

Unit 1 : Algorithms, Input, Movement, Events (Scratch)

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Introduction to Computer Science

Department of Curriculum and Instruction



Belleville Public Schools

Curriculum Guide

Introduction to Computer Science through Gaming and Design

Unit 1 - Algorithms, Input, Movement, Events (Scratch), Grades 9-12

Belleville Board of Education

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Unit Overview

- This unit introduces students to Scratch, a block-based programming language.
- A computer program responds to user input (clicking a sprite, pressing a key, etc.), processes information, and produces output (text, sound, images, etc.)
- Most computer programs use one or more algorithms.
- Scratch movements consist of changing x/y coordinates and turning/rotating at specific angles.

Enduring Understanding

- Scratch programs begin with an event block that represents an action performed by the user.
- Scratch programming has multiple scripts that can occur at the same time (parallel programming).
- Scratch programs control characters (sprites or objects) that can be made to move or talk.
- These sprites can be people, animals, or objects.
- When using the move block, the sprite moves in the direction that it is currently facing.

- When the x/y coordinates of a sprite change, or it is rotated a specific angle, the its orientation does not change.
- When a sprite rotates at a specific angle, the angle is relative to the position that it is currently facing.

Essential Questions

- When is it appropriate to use sequential programming, and when would it be better to use parallel programming?
- What are the advantages and disadvantages of using the sprites built into the Scratch program over using your own?
- How can the sprite begin in the same location every time the program runs?
- In what programs would it be necessary to turn or rotate?
- How do I know whether to make something part of the backdrop or as a single sprite?
- How does the 'move' block differ from the 'change x by' block?

Exit Skills

By the end of Unit 1, the student should be able to:

- Add a sprite to a Scratch program.
- Understand the difference between sequential and parallel programming, and when each of them should be used.
- Change the location of a sprite by assigning coordinates, moving the sprite a specific number of units, or changing a specific coordinate by a specific number of units.
- Use the turn blocks to turn a sprite in the correct directions, and to bring it to face in its original direction.
- Use event blocks to make a Scratch program interactive.
- Use appearance blocks to make a sprite talk, change color, or animate.

New Jersey Student Learning Standards (NJSL)

existing algorithms.

CS.9-12.8.1.12.AP.4	Design and iteratively develop computational artifacts for practical intent, personal expression, or to address a societal issue.
CS.9-12.8.1.12.AP.5	Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.
CS.9-12.8.1.12.CS.4	Develop guidelines that convey systematic troubleshooting strategies that others can use to identify and fix errors.
CS.9-12.8.1.12.DA.1	Create interactive data visualizations using software tools to help others better understand real world phenomena, including climate change.
CS.9-12.8.1.12.IC.1	Evaluate the ways computing impacts personal, ethical, social, economic, and cultural practices.
CS.9-12.8.2.12.EC.3	Synthesize data, analyze trends, and draw conclusions regarding the effect of a technology on the individual, culture, society, and environment and share this information with the appropriate audience.
CS.9-12.8.2.12.ED.1	Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.
CS.9-12.8.2.12.ED.4	Design a product or system that addresses a global problem and document decisions made based on research, constraints, trade-offs, and aesthetic and ethical considerations and share this information with an appropriate audience.

Interdisciplinary Connections

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.4	Model with mathematics.
MA.N-Q.A	Reason quantitatively and use units to solve problems.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.K-12.8	Look for and express regularity in repeated reasoning.
LA.W.11-12.2.D	Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic.
LA.W.11-12.6	Use technology, including the Internet, to produce, share, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.
LA.SL.11-12.4	Present information, findings and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience.
LA.L.11-12.6	Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.
SCI.HS-ESS2-4	Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.
SCI.HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Learning Objectives

- Design a simple animation with movement, talking, and color changes in scratch.
- Assess whether sequential programming, parallel programming, or both are necessary for a simple computer program.
- Distinguish between the results of the move block and the 'change x by' block.
- Make an interactive program by using key, mouse and sprite events.
- Determine what motions are necessary to bring a sprite back to its original position, facing the same way.
- Use backdrops to develop a slideshow about climate change.
- Use the Scratch pen tool to make rainbows and other LGBTQ Pride-related images and animations.

Action Verbs: Below are examples of action verbs associated with each level of the Revised Bloom's Taxonomy.

