Lesson Layout

- **Title**: "Playing with Color"
- **Scratch Activities**: Introduction, Practice, Closing Assignments
- **Introduction**: Review
  - Introduction - Review: Introduce the basics of Scratch, focusing on color blocks and their effects. Explain how colors can be changed and how they can affect the appearance of sprites.

- **List of Tutorials**: Tutorials for the lesson
  - Tutorial Part 1: Change Color
  - Tutorial Part 2: Using Turtles

- **Additional Exercises**
  - Practice Exercises: Use the color blocks to change the color of a sprite.
  - Additional Exercises: Create a new sprite and change its color using the color blocks.

- **Closing Assignments**: Review the key points covered in the lesson and assign additional exercises for practice.
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Class Management

**TIME SCHEDULE**

This course has been designed so that each lesson will occupy one meeting session with the students.

Once the lesson has been reviewed, the activity of the student will concentrate on mastering the new concepts presented.

Practicing with Scratch and exploring all the possibilities of the new concepts learned is essential for a robust learning process.

The exercises proposed in the Extensions section are designed to reinforce the learn-by-doing approach.

**SCRATCH ACTIVITIES**

After studying the tutorials the students will replicate on their own Scratch environment the activities presented during the lesson.

The students are encouraged to explore, beginning with the environment presented in the tutorials, all the possibilities open by the newly learned concepts.

**EXTENSIONS**

The exercises presented in the Extensions section provide suggestions to develop and reinforce the knowledge and techniques learned in the tutorials.

They also provide a schedule support by allocation a variety of work assignments for each lesson.
DVD WITH COURSE MATERIALS
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SOLUTIONS TO EXTENSIONS EXERCISES
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ADDITIONAL COURSES
New courses using Scratch are being developed to be incorporated into the K-12 curriculum. Information on these courses will be available at learnscratch.org.
INTRODUCTION - REVIEW

This tutorial introduces the basic programming elements to move the sprite (in this case the cat) several steps forwards or backwards. You will learn how to select building blocks from different menus (beginning with the Blue menu of Motion) and how to execute an action by double-clicking on it. In this lesson we add a sound (the sound of a drum) every time the Sprite moves. You will learn how to select building blocks from the Sound Menu, and how to interconnect two building blocks in order to execute them at the same time. The "play drum" block allows you to select the type of sound (one among many) and the length of the sound.

PRESENTATION - VIDEO TUTORIALS

Tutorial Part 1: Start Moving
Tutorial Part 2: Add a Sound
Tutorial Part 3: Start a Dance
**Practice**

Scratch Activity: Reproduce the actions in the tutorial. Experiment with the size and direction of the steps.

---

**Closing - Assignments**

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

---

**Extensions**

1. Experiment with step sizes: very small, small, larger, very large.
2. Experiment with sounds: select and combine different sounds.
3. Experiment with dances: two, three, more steps in the dance. Select and combine short and long steps.
INTRODUCTION - REVIEW

In this lesson we include the first control block, "forever", from the orange Menu of Control. We move the four blocks of previous examples - move and play drums - into the "mouth" of the "forever" control block. When we double-click on it, the actions are repeated forever, making the Sprite dance continuously. To stop the action we need to use the red Stop icon. In this lesson we also introduce a new control icon, the "green flag." When we click on the green flag anything connected to it will be executed.

PRESENTATION - VIDEO TUTORIALS

Tutorial Part 1: Again and Again
Tutorial Part 2: The Green Flag
**PRACTICE**

Scratch Activity: Reproduce the actions in the tutorial. Experiment with the size and direction of the steps.

---

**CLOSING - ASSIGNMENTS**

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

---

**EXTENSIONS**

1. Experiment with a second repeat block (for a second dancing sprite.)

2. Experiment playing sequences of multiple sounds again and again.

3. Experiment creating two or three repeat blocks and control them one by one, or all together with the green flag and the stop sign.
LESSON 3

Playing with Color

INTRODUCTION - REVIEW

From the Menu of "Looks", we introduce in this tutorial the block of "change effect". When we click on this block, the Sprite will change its color by the amount specified. We can also select other graphic changes, such as whirl, mosaic, etc. In this lesson we also introduce another control block to execute actions. The block "when key pressed" will execute all the actions of the blocks connected to it.

PRESENTATION - VIDEO TUTORIALS

Tutorial Part 1: Change Color

Tutorial Part 2: Pressing Keys
**PRACTICE**

Scratch Activity: Reproduce the actions in the tutorial. Experiment with the size and direction of the steps.

---

**CLOSING - ASSIGNMENTS**

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

---

**EXTENSIONS**

1. Experiment with different rates of changing the color.
2. Experiment with two sprites and see how they change colors.
3. Experiment with different keys to control how a sprite changes colors.
4. Experiment adding sounds when you change colors.
LESSON 4
Creating Your Own Sprites

**INTRODUCTION - REVIEW**

In this lesson we learn how to import other Sprites into our projects. As an alternative we can use the graphic editor to create new Sprites.

**PRESENTATION - VIDEO TUTORIALS**

Tutorial: Create a Sprite
1. Experiment drawing and painting your own sprites.
2. Experiment by having your sprites dance, change colors, play sounds, etc.
3. Experiment and explore the large library of sprites of Scratch.
4. Experiment by creating groups of related sprites.

Practice

Scratch Activity: Reproduce the actions in the tutorial. Experiment with the size and direction of the steps.

Closing - Assignments

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

Extensions

1. Experiment drawing and painting your own sprites.
2. Experiment by having your sprites dance, change colors, play sounds, etc.
3. Experiment and explore the large library of sprites of Scratch.
4. Experiment by creating groups of related sprites.
INTRODUCTION - REVIEW

This lesson introduces the programming blocks that allow us to display a speech or a thought bubble with its corresponding message. The message is presented permanently or for a fixed duration of time.

PRESENTATION - VIDEO TUTORIALS

Tutorial: Speaking
PRACTICE

Study Scratch Activity: Reproduce the actions in the tutorial. Experiment with the size and direction of the steps.

CLOSING - ASSIGNMENTS

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

EXTENSIONS

1. Experiment by writing ideas and thoughts.
2. Experiment with two sprites speaking to each other.
3. Experiment by using key of the keyboard to control when they speak.
4. Experiment by adding sounds when the sprite speak.
**LESSON 6**

Creating Image Effects

**INTRODUCTION - REVIEW**

In this lesson we use the block "change effect by" to apply other graphic effects. This block allows us to change the color, create mosaics, pixelate, create swirl and ghost effects, etc.

**PRESENTATION - VIDEO TUTORIALS**

Tutorial: Image Effects
1. Experiment with all graphic effects: fisheye, whirl, pixelate, mosaic, brightness, and ghost.

2. Experiment by applying two simultaneous image effects to the same sprite.

3. Experiment by controlling the values of the image effects applied.

4. Experiment by adding sounds to the image effects.

**Practice**

Scratch Activity: Reproduce the actions in the tutorial. Experiment with the size and direction of the steps.

**Closing - Assignments**

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

**Extensions**

1. Experiment with all graphic effects: fisheye, whirl, pixelate, mosaic, brightness, and ghost.

2. Experiment by applying two simultaneous image effects to the same sprite.

3. Experiment by controlling the values of the image effects applied.

4. Experiment by adding sounds to the image effects.
INTRODUCTION - REVIEW

Using the tab "Sounds" in the programming area, we can associate audio files recorded by us or imported from elsewhere with our Sprites. We can associate multiple audio files with each Sprite.

