GLITCH

ENGINEERING AN ESCAPE ROOM

Scope & Sequence

Tried&True

GL!TCH

ENGINEERING AN ESCAPE ROOM

Scope & Sequence

Student Learning Objectives

Chapter	Learning Objectives
Prologue	Students will identify characteristics of a growth mindset Students will list the class rules Students will assess their prior knowledge of computer programming and electronics Students will reflect on the impact of mindset when approaching engineering design problems
Chapter One: Breadboards	Students will demonstrate best practices for record keeping and maintaining an engineering journal Students will explore and make discoveries about breadboards and their internal anatomy through hands-on experiences Students will use diagrams or text to describe physical components of breadboards including power rails, terminal strips, mounting holes, and DIP support Students will trace the flow of electricity in simple circuits on a breadboard Students will evaluate various models of electronic circuits and predict whether or not they will function Students will listen, read, and/or act out a narrative that immerses the engineering concepts of GL!TCH into a story
Chapter Two: GL!TCH Kit Assembly	Students will build the GL!TCH kit Students will identify basic computer hardware components and describe their function Students will demonstrate their ability to interact with the computer operating system with a mouse and keyboard Students will practice the procedure for setting up and packing up the GL!TCH kit
Chapter Three: Coding	Students will explore various features of Thonny Python Integrated Development Environment and become more comfortable with its layout and quirks Students will create an organizational system and routine for a digital work environment Students will interpret and manipulate variables and commands in Turtle(Logo) code Students will predict the flow of execution of computer code through pseudocode Students will develop and use a series of test cases to verify that code performs according to design specifications Students will practice using rubber duck debugging, a systematic approach to review code and find errors Students will write appropriate documentation within their code

Student Learning Objectives

Chapter	Learning Objectives
Chapter Four: Series Circuits	Students will understand the scientific principle behind series circuits and the relationship between electrical components in a series circuit Students will identify the physical components of an LED Students will build a working series circuit with an LED and an external power supply Students will draw and label common electrical component symbols in schematic diagrams Students will differentiate between observations and inferences
Chapter Five: Parallel Circuits	Students will identify previous patterns and materials used to wire series circuits Students will build parallel circuits with multiple LEDs Students will compare and contrast the behavior of LEDs in series circuits and parallel circuits Students will practice creating schematic diagrams with electrical component symbols
Chapter Six: Coding & Circuits	Students will explore relationships between hardware and software components of the GL!TCH kit Students will investigate the anatomy of computer code with basic logic Students will modify code by adding iteration functionality with loops Students will debug errors in code that includes sequences and simple loops
Chapter Seven: Buttons & Switches	Students will modify series circuits to include physical buttons Students will integrate input signals to their code Students will implement logic through if-else statements Students will record quantitative and qualitative observations during their investigation
Chapter Eight: Escape Room Maze	Students will integrate their knowledge of circuit design and coding to build a maze with automated blinking LEDs Students will define the terms prototype and constraints as they apply to engineering design problems Students will create a model to test their design against problem constraints Students will adapt specific team roles taking into account the strengths and perspectives of potential team members
Chapter Nine: RGB LEDs	Students will identify the physical components of an RGB LED Students will build a circuit and write code to power the RGB LED Students will investigate the color mixing properties of an RGB LED Students will rewrite or refactor their code with improvements to efficiency, organization, and readability

Student Learning Objectives

Chapter	Learning Objectives
Chapter Ten: LDR	Students will identify the physical components of a light dependent resistor (LDR) Students will describe the structure and function of conductors, semiconductors, and insulators Students will draw schematics of circuits containing resistors and capacitors Students will illustrate the flow of electricity through an RC circuit Students will design and test a prototype for a night light
Chapter Eleven: Lasers	Students will describe the physical properties of lasers Students will build a circuit and write code to power a laser Students will investigate the interaction between a laser and the LDR
Chapter Twelve: Laser Tripwires	Students will design a prototype for a laser tripwire that integrates both a laser and an LDR Students will write code that implements the communication method of morse code Students will transmit a message in morse code using their laser tripwire
Chapter Thirteen: For Loops	Students will explain the function of fundamental data structures for sequences such as lists, ranges, and tuples Students will identify code features of functions that can be used to define abstractions Students will analyze a problem and design and implement an algorithmic solution using sequences and iteration Students will rewrite or refactor their laser tripwire code to implement the new data structure and abstraction
Chapter Fourteen: PWM	Students will model the concept of pulse width modulation (PWM) with diagrams and graphs Students will investigate the properties of PWM Students will recognize common signal types in electronics; digital and analog Students will demonstrate their ability to apply abstraction by defining new functions Students will design a computer game that reads typed input, evaluates a function, then responds with an electronic output to an LED.
Chapter Fifteen: Intro to Servos	Students will investigate the structure and function of servo motors Students will explain how computers interact with servo motors through PWM Students will evaluate the impact of coding decisions on the performance of the servo to reduce noise and vibrations
Chapter Sixteen: Servo Motors	Students will optimize code to rotate a servo motor smoothly from 0 to 180 degrees Students will describe physical characteristics of servo motors such as torque, stall torque, and gear ratios Students will design a circuit that contains a servo motor and an LED that can be controlled by computer code

Student Learning Objectives	
Chapter	**Learning Objectives**
Chapter Seventeen: Pressure Sensor	Students will identify physical components of piezoresistive sensors and describe their function Students will identify physical components of capacitive touch sensors and describe their function Students will construct circuits and code to compare and contrast the signals from each sensor
Chapter Eighteen: Final Game	Students will create a complex escape room using different forms of inputs and outputs including buttons, LEDs, lasers, sensors, and a servo motor Students will adapt specific team roles taking into account the strengths and perspectives of potential team members Students will evaluate a solution to a complex problem based on prioritized criteria and trade-offs that account for a range of constraints, including efficiency, cost, performance and reliability Students will reflect on factors that influence team dynamics including leadership, trust, diversity, and communication

Assessment Plan	
Pre-Test	60 minutes
Chapter Quizzes	10-15 minutes per Chapter
Unit Exams	45 minutes per Unit
Post-Test	60 minutes
TOTAL	**8 hours**

Suggested Course Formats & Timing

Full Course plus Testing

Chapters 1-18
56-60 hours

Full Course without Testing

Chapters 1-18
48-52 hours

Suggested Course Formats Based on Available Time	
14 hours	Chapters 1-6, 8
16 hours	Chapters 1-8
18 hours	Chapters 1-8 (expand Chapter 8 to 4 hours)
20 hours	Chapters 1-7, 9, 8
24 hours	Chapters 1-9, 18
26 hours	Chapters 1-9, 10, 18
28 hours	Chapters 1-9, 10, 11, 18
30 hours	Chapters 1-9, 10-12, 18
32 hours	Chapters 1-9, 10-12, 14, 18
34 hours	Chapters 1-9, 10-12, 14, 15, 18
36 hours	Chapters 1-9, 10-12, 14, 15, 17, 18 (Full Story)
38 hours	Chapters 1-9, 10-12, 14, 15, 17, 18
40 hours	Chapters 1-9, 10-12, 14-18
42 hours	Chapters 1-18 (Excluding 9.2)
44 hours	Chapters 1-18
46 hours	Chapters 1-18 (Expand Chapter 8 to 6 hours)
48 hours	Chapters 1-18 (Expand Chapter 18 to 8 hours)
52 hours	Chapters 1-18 (Expand Chapter 8 and Chapter 18)