Remember	Understand	Apply	Analyze	Evaluate	Create
Choose	Classify	Choose	Categorize	Appraise	Combine
Describe	Defend	Dramatize	Classify	Judge	Compose
Define	Demonstrate	Explain	Compare	Criticize	Construct
Label	Distinguish	Generalize	Differentiate	Defend	Design
List	Explain	Judge	Distinguish	Compare	Develop
Locate	Express	Organize	Identify	Assess	Formulate
Match	Extend	Paint	Infer	Conclude	Hypothesize
Memorize	Give Examples	Prepare	Point out	Contrast	Invent
Name	Illustrate	Produce	Select	Critique	Make
Omit	Indicate	Select	Subdivide	Determine	Originate
Recite	Interrelate	Show	Survey	Grade	Organize
Select	Interpret	Sketch	Arrange	Justify	Plan
State	Infer	Solve	Breakdown	Measure	Produce
Count	Match	Use	Combine	Rank	Role Play
Draw	Paraphrase	Add	Detect	Rate	Drive
Outline	Represent	Calculate	Diagram	Support	Devise
Point	Restate	Change	Discriminate	Test	Generate
Quote	Rewrite	Classify	Illustrate		Integrate
Recall	Select	Complete	Outline		Prescribe
Recognize	Show	Compute	Point out		Propose
Repeat	Summarize	Discover	Separate		Reconstruct
Reproduce	Tell	Divide			Revise
	Translate	Examine			Rewrite
	Associate	Graph			Transform
	Compute	Interpolate			
	Convert	Manipulate			
	Discuss	Modify			
	Estimate	Operate			
	Extrapolate	Subtract			
	Generalize				
	Predict				



Suggested Activities & Best Practices

Best Practices:

- Short slideshow presentations for content, with questioning built into them.
- Use of multiple-choice questions to check for understanding.
- Repetition and review of concepts.
- Step by step visual instructions to make programs, especially at the beginning.
- Programming with blocks (where students can translate to native language).
- Google Classroom and Schoology organized around units of study.
- Immediate feedback for assignments.

Exemplars:

- Use questioning activities about motion and events where students get feedback after submission (Edulastic, Google Forms, quizizz.com).
- Use slideshow notes for instructions to make programs, with illustrations of the blocks in English and Spanish.
- Students view slideshow notes and questions on whiteboard.fi so that they can participate at their own pace.

Assessment Evidence - Checking for Understanding (CFU)

- edulastic.com - for practice exercises and assessment (Formative and Summative)
- whiteboard.fi/ - to present notes and questions (Formative)
- Jamboard - for group work (Formative)
- Google Forms - for Do Nows, Exit Tickets and Assessment activities (Formative)

Performance Task Example (Alternate):

Review the suggested articles and websites about climate change.

Make a brief slideshow with Scratch where each backdrop contains an illustration or facts.

You may choose any article or video that was not listed in the suggested articles/websites.

- Google Slides - for Notes and Drag and Drop activities (Formative)
- Google Classroom - for open-ended questions (Formative)
- quizizz.com - for content practice in a game format (Alternate)
- oncourse.com - for benchmarks (if applicable) (Summative/Benchmark)

- Admit Tickets
- Anticipation Guide
- Common Benchmarks
- Compare & Contrast
- Create a Multimedia Poster
- Define
- Describe
- Evaluate
- Evaluation rubrics
- Exit Tickets
- Explaining
- Illustration
- Journals
- Learning Center Activities

- Multimedia Reports
- Outline
- Question Stems
- Quizzes
- Self- assessments
- Study Guide
- Teacher Observation Checklist
- Think, Pair, Share
- Think, Write, Pair, Share
- Unit review/Test prep
- Unit tests
- Web-Based Assessments

Primary Resources & Materials

Materials:

- computer or Chromebook
- internet access

Resources:

- scratch.mit.edu
- 25 Scratch 3 Games for Kids
- How to Code: A Step-by-Step Guide to Computer Coding

Ancillary Resources

Scratch Coding

- <https://csfirst.withgoogle.com/>
- <https://inventwithscratch.com/book3/>
- <https://livebook.manning.com/book/hello-scratch/>
- <https://www.youtube.com/c/ScratchTeam/videos>
- <https://www.geeksforgeeks.org/introduction-to-scratch-programming-2/> (articles on Scratch)

LGBTQ:

- https://www.youtube.com/watch?v=NZ77_R1E7_g (rainbow art tutorial)
- <https://scratch.mit.edu/projects/624705779/editor/> (experimenting with the pen tool)

Climate Change:

- <https://climate.nasa.gov/>
- <https://www.epa.gov/climate-change>
- <https://education.nationalgeographic.org/resource/climate-change>

Technology Infusion

- use of the internet - for Scratch and articles about climate change
- edulastic.com - for practice exercises and assessment
- whiteboard.fi/ - to present notes and questions
- Jamboard - for group work
- Google Forms - for Do Nows, Exit Tickets and Assessment activities
- Google Slides - for Notes and Drag and Drop activities (Formative)
- Google Classroom - for open-ended questions (Formative)
- quizizz.com - for content practice in a game format (Alternate)
- scratch.com - for programs and games (Formative/Summative)
- oncourse.com - for benchmarks (if applicable) (Summative/Benchmark)

Alignment to 21st Century Skills & Technology

- English Language Arts;
- Mathematics;
- Science and Scientific Inquiry (Next Generation);
- World languages;
- Technology;
- Visual and Performing Arts.

