NEW MILFORD PUBLIC SCHOOLS
New Milford, Connecticut

Introduction to Programming

August 2011

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New Milford Board of Education

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New Milford's Mission Statement

The mission of the New Milford Public Schools, a collaborative partnership of students, educators, family and community, is to prepare each and every student to compete and excel in an ever-changing world, embrace challenges with vigor, respect and appreciate the worth of every human being, and contribute to society by providing effective instruction and dynamic curriculum, offering a wide range of valuable experiences, and inspiring students to pursue their dreams and aspirations.

Introduction to Programming

Students will author on-screen movies and games while learning and using object-oriented programming concepts. Alice, an educational program created by Carnegie Melon University, will provide introductory level programming (loops, variables, methods) through the use of a drag and drop interface and 3-D animation. Students should have successfully completed the Business Computer Applications course or have been given permission by the business department to take this course.

Common Core State Standards Key

W6	Writing Standards 6-12 (Production and Distribution of Writing)
W10	Writing Standards 6-12 (Range of Writing)
SL5	Speaking and Listening Standards 6-12 (Presentation of Knowledge and Ideas)
L2	Language Standards 6-12 (Conventions of Standard English)
RST2	Reading Standards for Literacy in Science and Technical Subjects 6-12 (Key Ideas and Details)
RST4	Reading Standards for Literacy in Science and Technical Subjects 6-12 (Craft and Structure)
WHST2	Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects 6-12 (Text Types and Purposes)

Pacing Guide

Unit #	Title	Weeks	Pages
1	What is Programming	1 week	7-9
2	Program Design and Implementation	1 week	10-12
3	Putting the Code Together	2 weeks	13-15
4	Object-Oriented, Event Driven Concepts	3 weeks	16-18
5	Interacting with the Program	1 week	19-21
6	Functions and Control Statements	1 week	22-24
7	Repetition: Definite and Control Loops	2 weeks	25-27
8	Repetition: Recursion	1 week	28-30
9	Lists and List Processing	1 week	31-33
10	Variables and Arrays	2 weeks	34-37

New Milford Public Schools

Committee Members: Daryl Daniels & Janice Perrone Unit 1: What Is Programming?	Course/Subject: Introduction to Programming Grade Levels: 10-12 # of Weeks: 1

Identify Desired Results

State Standards

- W6: Use technology, including the Internet to produce, publish, and update individual or shared writing products in response to ongoing feedback including new arguments or information.
- W10: Write routinely over extended time frames (times for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.
- RST4: Determine the meaning of symbols, key terms, and other domain specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.

Enduring Understandings Generalizations of desired understanding via essential questions (Students will understand that …)	**Essential Questions** Inquiry used to explore generalizations
• Programming is problem solving. • Computer programs are a sequence of instructions. • We apply concepts of programming in our everyday life. • Alice is not a programming language but a program that teaches the concepts of object oriented computer programming. • 3-D models movement has six degrees of freedom and is in accordance to its orientation in the world.	• How can learning to program affect the outlook one has on how to complete tasks and solve problems? • In what ways can a computer programmer's tasks be compared to other occupations such as architects and artists?

Expected Performances
What students should know and be able to do

Students will know the following:

- Programming can help students build their problem-solving skills and get them to think in different ways
- All computer programs are made from very simple ideas (sequential processing, conditional execution, looping, reductionism, and computing results)
- Objects can move in "six degrees of freedom" based on their orientation
- Distance is measured by object center points

- 3-D models have height, width, and depth
- In what ways is a 3-D model is similar to a blueprint for a house

Students will be able to do the following:

- Create a flowchart using a basic collection of symbols
- Add 3-D text and billboards to a program
- Add and place objects in a program
- Navigate the GUI (Graphic User Interface) of the Alice software
- Provide a short summary of each of the four video tutorials

Character Attributes

- Cooperation
- Integrity
- Responsibility

Technology Competencies

- Students design a search strategy, narrowing the search parameters as needed.
- Students create electronic portfolios to demonstrate technology skills and content area knowledge.

Develop Teaching and Learning Plan

Teaching Strategies:

- Teacher opens a discussion regarding 21st century skills and what it means to have high level problem solving skills.
- Teacher gives students a template of a word processed document via the network, Moodle, or Internet regarding why students should learn programming.
- Teacher presents the Alice interface and Alice solutions using a PowerPoint presentation.
- Teacher demonstrates the steps necessary to begin, set-up, and place objects in an Alice world.