PRESENTATION - VIDEO TUTORIALS

Tutorial: Add Audio
Scratch Activity: Reproduce the actions in the tutorial. Experiment with the size and direction of the steps.

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

1. Experiment by exploring all the sounds in the Scratch libraries.
2. Experiment with two or more sprites singing together.
3. Experiment adding image effects with the voices and music.
4. Experiment controlling with the keyboard the sequence of sounds.
INTRODUCTION - REVIEW

Using the tab "Costumes" in the programming area, we can associate images or costumes with our sprites. We can import existing costumes, or we can use the graphic editor to create new ones. We can associate multiple costumes with each Sprite. The change of costumes can be used to create animation effects.
**Practice**

Scratch Activity: Reproduce the actions in the tutorial. Experiment with the size and direction of the steps.

**Extensions**

1. Experiment by creating your own sprite costumes and make your own animation.
2. Experiment making animations with some of the sprites from the Scratch Libraries.
3. Experiment by animating two or three or more sprites at the same time.
4. Experiment by adding sounds as the sprites are animated.

**Closing - Assignments**

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.
Scratch Courses

This guide and materials were prepared by Juan Carlos Olabe and other members of the LearnScratch Team.

Christian Brothers University
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Memphis, TN 38104

learnscratch.org
Step by Step: A Course In Scratch Programming

Lesson Plans

learnscratch.org
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INTRODUCTION - REVIEW

This lesson introduces the building blocks that allow the Sprites to move forwards and backwards and to rotate clock and counter clockwise, and to make our Sprites face or point in a particular direction. The direction may be determined by an angle in degrees, or by the position of the mouse pointer or other Sprites.

PRESENTATION - VIDEO TUTORIALS

Tutorial Part 1: Move and Turn

Tutorial Part 2: Pointing
**PRACTICE**

Scratch Activity: Reproduce the actions in the tutorial. Experiment with the size and direction of the steps and turns.

Scratch Activity: Reproduce the actions in the tutorial. Experiment with other directions and sprites.

---

**EXTENSIONS**

1. Experiment with step sizes: very small, small, larger, very large.
2. Experiment with all ranges of turns.
3. Experiment by combining move and turn actions simultaneously.
4. Experiment pointing into all range of directions and to other sprites.
5. Experiment combining all actions in this lesson.

---

**CLOSING - ASSIGNMENTS**

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.
INTRODUCTION - REVIEW

This lesson presents the blocks that allow us to position immediately or smoothly our Sprite in a particular position within the X-Y grid of Scratch. The position may be determined by a set of x-y coordinates, the position of the mouse pointer or another Sprite,. It also presents how to modify relatively or absolutely the X and Y coordinates of the Sprite within the Scratch grid.

PRESENTATION - VIDEO TUTORIALS

Tutorial Part 1: Go and Glide

Tutorial Part 2: Changing Positions
1. Experiment by exploring the range of vertical and horizontal coordinates.

2. Experiment with the controls of the Go and Glide and Change and Set controls.

3. Experiment by performing equivalent movements of the sprite with alternative controls.

4. Experiment by moving the sprite around the edge of the stage.

5. Experiment by moving the sprite over the vertical and horizontal axes (x=0, and y=0)

**PRACTICE**

Scratch Activity: Reproduce the actions in the tutorial. Experiment with the controls of the glide movements.

Scratch Activity: Reproduce the actions in the tutorial. Experiment by exploring the range of vertical and horizontal coordinates.

**CLOSING - ASSIGNMENTS**

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

**EXTENSIONS**

1. Experiment by exploring the range of vertical and horizontal coordinates.

2. Experiment with the controls of the Go and Glide and Change and Set controls.

3. Experiment by performing equivalent movements of the sprite with alternative controls.

4. Experiment by moving the sprite around the edge of the stage.

5. Experiment by moving the sprite over the vertical and horizontal axes (x=0, and y=0)
INTRODUCTION - REVIEW

This lesson presents the programming block that allows us to force a Sprite in motion to remain within the limits of the Scratch grid by requiring it to bounce when it reaches one of the edges of the Stage. It also introduces the programming blocks that provide us with the three characteristics of the Motion of the Sprite: the x position, the y position, and its direction.

PRESENTATION - VIDEO TUTORIALS

Tutorial Part 1: Bouncing
Tutorial Part 2: Locating the Sprite
**PRACTICE**

Scratch Activity: Reproduce the actions in the tutorial. Experiment by modifying the settings and parameters used in the tutorial.

Scratch Activity: Reproduce the actions in the tutorial. Experiment by modifying the settings and parameters used in the tutorial.

**CLOSING - ASSIGNMENTS**

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

**EXTENSIONS**

1. Experiment by having two sprites bouncing off the edges of the stage.
2. Experiment by having two sprites reporting their location and direction.
3. Experiment by adding sounds when the sprite moves or bounces.
4. Experiment by adding sounds when the sprite crosses some thresholds.
INTRODUCTION - REVIEW
This lesson introduces the programming blocks that allow us to select the next costume of the sprite or any of the its predefined costumes. It also introduces the programming block to change the backgrounds.

PRESENTATION - VIDEO TUTORIALS
Tutorial Part 1: Change of Costumes
Tutorial Part 2: Change of Backgrounds
1. Experiment by applying the techniques of the tutorial to other sprites.

2. Experiment by synchronizing changes of costumes and backgrounds.

3. Experiment by adding sounds when the sprite changes costumes.

4. Experiment by adding sounds when the background changes costumes.

**Practice**

Scratch Activity: Reproduce the actions in the tutorial. Experiment by exploring the sprites and their costumes in the different Scratch libraries.

Scratch Activity: Reproduce the actions in the tutorial. Experiment by exploring the backgrounds and their costumes in the different Scratch libraries.

**Closing - Assignments**

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

**Extensions**

1. Experiment by applying the techniques of the tutorial to other sprites.

2. Experiment by synchronizing changes of costumes and backgrounds.

3. Experiment by adding sounds when the sprite changes costumes.

4. Experiment by adding sounds when the background changes costumes.
Lesson 5

Speaking, Thinking and Graphic Effects

**Introduction - Review**

This lesson introduces the programming blocks that allow us to display a speech or a thought bubble with its corresponding message. The message is presented permanently or for a fixed duration of time. It also introduces the programming blocks that allow us to set or change graphic effects applied to the sprite. These effects include: color, fisheye, whirl, pixelate, mosaic, brightness and ghost.

**Presentation - Video Tutorials**

Tutorial Part 1: Speaking and Thinking

Tutorial Part 2: Graphic Effects
PRACTICE
Scratch Activity: Reproduce the actions in the tutorials. Experiment by modifying the settings and parameters used in the tutorial.

CLOSING - ASSIGNMENTS
Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

EXTENSIONS
1. Experiment by having two sprites communicate in words and thoughts.
2. Experiment by adding sounds when a sprite speaks or thinks.
3. Experiment by applying multiple graphic effects to a sprite.
4. Experiment by adding sounds when graphic effects are applied.
INTRODUCTION - REVIEW

This lesson introduces the programming blocks that allow us to set or change the size of the sprite, making it larger or smaller than its initial size. It also introduces the programming blocks that allow us to show the sprite on the Stage or to make it disappear from it, and how to move the sprite in front of the other sprites, or to move it back one or several layers.