WRK.9.2.12.CAP.2	Develop college and career readiness skills by participating in opportunities such as structured learning experiences, apprenticeships, and dual enrollment programs.
WRK.9.2.12.CAP.6	Identify transferable skills in career choices and design alternative career plans based on those skills.
TECH.9.4.12.DC.7	Evaluate the influence of digital communities on the nature, content and responsibilities of careers, and other aspects of society (e.g., 6.1.12.CivicsPD.16.a).
TECH.9.4.12.TL.1	Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).
TECH.9.4.12.GCA.1	Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why some solutions (e.g., political, economic, cultural) may work better than others (e.g., SL.11-12.1., HS-ETS1-1, HS-ETS1-2, HS-ETS1-4, 6.3.12.GeoGI.1, 7.1.IH.IPERS.6, 7.1.IL.IPERS.7, 8.2.12.ETW.3).
TECH.9.4.12.IML.5	Evaluate, synthesize, and apply information on climate change from various sources appropriately (e.g., 2.1.12.CHSS.6, S.IC.B.4, S.IC.B.6, 8.1.12.DA.1, 6.1.12.GeoHE.14.a, 7.1.AL.PRSNT.2).

21st Century Skills/Interdisciplinary Themes

Exemplars:

- Students express information clearly in their backdrops (backgrounds).
 - Students have the opportunity to connect key and mouse actions to results.
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- Communication and Collaboration
 - Creativity and Innovation
 - Critical thinking and Problem Solving
 - ICT (Information, Communications and Technology) Literacy
 - Information Literacy

- Life and Career Skills
- Media Literacy

21st Century Skills

Exemplars:

- Students read articles about climate change and show their findings in a Scratch program.
- Students have the opportunity to improve their graphic arts skills, which can be used in various industries.
- Students learn about their ethical and moral responsibilities as an internet user.

- Environmental Literacy
- Financial, Economic, Business and Entrepreneurial Literacy
- Global Awareness

Differentiation

Differentiations:

- Small group instruction
- Small group assignments
- Extra time to complete assignments
- Pairing oral instruction with visuals
- Repeat directions
- Use manipulatives
- Center-based instruction
- Study guides
- Teacher reads assessments allowed
- Scheduled breaks
- Rephrase written directions
- Multisensory approaches
- Additional time
- Preview vocabulary
- Preview content & concepts
- Behavior management plan
- Highlight text
- Student(s) work with assigned partner
- Visual presentation
- Assistive technology
- Auditory presentations
- Small group setting

Hi-Prep Differentiations:

- Alternative formative and summative assessments
- Games and tournaments

- Group investigations
- Guided Reading
- Independent research and projects
- Interest groups
- Learning contracts
- Leveled rubrics
- Multiple intelligence options
- Multiple texts
- Project-based learning
- Problem-based learning
- Stations/centers
- Tiered activities/assignments
- Tiered products
- Varying organizers for instructions

Lo-Prep Differentiations

- Choice of books or activities
- Exploration by interest
- Flexible grouping
- Goal setting with students
- Mini workshops to re-teach or extend skills
- Open-ended activities
- Think-Pair-Share
- Reading buddies
- Varied supplemental materials

Special Education Learning (IEP's & 504's)

Exemplars:

- Allow multiple-choice assignments, written assignments, and quizzes to be submitted late
- Convert article to PDF and highlight important ideas for students.

- printed copy of board work/notes provided
- additional time for skill mastery
- assistive technology
- behavior management plan
- Center-Based Instruction
- check work frequently for understanding

- computer or electronic device utilizes
- extended time on tests/ quizzes
- have student repeat directions to check for understanding
- highlighted text visual presentation
- modified assignment format
- modified test content
- modified test format
- modified test length
- multi-sensory presentation
- multiple test sessions
- preferential seating
- preview of content, concepts, and vocabulary
- Provide modifications as dictated in the student's IEP/504 plan
- reduced/shortened reading assignments
- Reduced/shortened written assignments
- secure attention before giving instruction/directions
- shortened assignments
- student working with an assigned partner
- teacher initiated weekly assignment sheet
- Use open book, study guides, test prototypes