Learning Activities:

- Students will research links between problem solving and computer programming.
- Students will share and discuss with neighbors the sites and information they found while researching links between programming and problems solving skills.
- Students will view four tutorial videos on the Alice software and will provide short written summaries of each.
- Students will work in groups of two to complete questions regarding the unit.
- Students will capture a screenshot of the Alice interface, insert the image into a presentation program, and use the program to identify the program parts to the interface.
- Students will create a world, research objects in the gallery, place their favorite three objects into a world, and manipulate their size, coordinates, subpart locations, and properties.
- Students will follow steps to add 3D text and a graphic billboard.
- Students will journalize/blog in their Google doc shared with the teacher.

Assessments

Performance Task Authentic application to evaluate student achievement of desired results designed according to GRASPS (one per marking period)	**Other Evidence** Application that is functional in a classroom context to evaluate student achievement of desired results
Goal: Journal of reflection for present and future use **Role**: Author **Audience**: Yourself – Teacher – Various assessors of future proposals **Situation**: You are about to begin research in the field of programming and computer science and understand reflection to be an enormous educational tool as well as an entity for future productivity (thesis, book). **Product**: A journal regarding personal thoughts, new knowledge, and connections to previous understandings **Standard for Success**: Daily entries that will assist student learning and possibly will be useful for future experiences	• Knowledge of the vocabulary through matching, fill in the blank, and/or a crossword • Answers to review questions completed without the use of resources • Answers to review questions using peers and other resources • Completion of two out of five exercises with varying point values to demonstrate knowledge of placement and manipulation of objects using the Alice software • Class discussion responses • Observation of student work habits, ability to use resources, designs, and inspirations • Comprehensiveness of lab results • Breadth and sincerity of student journal entries

Suggested Resources

- Dann, Wanda, Stephen Cooper, and Randy Pausch. Learning to Program with Alice. Upper Saddle River, NJ: Pearson Prentice Hall, 2009.
- Dickbaldwin.com
- Aliceprogramming.net
- Cs.duke.edu
- Bermuda.stanford.edu
- Google docs

New Milford Public Schools

Committee Members: Daryl Daniels & Janice Perrone Unit 2: Program Design and Implementation	Course/Subject: Introduction to Programming Grade Levels: 10-12 # of Weeks: 1

Identify Desired Results

State Standards

- RST4: Determine the meaning of symbols, key terms, and other domain specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.

Enduring Understandings Generalizations of desired understanding via essential questions (Students will understand that …)	**Essential Questions** Inquiry used to explore generalizations
• A scenario is a problem and can be displayed visually or textually. • Storyboards provide an algorithmic list describing actions. • A program consists of lines of code (methods) that specify the actions objects are to perform.	• What is a storyboard and how can they be incorporated into creating a computer program and everyday tasks? • How do programmers communicate their thoughts and remember what they have written? • How do we use algorithms everyday, and in what ways are then incorporated into programming?

Expected Performances
What students should know and be able to do

Students will know the following:

- A scenario provides answers to three questions
- A pseudo-code is an algorithm (list of actions) described in English-like phrases to solve a problem
- The four-step process that is used to create a computer program
- The two major differences between a visual storyboard and a textual storyboard
- A method is a segment of program code (instruction) which may include control statements that direct the computer how to carry out the instruction
- Methods contain arguments or information allowing a program to execute an action
- Nesting can be completed with various control statements
- Comments are not instructions; they help humans read the computer code, are ignored by the program, and are necessary to use in this class
- Translational motion is the changing of the coordinates of an object and is caused by the move method
- Rotational motion is caused by the turn and roll methods

- Joint connections in objects are known as pivot points
- Arguments guide the movement of objects

Students will be able to do the following:

- Write out the four-step process used to create a computer program
- Research and find free software on the Internet used to create storyboards
- Create and save a world (program), add objects, give objects instruction (methods), comment within a program, and test a program
- Synchronize the orientation of two objects
- Manipulate the vehicle property of an object to give it motion
- Explain the difference between translational and rotational motion and create an example
- Describe the six degrees of motion and show how movement is based on the orientation of the object in the world

Character Attribute

- Responsibility

Technology Competencies

- Students collaborate with peers and others to solve problems and to develop solutions using technology tools and resources.

Develop Teaching and Learning Plan

Teaching Strategies:

- Teacher leads a class discussion regarding how computer programs are used to solve problems and that setting a scenario or a problem to solve can be the first step in creating a program by giving a basis in which to choose objects and actions needed to solve the problem.
- Teacher discusses types of story boards and how story boards are used in programming.
- Teacher presents objectives using a PowerPoint presentation.
- Teacher demonstrates the movements of objects using the six degrees of movement and the orientation of an object in the world.
- Teacher demonstrates the use of object properties such as vehicle and color and speaks of and shows the importance of the arguments (duration, style, and asSeenBy).