PRESENTATION - VIDEO TUTORIALS

Tutorial Part 1: Changing Size
Tutorial Part 2: Show and Hide
Tutorial Part 3: Controlling Layers
PRACTICE
Scratch Activity: Reproduce the actions in the tutorials. Experiment by modifying the settings and parameters used in the tutorial.

CLOSING - ASSIGNMENTS
Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

EXTENSIONS
1. Experiment by changing the size of two or more sprites at the same time.
2. Experiment by making appear and disappear several sprites.
3. Experiment by controlling the layer relative position of several sprites.
4. Experiment by adding sounds as the sprite change sizes, show or hide, or change layers.
INTRODUCTION - REVIEW

This lesson introduces the programming blocks that allow us to play one of the predefined sounds associated with the sprite, and either continue with other actions or wait until the end of the sound. It also introduces the control to stop all sounds.

PRESENTATION - VIDEO TUTORIALS

Tutorial: Playing Sounds
**Practice**

Scratch Activity: Reproduce the actions in the tutorial. Experiment by exploring the sounds in the libraries of Scratch and by recording your own sounds.

**Extensions**

1. Experiment by recording multiple sounds.
2. Experiment by having multiple sprites play multiple sounds.
3. Experiment by adding text and sounds to a simple story.
4. Experiment by having several sprites sing and play instruments together.

**Closing - Assignments**

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.
INTRODUCTION - REVIEW

This Tutorial introduces the programming block that allows us to select one among many drum sounds and to play it for a pre-defined duration.

PRESENTATION - VIDEO TUTORIALS

Tutorial Part 1: Playing Drums
Tutorial Part 2: Playing Drums
**PRACTICE**

Scratch Activity: Reproduce the actions in the tutorial. Experiment by exploring the sounds in the libraries of Scratch and by recording your own sounds.

**EXTENSIONS**

1. Experiment by playing multiple drums.
2. Experiment by playing sequences of drums.
3. Experiment by adding text when drum sounds are played.
4. Experiment by exploring the drum sounds in the Scratch libraries.

**CLOSING - ASSIGNMENTS**

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.
LESSON 9

Playing Instruments

INTRODUCTION - REVIEW

This lesson introduces the programming blocks that allow us to select one among many instruments and to play a selected note for a predefined duration.

PRESENTATION - VIDEO TUTORIALS

Tutorial Part 1: Playing Instruments
Tutorial Part 2: Playing Instruments
PRACTICE

Scratch Activity: Reproduce the actions in the tutorials. Experiment by exploring the sounds in the libraries of Scratch and by recording your own sounds.

CLOSING - ASSIGNMENTS

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

EXTENSIONS

1. Experiment by playing multiple instruments.
2. Experiment by playing sequences of instruments.
3. Experiment by adding text when instrument sounds are played.
4. Experiment by exploring the instrument sounds in the Scratch libraries.
**INTRODUCTION - REVIEW**

This lesson introduces the programming blocks that allow us to put the pen down, and therefore draw as it moves, or to move the pen up, disabling the pen from marking as it moves. The clear block removes all the pen marks from the Stage. It also introduces the programming blocks that allow us to set or change the pen color. We can set the pen color graphically or numerically.

**PRESENTATION - VIDEO TUTORIALS**

Tutorial Part 1: Pen Up and Down

Tutorial Part 2: Changing Colors
PRACTICE
Scratch Activity: Reproduce the actions in the tutorials. Experiment by modifying the settings and parameters used in the tutorial.

CLOSING - ASSIGNMENTS
Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

EXTENSIONS
1. Experiment by drawing circles (use move and turn: Unit 1.)
2. Experiment by drawing rectangle (use move and set direction: Unit 1.)
3. Experiment by adding sounds as the pen draws.
4. Experiment by having two or more pens draw together.
INTRODUCTION - REVIEW

This lesson introduces the programming blocks that allow us to set or change the shade of the pen. The shade scale ranges from 0, very dark or black, to 100, very light. It also introduces the programming blocks that allow us to set or change the pen size. The scale of the size goes from 1 pixel to sizes larger than the complete Stage. Finally it introduces how to stamp on the Stage images of the sprite.

PRESENTATION - VIDEO TUTORIALS

Tutorial Part 1: Changing Shades
Tutorial Part 2: Changing Pen Size
Tutorial Part 3: Stamping Effects
1. Experiment by changing the size of the pen as it draws circles and rectangles.

2. Experiment by changing the shade of the color of the pen as it draws circles and rectangles.

3. Experiment by performing stamping effects as those seen in the tutorials.

4. Experiment by adding sound effects to the previous programs.

**PRACTICE**

Scratch Activity: Reproduce the actions in the tutorials. Experiment by modifying the settings and parameters used in the tutorial.

**CLOSING - ASSIGNMENTS**

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

**EXTENSIONS**

1. Experiment by changing the size of the pen as it draws circles and rectangles.

2. Experiment by changing the shade of the color of the pen as it draws circles and rectangles.

3. Experiment by performing stamping effects as those seen in the tutorials.

4. Experiment by adding sound effects to the previous programs.
INTRODUCTION - REVIEW

This lesson introduces the programming blocks that allow us to activate scripts by clicking on the green flag, clicking on the corresponding sprite, or by pressing a key on the keyboard. It also introduces the programming blocks that allow us to stop the execution of the script and wait for a predefined time or until a condition becomes true.

PRESENTATION - VIDEO TUTORIALS

Tutorial Part 1: Beginning Actions

Tutorial Part 2: Waiting
**PRACTICE**

Scratch Activity: Reproduce the actions in the tutorials. Experiment by modifying the settings and parameters used in the tutorial.

---

**CLOSING - ASSIGNMENTS**

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

---

**EXTENSIONS**

1. Experiment by controlling actions using three different techniques.
2. Experiment by applying simultaneous controls to multiple sprites.
3. Experiment by starting some actions and stopping others with the same controls.
4. Experiment by adding sound effects to the previous programs.
INTRODUCTION - REVIEW

This lesson introduces the programming blocks that allow us to repeat indefinitely a group of actions unconditionally or when a condition, which is constantly checked, becomes true. It also introduces the programming blocks that allow us to repeat a group of actions a predetermined number of times, or until a condition becomes true.

PRESENTATION - VIDEO TUTORIALS

Tutorial Part 1: Doing Forever
Tutorial Part 2: Repeating Actions
PRACTICE
Scratch Activity: Reproduce the actions in the tutorials. Experiment by modifying the settings and parameters used in the tutorial.

CLOSING - ASSIGNMENTS
Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

EXTENSIONS
1. Experiment by applying the techniques seen in the tutorials to: two, three or more sprites.
2. Experiment by applying image effects to the previous programs.
3. Experiment by adding sound effects to the previous programs.
INTRODUCTION - REVIEW
This lesson introduces the programming blocks that allows communication between sprites through messages which are broadcast by one sprite and received by all sprites.