English Language Learning (ELL)

Exemplars:

- Have all notes, activity directions, and assessment items translated into Spanish.
 - Place students next to Spanish-speaking peers.
 - Have individual interaction with students to make sure that they understand the content and expectations.
-
- teaching key aspects of a topic. Eliminate nonessential information
 - using videos, illustrations, pictures, and drawings to explain or clarify
 - allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning;
 - allowing students to correct errors (looking for understanding)
 - allowing the use of note cards or open-book during testing
 - decreasing the amount of work presented or required

- having peers take notes or providing a copy of the teacher's notes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using computer word processing spell check and grammar check features
- using true/false, matching, or fill in the blank tests in lieu of essay tests

At Risk

Exemplars:

- Minimize the amount of reading that needs to be done.
 - Make multi-colored notes, and provide drag/drop notes instead of requiring students to write the information down.
-
- allowing students to correct errors (looking for understanding)
 - teaching key aspects of a topic. Eliminate nonessential information
 - allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning
 - allowing students to select from given choices
 - allowing the use of note cards or open-book during testing
 - collaborating (general education teacher and specialist) to modify vocabulary, omit or modify items to reflect objectives for the student, eliminate sections of the test, and determine how the grade will be determined prior to giving the test.
 - decreasing the amount of work presented or required
 - having peers take notes or providing a copy of the teacher's notes
 - marking students' correct and acceptable work, not the mistakes
 - modifying tests to reflect selected objectives
 - providing study guides
 - reducing or omitting lengthy outside reading assignments
 - reducing the number of answer choices on a multiple choice test
 - tutoring by peers
 - using authentic assessments with real-life problem-solving
 - using true/false, matching, or fill in the blank tests in lieu of essay tests
 - using videos, illustrations, pictures, and drawings to explain or clarify

Talented and Gifted Learning (T&G)

- Have students do further research on climate change.
- Allow students to explore Scratch beyond the class content.

- Let students see their Scratch program converted to HTML and identify the parts of code.
- Above grade level placement option for qualified students
- Advanced problem-solving
- Allow students to work at a faster pace
- Cluster grouping
- Complete activities aligned with above grade level text using Benchmark results
- Create a plan to solve an issue presented in the class or in a text
- Debate issues with research to support arguments
- Flexible skill grouping within a class or across grade level for rigor
- Higher order, critical & creative thinking skills, and discovery
- Multi-disciplinary unit and/or project
- Teacher-selected instructional strategies that are focused to provide challenge, engagement, and growth opportunities
- Utilize exploratory connections to higher-grade concepts
- Utilize project-based learning for greater depth of knowledge

Sample Lesson

Unit Name: Climate Change and its Causes

NJSLS:

Interdisciplinary Connection: Science connection - Students will read articles about climate change and discuss/present their findings.

Statement of Objective: The student should be able to:

- Explain what climate change is.
- Identify the possible causes of climate change.
- Create an interactive slideshow with Scratch.

Anticipatory Set/Do Now: Ask students to brainstorm on what climate change is.

Learning Activity: Do Now.

Students read articles on climate change, and they can also use ones that they found.

Students discuss climate change in a large group.

Students design a Scratch animation/slideshow with their findings.

Student Assessment/CFU's: observation, questioning

Materials: Chromebooks/computers, Scratch (internet access), climate change articles

21st Century Themes and Skills: communication, critical thinking, information literacy

Differentiation/Modifications: try to translate articles to Spanish, have main ideas highlighted for at-risk/IEP students

Integration of Technology: use of the internet, use of computers/Chromebooks, use of Scratch software

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LA.SL.11-12.4	Present information, findings and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience.
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CS.9-12.8.2.12.ED.1	Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.
CS.9-12.8.2.12.ED.4	Design a product or system that addresses a global problem and document decisions made based on research, constraints, trade-offs, and aesthetic and ethical considerations and share this information with an appropriate audience.
TECH.9.4.12.IML.5	Evaluate, synthesize, and apply information on climate change from various sources appropriately (e.g., 2.1.12.CHSS.6, S.IC.B.4, S.IC.B.6, 8.1.12.DA.1, 6.1.12.GeoHE.14.a, 7.1.AL.PRSNT.2).
TECH.9.4.12.IML.6	Use various types of media to produce and store information on climate change for different purposes and audiences with sensitivity to cultural, gender, and age diversity (e.g., NJLSA.SL5).
TECH.9.4.12.IML.7	Develop an argument to support a claim regarding a current workplace or societal/ethical issue such as climate change (e.g., NJLSA.W1, 7.1.AL.PRSNT.4).