Learning Activities:

- Students will follow steps to complete a lab.
- Students will import a .png file into their world to help set the scene.
- Students will sit in groups of 2-3 to create matching, fill-in-the-blank or a crossword using the vocabulary from unit two.
- Students will exchange their assignment results with other groups who will complete and provide feedback.
- Students will journalize/blog in their Google doc shared with the teacher.

Assessments	
Performance Task Authentic application to evaluate student achievement of desired results designed according to GRASPS (one per marking period)	**Other Evidence** Application that is functional in a classroom context to evaluate student achievement of desired results
	• End of unit questions • Two of six exercises with varying point values to demonstrate knowledge of story boards, methods, and other unit two material • Class discussion responses • Observation of student work habits, ability to use resources, designs, and inspirations • Completion of one of four projects for extra credit • Comprehensiveness of lab results • Breadth and sincerity of student journal entries

Suggested Resources

- Dann, Wanda, Stephen Cooper, and Randy Pausch. Learning to Program with Alice. Upper Saddle River, NJ: Pearson Prentice Hall, 2009.
- Dickbaldwin.com
- Aliceprogramming.net
- Cs.duke.edu

New Milford Public Schools

Committee Members: Daryl Daniels & Janice Perrone Unit 3: Putting the Code Together	Course/Subject: Introduction to Programming Grade Levels: 10-12 # of Weeks: 2

Identify Desired Results

State Standards

- RST4: Determine the meaning of symbols, key terms, and other domain specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.

Enduring Understandings Generalizations of desired understanding via essential questions (Students will understand that …)	**Essential Questions** Inquiry used to explore generalizations
• Instructions, control structures, functions, and expressions are used to create a program. • Functions return values to the program. • Expressions use arithmetic and relational operators to compute values and compare properties of objects. • Conditional execution control structures make decisions. • A Boolean value is used in object-oriented programming.	• How can functions (questions) be used in programming? • Why do programs need values returned to the instruction and in what ways can this be done?

Expected Performances
What students should know and be able to do

Students will know the following:

- Conditional and repetition control statements give the programmer control to determine how a program will run
- Expressions check the current condition in a program such as the distance between two objects
- Functions ask questions and return values. Many times functions will contain expressions
- Functions find proximity, size, spatial relation, point of view, and other details of objects
- Common types of values are: number, Boolean (True or False), string (words), and objects
- World built-in functions give access to relational operators (==, !=,>,>=,<,<=)
- A loop statement is a simple way to repeat an action
- How to manipulate camera controls and move the camera to a dummy object

Students will be able to do the following:

- Create a function using relational arithmetic operators to specify distance an object can move which will avoid a collision
- Code a conditional control statement allowing the program to make a decision based on a value returned by a function
- Generate a loop statement that will repeat 5 a block of code five times
- Drop a dummy camera in a scene and reposition the camera to view the scene from the dummy object's point of view
- Use the speed multiplier control while viewing an animation

Character Attributes

- Respect
- Responsibility

Technology Competencies

- Students use graphics, symbols, and text to represent ideas and information.

Develop Teaching and Learning Plan

Teaching Strategies:

- Teacher creates class discussion regarding why people ask questions and how this can be similar to functions and how true and false answers can help a program solve its problems.
- Teacher presents preloaded functions in Alice and demonstrates how these functions can be used and altered using relational and mathematical operators.
- Teacher demonstrates the use of control structures using flowchart symbols and camera controls including the use of dummy objects.
- Teacher presents unit three objectives using a PowerPoint presentation.

Learning Activities:

- Students will watch a Pixar animated movie to gain insight on the use of camera controls and dummy objects.
- Students will avoid collisions using expressions in their functions by following along and completing lab one.
- Students will practice their abilities with the camera controls and move the camera to a dummy object by following the tips and techniques instruction.
- Students will journalize/blog in their Google doc shared with the teacher.