PRESENTATION - VIDEO TUTORIALS
Tutorial: Broadcasting
PRACTICE
Scratch Activity: Reproduce the actions in the tutorials. Experiment by modifying the settings and parameters used in the tutorial.

CLOSING - ASSIGNMENTS
Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

EXTENSIONS
1. Experiment by creating two sprites (to draw circles and rectangles) controlled by the broadcast signal of a third sprite.
2. Experiment by creating a dialog between two sprites coordinated with broadcast signals.
3. Experiment by adding sound effects when the broadcast signals are sent and received.
INTRODUCTION - REVIEW

This lesson introduces the programming blocks that allow us to implement a group of actions when a condition is true, or to select between two groups of actions depending on the state, true or false, of a condition.

PRESENTATION - VIDEO TUTORIALS

Tutorial: Conditional Actions
**Practice**

Scratch Activity: Reproduce the actions in the tutorials. Experiment by modifying the settings and parameters used in the tutorial.

---

**Closing - Assignments**

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

---

**Extensions**

1. Experiment by drawing circles when a condition is true (e.g.: the sprite is touching the edge.)
2. Experiment by drawing rectangles or circles depending on whether a condition is true or not (e.g.: the sprite is on the right side of the stage - x is positive.)
3. Experiment by adding sound to the previous programs.
INTRODUCTION - REVIEW
This lesson introduces the programming blocks that allow us to stop the execution of a particular script or to stop the execution of all scripts in all sprites of the project.

PRESENTATION - VIDEO TUTORIALS
Tutorial: Stopping
**PRACTICE**

Scratch Activity: Reproduce the actions in the tutorials. Experiment by modifying the settings and parameters used in the tutorial.

**CLOSING - ASSIGNMENTS**

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

**EXTENSIONS**

1. Experiment by stopping the movement of the sprite when it reaches the edge.
2. Experiment by drawing circles of different colors until the color turns to white.
3. Experiment by moving two sprites and stopping them when they collide.
4. Experiment by adding sound effects to the previous programs.
INTRODUCTION - REVIEW

This lesson introduces the programming blocks that allow us to receive information on the location of the mouse, coordinates x and y, and whether the mouse button is pressed down or not. It also introduces the programming block that allows to receive information on whether a particular key of keyboard is being pressed down.

PRESENTATION - VIDEO TUTORIALS

Tutorial Part 1: Mouse Report
Tutorial Part 2: Pressing Keys
**PRACTICE**

Scratch Activity: Reproduce the actions in the tutorials. Experiment by modifying the settings and parameters used in the tutorial.

---

**CLOSED - ASSIGNMENTS**

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

---

**EXTENSIONS**

1. Experiment by drawing shapes defined by the mouse cursor.
2. Experiment by playing sounds using the keyboard keys (e.g.: asdf.)
3. Experiment by moving one sprite with the mouse and another with the arrow keys.
4. Experiment by changing the color of the background by pressing keys.
INTRODUCTION - REVIEW

This lesson introduces the programming blocks that allow us to know whether the sprite is touching another sprite, the mouse pointer or an edge of the Stage, a particular color, or if a color of the sprite is touching another color. It also introduces the programming block that allow us to know the current distance from the sprite to another sprite or to the mouse pointer.

PRESENTATION - VIDEO TUTORIALS

Tutorial Part 1: Touching and Over
Tutorial Part 2: Reporting Distance
**PRACTICE**

Scratch Activity: Reproduce the actions in the tutorials. Experiment by modifying the settings and parameters used in the tutorial.

**EXTENSIONS**

1. Experiment by drawing circles when the sprite touches a green path of color.
2. Experiment by playing sounds when the sprite touches another sprite.
3. Experiment by playing a warning sound when the sprite gets close to the edge.
4. Experiment by adding graphic or sound effects to the previous programs.

**CLOSING - ASSIGNMENTS**

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.
This lesson introduces the programming blocks that allow us to know the current value of the timer in seconds, and to reset the timer. The timer starts running the moment we open or create a new project. It also introduces the programming blocks that allow us to determine the current volume of the sounds detected in the microphone, and whether this value is greater than 30 on a scale from 1 to 100.

Tutorial Part 1: Using the Timer

Tutorial Part 2: Checking the Volume
**PRACTICE**

Scratch Activity: Reproduce the actions in the tutorials. Experiment by modifying the settings and parameters used in the tutorial.

**EXTENSIONS**

1. Experiment by resetting the timer each time a moving sprite bounces off the edge.
2. Experiment by microphone to move forward a sprite.
3. Experiment by using the timer to measure the time it takes a sprite to move around the edges of the stage.
4. Experiment by using the microphone to change the color of the sprite.

**CLOSING - ASSIGNMENTS**

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.
INTRODUCTION - REVIEW

This lesson introduces the programming blocks that allow us to know the current value of the timer in seconds, and to reset the timer. The timer starts running the moment we open or create a new project. It also introduces the programming blocks that allow us to determine the current volume of the sounds detected in the microphone, and whether this value is greater than 30 on a scale from 1 to 100.

PRESENTATION - VIDEO TUTORIALS

Tutorial: Variables
1. Experiment by setting the color of the sprite using variables.

2. Experiment by drawing squares using variables.

3. Experiment by controlling the speed of a moving sprite using variables.

4. Experiment by playing different sounds using variables.

**Practice**

Scratch Activity: Reproduce the actions in the tutorials. Experiment by modifying the settings and parameters used in the tutorial.

**Closing - Assignments**

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

**Extensions**

1. Experiment by setting the color of the sprite using variables.
2. Experiment by drawing squares using variables.
3. Experiment by controlling the speed of a moving sprite using variables.
4. Experiment by playing different sounds using variables.
INTRODUCTION - REVIEW

This lesson introduces the programming blocks that allow us to implement the arithmetic operations addition, subtraction, multiplication and division, both with integer and real numbers. It also introduces the programming block that allows us to generate randomly a number in a range determined by its minimum and maximum limits.

PRESENTATION - VIDEO TUTORIALS

Tutorial Part 1: Arithmetic Operations
Tutorial Part 2: Random Numbers
**PRACTICE**

Scratch Activity: Reproduce the actions in the tutorials. Experiment by modifying the settings and parameters used in the tutorial.

**CLOSING - ASSIGNMENTS**

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

**EXTENSIONS**

1. Experiment by using variables and arithmetic operators to draw circles of different sizes and colors.
2. Experiment by using variables and arithmetic operators to move a sprite at different speeds.
3. Experiment by using random numbers to play computer generated melodies.
4. Experiment by adding image and sound effects to the previous programs.
INTRODUCTION - REVIEW
This lesson introduces the programming blocks that allow us to determine whether a number is less than, equal to, or greater than a second number.

PRESENTATION - VIDEO TUTORIALS
Tutorial: Comparing Numbers
PRACTICE

Scratch Activity: Reproduce the actions in the tutorials. Experiment by modifying the settings and parameters used in the tutorial.

CLOSING - ASSIGNMENTS

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

EXTENSIONS

1. Experiment by using variables and comparison of numbers to change the background when the sprite moves close to the edges (for example: distance = 40.)

2. Experiment by using variables and comparison of numbers to play a sound when two moving sprites have the same vertical coordinate.

