, D, E, F, G, H, I, J, L (6) B, E
Remix Project 8 *5 class periods*	**All Systems Go Remix** For this project students will use what they have learned from projects 2-8 to create their own original program. Suggestions for a remix are included at the end of project 8, or students can be creative and come up with their own ideas. Another suggestion is for students to work in teams and work on employability skills, like time management, leadership, planning, and communication. Students should seek feedback during their remix, and present their project in a variety of ways such as print, monitor display, web pages, or video.	(1) C, D, E, F, H (2) B (3) A, B, C (4) C, D, E, F, G, H, I, J, L (6) B, E
Coding Project 9 *7-10 class periods*	**Obstacle Course** This extension project will have the robot to complete an obstacle course. Students will use proximity sensors to avoid obstacles and navigation code to navigate the course. Students will create their own custom library of functions to use in their program. Extra features can be programmed, like using the LEDs, making beeps, and a win or lose feature.	(1) C, D, E, F, H (2) B (3) A, B, C (4) C, D, E, F, G, H, I, J, L (6) B, E
Coding Project 10 *7-10 class periods*	**Multitasking** The extension project uses event-driven commands. Students create a callback function to react to events such as timeouts and sensor changes. Functions are written that enable the robot to multitask when an event happens,	(1) C, D, E, F, H (2) B (3) A, B, C (4) C, D, E, F, G, H, I, J, L (6) B, E