3. Experiment by using variables and comparison of numbers to change the size of a sprite if it is smaller than a certain reference.
INTRODUCTION - REVIEW
This lesson introduces the programming blocks that allow us to implement the logic functions AND and OR between two boolean values, and the NOT function of a boolean value.

PRESENTATION - VIDEO TUTORIALS
Tutorial: Logic Operations
PRACTICE
Scratch Activity: Reproduce the actions in the tutorials. Experiment by modifying the settings and parameters used in the tutorial.

CLOSING - ASSIGNMENTS
Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

EXTENSIONS
1. Experiment by play a sound when two moving sprites touch the edge of the stage.
2. Experiment by changing the background when one of two sprites (or both) touch a read square in the middle of the stage.
3. Experiment by adding graphic effects when the sprite is not over a red color square in the middle of the stage.
INTRODUCTION - REVIEW
This lesson introduces the programming blocks that allow us to obtain the remainder of the division of two numbers, the absolute value of a number, or the closest integer to a number.

PRESENTATION - VIDEO TUTORIALS
Tutorial: Extra Operations
1. Experiment by using variables and the modulo operator to play different sounds according with the result of a division.

2. Experiment by using the absolute operator to have two sprites jump the same height but move in opposite directions.

3. Experiment by using a variable and the round operator to have the sprite move in discrete jumps.

**PRACTICE**

Scratch Activity: Reproduce the actions in the tutorials. Experiment by modifying the settings and parameters used in the tutorial.

**CLOSING - ASSIGNMENTS**

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

**EXTENSIONS**

1. Experiment by using variables and the modulo operator to play different sounds according with the result of a division.

2. Experiment by using the absolute operator to have two sprites jump the same height but move in opposite directions.

3. Experiment by using a variable and the round operator to have the sprite move in discrete jumps.
This guide and materials were prepared by Juan Carlos Olabe and other members of the LearnScratch Team.

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SCRATCH PROJECTS: A COMPREHENSIVE COURSE

LESSON PLANS

learnscratch.org
# List of Lessons

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TIME SCHEDULE
This course has been designed so that each lesson will occupy one meeting session with the students.

Once the tutorial has been reviewed, the activity of the student will concentrate on mastering the new concepts presented.

Practicing with Scratch and exploring all the possibilities of the new concepts learned is essential for a robust learning process.

The exercises proposed in the Extensions section are designed to reinforce the learn-by-doing approach.

SCRATCH ACTIVITIES
After studying the tutorials the students will replicate on their own Scratch environment the activities presented during the lesson.

The students are encouraged to explore, beginning with the environment presented in the tutorials, all the possibilities open by the newly learned concepts.

EXTENSIONS
The exercises presented in the Extensions section provide suggestions to develop and reinforce the knowledge and techniques learned in the tutorials.

They also provide a schedule support by allocation a variety of work assignments for each lesson.
DVD WITH COURSE MATERIALS

Schools and institutions can reduce their internet demands for using these materials by installing them locally in their labs and computers.

To receive DVDs with these materials, send the institutions mailing address via the “Contact Us” link at learnscratch.org.

SOLUTIONS TO EXTENSIONS EXERCISES

Scratch programs with solutions to the Extension exercises can also be obtained sending a request via the “Contact Us” link at learnscratch.org.

ADDITIONAL COURSES

New courses using Scratch are being developed to be incorporated into the K-12 curriculum. Information on these courses will be available at learnscratch.org.
INTRODUCTION - REVIEW

This project includes a dialog between two friends and a final sound effect. It uses a sequence of wait blocks to synchronize the communication between them. It is a good example for an initial story telling project.

PRESENTATION - VIDEO TUTORIALS

View and study the tutorial. Take notes of the new features introduced in this project. Stop and rewind if necessary. Use the print out of the main script as you take notes.
**PRACTICE**

Study the scripts of the project and recreate the program.

Reproduce the actions in the tutorial.

Experiment with different dialogs, different timing, and different sound effects.

**CLOSING - ASSIGNMENTS**

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

**EXTENSIONS**

1. Experiment with additional protagonist in the story: three, four, etc.
2. Experiment with the control of who speaks at which time.
3. Experiment with sequential and simultaneous dialog.
4. Experiment with different sound effects and multiple sound effects.
INTRODUCTION - REVIEW

This project includes a dialog between the two protagonists. During the story there are changes of scenery and costumes and a final section for the project credits. It uses broadcasting signals to synchronize the dialog and the changes of scenery and costumes.

PRESENTATION - VIDEO TUTORIALS

View and study the tutorial. Take notes of the new features introduced in this project. Stop and rewind if necessary. Use the print out of the main script as you take notes.
**PRACTICE**

Study the scripts and recreate the program. Reproduce the actions in the tutorial. Experiment with different dialogs, different timing, and different backgrounds and costumes.

**CLOSING - ASSIGNMENTS**

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

**EXTENSIONS**

1. Experiment with additional protagonist in the story: three, four, etc.
2. Experiment with additional scene changes.
3. Experiment with additional costume changes for the actors.
4. Experiment by adding sound effects.
INTRODUCTION - REVIEW
This project includes animation effects through continuous change of consecutive costumes. It allows step by step study of motion. It is a good project to start using frame by frame costumes of sprites.

PRESENTATION - VIDEO TUTORIALS
View and study the tutorial. Take notes of the new features introduced in this project. Stop and rewind if necessary. Use the print out of the main script as you take notes.
**PRACTICE**

Study the scripts and recreate the program. Reproduce the actions in the tutorial. Experiment with different timing for the animation and different number of sprites. Create your own animated sprites.

**CLOSING - ASSIGNMENTS**

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

**EXTENSIONS**

1. Experiment with additional animated sprites: three, four, etc.
2. Experiment creating your own multi-costume animated sprites.
3. Experiment synchronizing multiple animated sprites.
4. Experiment by adding sound effects to the animations.
INTRODUCTION - REVIEW

This project uses random selection of predefined set of phrases to automatically create stories. It illustrates the use of location on the Stage, random number generation, and the synchronized action of multiple sprites.

PRESENTATION - VIDEO TUTORIALS

View and study the tutorial. Take notes of the new features introduced in this project. Stop and rewind if necessary. Use the print out of the main script as you take notes.
PRACTICE

Study the scripts and recreate the program. Reproduce the actions in the tutorial. Experiment with new sets of text, new costumes for the stories and new backgrounds.

CLOSING - ASSIGNMENTS

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

EXTENSIONS

1. Experiment adding more lines to the text.
2. Experiment adding color to each line.
3. Experiment adding sound effects with each new story.
4. Experiment with background changes.
INTRODUCTION - REVIEW

This project is a good example of interactivity. The user has the ability to create random audio stories. It includes a sprite with audio for each individual represented in the painting. By clicking the sprites the user controls dialogue in the group. It is a good example of graphic and audio design.

PRESENTATION - VIDEO TUTORIALS

View and study the tutorial. Take notes of the new features introduced in this project. Stop and rewind if necessary. Use the print out of the main script as you take notes.
PRACTICE

Study the scripts and recreate the program. Experiment changing the sounds and adding musical or instrumental elements to the picture.

EXTENSIONS

1. Experiment with a new picture.
2. Experiment adding musical effects to parts of the picture.
3. Experiment with two or more sounds at the same time.
4. Experiment adding text references to the picture.

CLOSING - ASSIGNMENTS

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.
INTRODUCTION - REVIEW

This project simulates the operation of an etch-sketch toy, allowing the user to draw by using the key arrows and special keys to select colors and the width of the marks. It is a good example for an initial drawing project.

PRESENTATION - VIDEO TUTORIALS

View and study the tutorial. Take notes of the new features introduced in this project. Stop and rewind if necessary. Use the print out of the main script as you take notes.
PRACTICE

Study the scripts and recreate the program. Reproduce the actions in the tutorial. Experiment with different sizes for the drawings and width for the pen.

CLOSING - ASSIGNMENTS

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

EXTENSIONS

1. Experiment with size of the steps and the width of the pen.
2. Experiment with adding sounds to each color marking.
3. Experiment with new colors and shades.
4. Experiment with two simultaneous pens.
INTRODUCTION - REVIEW
This project allows the use of the arrow keys and other keys to control the forward direction, turning and color of the pen. It creates an environment where different types of drawings can be obtained by selective and combined use of the controls. It illustrates the use of simultaneous controls in computer drawing.

PRESENTATION - VIDEO TUTORIALS
View and study the tutorial. Take notes of the new features introduced in this project. Stop and rewind if necessary. Use the print out of the main script as you take notes.
**Practice**

Study the scripts and recreate the program. Reproduce the actions in the tutorial. Experiment with different controls for the airplane: size of the pen, color change, speed of drawing.

**Extensions**

1. Experiment with different settings for the airplane controls.
2. Experiment adding a second drawing airplanes.
3. Experiment with changes in the colors of the background.
4. Experiment by adding sound effects to the flight of the airplane.

**Closing - Assignments**

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.
INTRODUCTION - REVIEW

This project combines the simple use of arrow keys to move the sprite and the effect of changing colors to obtain colorful designs. It allows for easy modification and expansion of its features.

PRESENTATION - VIDEO TUTORIALS

View and study the tutorial. Take notes of the new features introduced in this project. Stop and rewind if necessary. Use the print out of the main script as you take notes.
**PRACTICE**

Study the scripts and recreate the program. Reproduce the actions in the tutorial. Experiment with different directions of drawing, different color changes and different speeds of drawing.

---

**CLOSING - ASSIGNMENTS**

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

---

**EXTENSIONS**

1. Experiment with additional directions of the drawing path.
2. Experiment with changes of the color of the background.
3. Experiment with two simultaneous drawing balls.
4. Experiment by adding sound effects to the drawing ball.
INTRODUCTION - REVIEW

This project simulates a lego construction kit, allowing the creation of sophisticated designs with a relatively simple program. The richness of the possible designs is in part due to the large number of existing building blocks, their sizes and colors. It uses a very resourceful method to move the blocks throughout the grid and in the vertical space. It allows for easy expansion and addition of new features.

PRESENTATION - VIDEO TUTORIALS

View and study the tutorial. Take notes of the new features introduced in this project. Stop and rewind if necessary. Use the print out of the main script as you take notes.
**PRACTICE**

Study the scripts and recreate the program. Reproduce the actions in the tutorial. Experiment with different sizes, colors and forms for the building blocks.

---

**CLOSING - ASSIGNMENTS**

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

---

**EXTENSIONS**

1. Experiment with additional orientations for the bricks.
2. Experiment with different shapes for the bricks.
3. Experiment with additional building elements (windows, doors...)
4. Experiment by adding sounds with each building block.
INTRODUCTION - REVIEW

This project simulates the operation of a typewriter by printing on the screen the characters typed on the keyboard. It includes a simple but long program which illustrates how to use a large number of inputs to control a project. It allows for easy expansion and it is a good example of how a project can include very long, and at the same time simple, scripts.

PRESENTATION - VIDEO TUTORIALS

View and study the tutorial. Take notes of the new features introduced in this project. Stop and rewind if necessary. Use the print out of the main script as you take notes.
1. Experiment with additional font colors.
2. Experiment with additional font sizes.
3. Experiment changing the color and theme of the paper (background.)
4. Experiment by adding sound effects as you type.
INTRODUCTION - REVIEW

This project implements a version of the traditional pac-man game. It provides a simple method to navigate through the maze without trespassing its limits. It is a good example for an initial game project. It allows for easy expansion and the addition of new features.

PRESENTATION - VIDEO TUTORIALS

View and study the tutorial. Take notes of the new features introduced in this project. Stop and rewind if necessary. Use the print out of the main script as you take notes.
1. Experiment adding a second Pac Man (with different sets of controls.)

2. Experiment with additional mazes (backgrounds.)

3. Experiment by adding a score counter for the targets obtained.

4. Experiment by adding sound effects according to the motion of the Pac Man.

**PRACTICE**

Study the scripts and recreate the program. Reproduce the actions in the tutorial. Experiment with the speed of the Pac Man, and the controls of its movement (substitute arrows by a set of four keys.)

**CLOSING - ASSIGNMENTS**

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

**EXTENSIONS**

1. Experiment adding a second Pac Man (with different sets of controls.)

2. Experiment with additional mazes (backgrounds.)

3. Experiment by adding a score counter for the targets obtained.

4. Experiment by adding sound effects according to the motion of the Pac Man.
INTRODUCTION - REVIEW

This project implements a version of the traditional pong game. It includes two moving parts: the ball, which bounces on the edges of the Stage, and the paddle, which is controlled by the player. It includes sound effects, and it is a good example of an initial interactive game project.

PRESENTATION - VIDEO TUTORIALS

View and study the tutorial. Take notes of the new features introduced in this project. Stop and rewind if necessary. Use the print out of the main script as you take notes.
PRACTICE

Study the scripts and recreate the program. Reproduce the actions in the tutorial. Experiment with the speed of the ball and the width of the paddle.

EXTENSIONS

1. Experiment with an additional ball.
2. Experiment by adding a score counter for the number of contacts.
3. Experiment with adding a second paddle controlled by the key arrows (a second player.)
4. Experiment by assigning different score values to each ball hit.

CLOSING - ASSIGNMENTS

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.
INTRODUCTION - REVIEW

This project implements a maze game where the objective is to arrive to the destination without exiting the allowed -color coded- path. It uses color overlap to control the rules of the game. The operation of the sprite is simple, and illustrates a typical implementation of maze games.

PRESENTATION - VIDEO TUTORIALS

View and study the tutorial. Take notes of the new features introduced in this project. Stop and rewind if necessary. Use the print out of the main script as you take notes.
**PRACTICE**

Study the scripts and recreate the program. Reproduce the actions in the tutorial. Experiment with different sizes for the movement of the bee. Experiment by changing the control arrows to a set of arrows in the keyboard.

**CLOSING - ASSIGNMENTS**

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

**EXTENSIONS**

1. Experiment with additional maze layouts.
2. Experiment adding a second bee (second player, with different controls.)
3. Experiment by adding a timer to measure the time to finish.
4. Experiment by adding sound effects.
**INTRODUCTION - REVIEW**

This project implements a maze game where the objective is to arrive to the final destination in the shortest time possible. It implements the effect of bouncing on the walls, and it includes a simple control of the motion of the sprite. It uses creative text and sound effects.

**PRESENTATION - VIDEO TUTORIALS**

View and study the tutorial. Take notes of the new features introduced in this project. Stop and rewind if necessary. Use the print out of the main script as you take notes.
PRACTICE

Study the scripts and recreate the program. Reproduce the actions in the tutorial. Experiment with different layouts for the maze.

CLOSING - ASSIGNMENTS

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

EXTENSIONS

1. Experiment by adding a second player (use a set of four keys to control it.)
2. Experiment with adding a score of the times the walls are hit.
3. Experiment with controlling the speed of the sprite.
4. Experiment by modifying and adding sound effects.
INTRODUCTION - REVIEW

This project illustrates the use of simultaneous actions to create colorful designs with simple controls. It allows for easy modification of its parameters. The drawings are obtained with the stamp effect, and therefore multiple sprite costumes efficiently add to the final aspect of the drawings.

PRESENTATION - VIDEO TUTORIALS

View and study the tutorial. Take notes of the new features introduced in this project. Stop and rewind if necessary. Use the print out of the main script as you take notes.
PRACTICE

Study the scripts and recreate the program. Reproduce the actions in the tutorial. Experiment with different four sprites and changing colors.

CLOSING - ASSIGNMENTS

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

EXTENSIONS

1. Experiment with additional sprites: four, five, six...
2. Experiment with sound effects as the sprites move and turn.
3. Experiment with a second drawing set (a second player, using a separate set of controls.)
INTRODUCTION - REVIEW

This project combines graphic effects and a set of multiple costumes, selected randomly, to create an enjoyable experience. It illustrates the ability to apply a sequence of graphic effects with opposite parameters to return to the original image.

PRESENTATION - VIDEO TUTORIALS

View and study the tutorial. Take notes of the new features introduced in this project. Stop and rewind if necessary. Use the print out of the main script as you take notes.
**Practice**

Study the scripts and recreate the program. Reproduce the actions in the tutorial. Experiment by adding new messages.

**Closing - Assignments**

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

**Extensions**

1. Experiment with different sets of messages.
2. Experiment with different image effects
3. Experiment by adding sound effects as the messages appear and disappear.
INTRODUCTION - REVIEW
This project is an example on the use of multiple costumes to illustrate a sequence of events in the process of accomplishing a complex task, in this case a hand drawing. It is a good example on how to illustrate a sequence of steps.

PRESENTATION - VIDEO TUTORIALS
View and study the tutorial. Take notes of the new features introduced in this project. Stop and rewind if necessary. Use the print out of the main script as you take notes.
**PRACTICE**

Study the scripts and recreate the program. Reproduce the actions in the tutorial. Experiment with your own drawings.

**CLOSED - ASSIGNMENTS**

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

**EXTENSIONS**

1. Experiment with your own drawings
2. Experiment with downloaded drawings.
3. Experiment adding graphic effects.
INTRODUCTION - REVIEW
This project illustrates the combined use of multiple copies of the same sprite to produce a complex result. In this case it uses a sprite with an arrow shape and a simple script, which in combination with many copies of itself produces remarkable results.

PRESENTATION - VIDEO TUTORIALS
View and study the tutorial. Take notes of the new features introduced in this project. Stop and rewind if necessary. Use the print out of the main script as you take notes.
**PRACTICE**

Study the scripts and recreate the program. Reproduce the actions in the tutorial. Experiment with a small group of arrows or sprites (4, 5 or 6.)

**CLOSING - ASSIGNMENTS**

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

**EXTENSIONS**

1. Experiment with different shapes of sprites.
2. Experiment with additional background changes.
3. Experiment by adding sound effects when the arrows turn.
LINEAR PATTERNS

INTRODUCTION - REVIEW

This project illustrates the use of variables and external input from the user to control the size and shape of the final design. It is a good example on how to control a program by selecting the values of its variables.

PRESENTATION - VIDEO TUTORIALS

View and study the tutorial. Take notes of the new features introduced in this project. Stop and rewind if necessary. Use the print out of the main script as you take notes.
**PRACTICE**

Study the scripts and recreate the program. Reproduce the actions in the tutorial. Experiment different settings for steps, degrees and increment.

---

**CLOSING - ASSIGNMENTS**

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

---

**EXTENSIONS**

1. Experiment by slowing down the drawing process.
2. Experiment with color and sizes of the pen.
3. Experiment by adding sound effects as the pen draws and turns.
INTRODUCTION - REVIEW

This project illustrates an interactive application where random addition problems are created. The user enters the expected solution and later is able to check its accuracy. It illustrates how to create multiple problems randomly, how to get input from the user, how to display this input on the screen and how to check the correctness of the input. It can be expanded to implement other operations and extend the range of final results.

PRESENTATION - VIDEO TUTORIALS

View and study the tutorial. Take notes of the new features introduced in this project. Stop and rewind if necessary. Use the print out of the main script as you take notes.
PRACTICE

Study the scripts and recreate the program. Reproduce the actions in the tutorial. Experiment by adding a third number to be added.

CLOSING - ASSIGNMENTS

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

EXTENSIONS

1. Experiment with the addition and subtraction.
2. Experiment with one digit multiplication.
3. Experiment by adding sound effects according to the responses.
INTRODUCTION - REVIEW

This project illustrates the graphical representation of a fractal algorithm. It creates an attractive design by repeatedly adding points to the drawing. The consecutive points seem unrelated at first. As the program continues execution the fractal design becomes apparent. It includes three controls for the operation of the program and an additional control to position the sprites in the corners of the design.

PRESENTATION - VIDEO TUTORIALS

View and study the tutorial. Take notes of the new features introduced in this project. Stop and rewind if necessary. Use the print out of the main script as you take notes.
**PRACTICE**

Study the scripts and recreate the program. Reproduce the actions in the tutorial. Experiment with the location of the three targets.

---

**CLOSING - ASSIGNMENTS**

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

---

**EXTENSIONS**

1. Experiment with color, shade and size of the pen.
2. Experiment with the speed of the drawing.
3. Experiment by adding sound effects as the spider moves and turns.
INTRODUCTION - REVIEW

This project illustrates the graphical representation of mathematical equations, in this case linear equations. It allows the user to enter the two parameters of the equation, and changes colors as a new curve is plotted. It allows easy expansion to represent more complex curves - parabolas, hyperbolas, ellipses, other polynomials, etc.

PRESENTATION - VIDEO TUTORIALS

View and study the tutorial. Take notes of the new features introduced in this project. Stop and rewind if necessary. Use the print out of the main script as you take notes.
PRACTICE

Study the scripts and recreate the program. Reproduce the actions in the tutorial. Experiment with angles and zero crossing for the lines.

EXTENSIONS

1. Experiment drawing parallel lines at the same time.
2. Experiment with the speed, color and size of the drawings.
3. Experiment by adding sound effects when elements of the grid are crossed.

CLOSING - ASSIGNMENTS

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.
**INTRODUCTION - REVIEW**

This project implements a simulation of the random process of tossing a coin. It keeps records of the number of flips and their outcomes: tails and heads. It is a good project to experience the nature of random numbers.

**PRESENTATION - VIDEO TUTORIALS**

View and study the tutorial. Take notes of the new features introduced in this project. Stop and rewind if necessary. Use the print out of the main script as you take notes.
**Practice**

Study the scripts and reproduce the actions in the tutorial. Experiment with different values for the random numbers generated.

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**Closing - Assignments**

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

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**Extensions**

1. Experiment with objects with 3, 4 or more outcomes (e.g. 6 sided dice).
2. Experiment with graphic effects for each possible outcome.
3. Experiment by adding sound effects for each possible outcome.
INTRODUCTION - REVIEW

This project illustrates the combined effect of sounds and graphics by drawing boxes and ringing bells as the user clicks the mouse pointer on the screen. The color and the shade of the boxes and the pitch of the sounds are a function of the location of the click. It is a good example of a combination of expected and random effects.

PRESENTATION - VIDEO TUTORIALS

View and study the tutorial. Take notes of the new features introduced in this project. Stop and rewind if necessary. Use the print out of the main script as you take notes.
PRACTICE
Study the scripts and reproduce the actions in the tutorial. Experiment with different sounds and shade changes.

CLOSING - ASSIGNMENTS
Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

EXTENSIONS
1. Experiment with changing rectangles by other shapes.
2. Experiment with simultaneous sounds for each shape.
3. Experiment with changing the sounds according to the colors.
INTRODUCTION - REVIEW

This project implements a piano keyboard that the user can control with the mouse or with the keys of the computer. It simulates the operation of an electronic piano. It also includes pre-programmed melodies that can be automatically played by the piano. It is a good example of a musical project.

PRESENTATION - VIDEO TUTORIALS

View and study the tutorial. Take notes of the new features introduced in this project. Stop and rewind if necessary. Use the printout of the main script as you take notes.
1. Experiment writing additional melodies.

2. Experiment modifying the instrument's sounds.

3. Experiment playing the keys while the piano plays a background melody.
INTRODUCTION - REVIEW

This project presents a rock band performing one of their songs. It includes graphic motion of the sprites by changing their costumes. It is a good starting project combining image and sound coordination.

PRESENTATION - VIDEO TUTORIALS

View and study the tutorial. Take notes of the new features introduced in this project. Stop and rewind if necessary. Use the print out of the main script as you take notes.
PRACTICE

Study the scripts and reproduce the actions in the tutorial. Experiment redrawing the costumes of one of the sprites.

CLOSING - ASSIGNMENTS

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

EXTENSIONS

1. Experiment with additional melodies.
2. Experiment with additional members of the band.
3. Experiment with new members of the audience.
4. Experiment by adding sound effects.
LESSON 27

Sound Maker

INTRODUCTION - REVIEW

This project illustrates the use of variables to control musical instruments. The user controls with the mouse the choice of instrument, the note played, and the speed or length of the notes. It uses long variable names to allow good control of the sliders.

PRESENTATION - VIDEO TUTORIALS

View and study the tutorial. Take notes of the new features introduced in this project. Stop and rewind if necessary. Use the print out of the main script as you take notes.
**PRACTICE**

Study the scripts and reproduce the actions in the tutorial. Experiment with different preset notes.

**CLOSING - ASSIGNMENTS**

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

**EXTENSIONS**

1. Experiment with multiple present notes.
2. Experiment with present sprites that play a short melody.
3. Experiment by adding graphic effects (add a color changing sprite.)
INTRODUCTION - REVIEW

This project presents the action of land and air travel accompanied by music. It uses the combined effect of several sprites. It is a good example of the use of motion and change of size to simulate movement, and a good integration of music.

PRESENTATION - VIDEO TUTORIALS

View and study the tutorial. Take notes of the new features introduced in this project. Stop and rewind if necessary. Use the print out of the main script as you take notes.
**PRACTICE**

Study the scripts and reproduce the actions in the tutorial. Experiment with different melodies and speed of the animation.

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**CLOSING - ASSIGNMENTS**

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

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**EXTENSIONS**

1. Experiment with additional flying objects.
2. Experiment with animated objects (trees, road, cars, etc.)
3. Experiment with additional background changes (day, night, etc.)
4. Experiment by adding sound effects (as the trees pop-up from the horizon, etc.)
INTRODUCTION - REVIEW

This project illustrates the use of broadcasting signals to control sprites as they play their instruments. The sprites are pre-programmed to play several types of notes. They actually play them, in a synchronized form, when the director, in this case the script of the background, sends the corresponding signals.

PRESENTATION - VIDEO TUTORIALS

View and study the tutorial. Take notes of the new features introduced in this project. Stop and rewind if necessary. Use the print out of the main script as you take notes.
PRACTICE

Study the scripts and reproduce the actions in the tutorial. Experiment by selecting different sequences of players.

CLOSING - ASSIGNMENTS

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

EXTENSIONS

1. Experiment by adding new players to the band.
2. Experiment with new sounds for all players.
3. Experiment by adding image effects when a player plays.
INTRODUCTION - REVIEW

This project uses a very short and simple script to implement a spinning wheel. The operation of the turning sprite is controlled by a random number generator. It allows for easy modification of its parameters. A change in the background can add meaning to the final position of the turning arrow.

PRESENTATION - VIDEO TUTORIALS

View and study the tutorial. Take notes of the new features introduced in this project. Stop and rewind if necessary. Use the print out of the main script as you take notes.
PRACTICE

Study the scripts and recreate the program. Reproduce the actions in the tutorial.

CLOSING - ASSIGNMENTS

Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

EXTENSIONS

1. Experiment with two arrows turning in different directions.
2. Experiment with different backgrounds.
3. Experiment by adding sound effects as the arrow turns and stops.
INTRODUCTION - REVIEW

This project illustrates the interaction of multiple sprites simulating the effect of gravity in falling bodies. The interaction between the sprites is controlled by overlapping colors. In addition, the audio signal from the microphone randomly affects the position of the sprites.

PRESENTATION - VIDEO TUTORIALS

View and study the tutorial. Take notes of the new features introduced in this project. Stop and rewind if necessary. Use the print out of the main script as you take notes.
PRACTICE
Study the scripts and recreate the program. Reproduce the actions in the tutorial. Experiment with different falling speed for the blocks.

CLOSING - ASSIGNMENTS
Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

EXTENSIONS
1. Experiment with different types of blocks (size, color, rules for stopping.)
2. Experiment with blocks moving up and down, and bouncing off the walls.
3. Experiment by adding sound effects as the blocks move, fall, collide, etc.
INTRODUCTION - REVIEW

This project illustrates in great detail the process of a web construction with the combined and synchronized motion of two sprites. It uses broadcast signals to activate the different parts of the process. It is a good example of the use of broadcasting and modular scripts to illustrate long and complex processes.

PRESENTATION - VIDEO TUTORIALS

View and study the tutorial. Take notes of the new features introduced in this project. Stop and rewind if necessary. Use the print out of the main script as you take notes.
1. Experiment adding new segments with new broadcast signals.
2. Experiment adding a second spider with similar scripts.
3. Experiment by adding sound effects as the spider does the work.

Practice
Study the scripts and recreate the program. Reproduce the actions in the tutorial. Experiment executing the individual segments of the program.

Closing - Assignments
Review the main topics introduced in this lesson and discuss the assignments proposed in the Extensions section.

Extensions
1. Experiment adding new segments with new broadcast signals.
2. Experiment adding a second spider with similar scripts.
3. Experiment by adding sound effects as the spider does the work.
Scratch Courses

This guide and materials were prepared by Juan Carlos Olabe and other members of the LearnScratch Team.

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