Assessments

Performance Task Authentic application to evaluate student achievement of desired results designed according to GRASPS (one per marking period)	**Other Evidence** Application that is functional in a classroom context to evaluate student achievement of desired results
	• End-of-unit questions without the use of a textbook • Answers to unit questions using peers and a textbook as resources • Vocabulary quiz for units 1-3 • Class discussion responses • Completion of 2-3 of seven exercises with varying point values • Observation of student work habits, ability to use resources, designs, and inspirations • Comprehensiveness of lab results • Breadth and sincerity of student journal entries

Suggested Resources

- Dann, Wanda, Stephen Cooper, and Randy Pausch. Learning to Program with Alice. Upper Saddle River, NJ: Pearson Prentice Hall, 2009.
- Dickbaldwin.com
- Aliceprogramming.net
- Cs.duke.edu
- Pixar.com

New Milford Public Schools

Committee Members: Daryl Daniels & Janice Perrone Unit 4: Object-Oriented, Event Driven Programming Concepts	Course/Subject: Introduction to Programming Grade Levels: 10-12 # of Weeks: 3 Weeks

Identify Desired Results

State Standards

- RST2: Determine the central ideas or conclusions of a text, summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.
- RST4: Determine the meaning of symbols, key terms, and other domain specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.

Enduring Understandings Generalizations of desired understanding via essential questions (Students will understand that ...)	**Essential Questions** Inquiry used to explore generalizations
• Methods can be world or class level. • By acting as a place holder, parameters can communicate values from one method to another. • Parameters allow a method to be used several times. • Programming breaks down complex tasks into several simple actions.	• How are methods and parameters created and used in object-oriented programming languages? • How can the use of abstraction assist when creating a program? • What is and how can we use stepwise refinement in programming and other activities in which we engage?

Expected Performances
What students should know and be able to do

Students will know the following:

- A class defines a particular kind of object and Alice provides many predefined 3D models
- Objects are instances (copies) of the blueprint of a class
- Dividing a program into many methods allows the programmer to think abstractly about the project, connecting several methods as if they were one
- Parameters represent a placeholder in a method allowing the programmer to use the method multiple times with a variety of differing objects and values
- Methods that reference more than one object must be created as world level methods
- The design technique known as stepwise refinement breaks down tasks into several smaller tasks
- In order to get a method to execute, the program must invoke the method. This will be referred to as “calling” a method

- Class level methods can be saved out of one world to be used later in other worlds. This new class will inherit the attributes of the original plus any created by the programmer.
- Properties of objects can be used to create special effects.

Students will be able to do the following:

- Write a storyboard and use it to create a method
- Use the design technique, stepwise refinement, to break down a problem into several tasks (methods)
- Fashion a world level method to call multiple class level methods
- Comment in the code that explains the code to a non-programmer
- Change the default run setting to call or to invoke a method the student created
- Use one method for several actions by constructing it using various parameters with differing types
- Import and apply a sound file
- Save out a class to create a new class with enhanced methods
- Import the students' new class for use in a new world (program)
- Manipulate while in use the "opacity" and "isShowing" properties of an object
- Use an invisible object as a reference point for objects

Character Attributes

- Cooperation
- Responsibility

Technology Competencies

- Students evaluate accuracy and quality of online information.
- Students show respect for the work of others.

Develop Teaching and Learning Plan

Teaching Strategies:

- Teacher leads a discussion on the meaning and importance of instantiating, abstraction, and stepwise refinement in programming.
- Teacher shows MIT computer science video on abstraction.
- Teacher presents unit objectives using a PowerPoint presentation.
- Teacher demonstrates the creation and calling of a method.
- Teacher demonstrates the role parameters play in decreasing the amount of coding and increasing productivity.
- Teacher demonstrates the opacity and isShowing properties and develops a class discussion on how these properties may be used in our long-term-project.
- Teacher introduces the parameters of a long-term-project to be presented at the end of the course.

Learning Activities:

- Students will use a textbook to locate answers to the assignment.
- Students will work through a lab to practice creating and the use of different types of parameters.

- Students will import a sound file into their world to be used in the lab.
- Students will be set into groups of 2-3 and given the assignment to create matching, fill-in-the-blank, or a crossword using the unit vocabulary.
- Students will exchange their assignment results with other groups who will complete and provide feedback.
- Students will work through a lab three and save out a class with special methods to be imported into another world.
- Students will journalize/blog in their Google doc shared with the teacher.
- Student will begin their long-term-project.

Assessments

Performance Task Authentic application to evaluate student achievement of desired results designed according to GRASPS (one per marking period)	**Other Evidence** Application that is functional in a classroom context to evaluate student achievement of desired results
	• Answer questions without the use of a resource • Elaborate answers using peers and other resources • Participate in class discussions • Complete 2-3 exercises with varying point values • Extra credit project • Observation of student work habits, ability to use resources, designs, and inspirations • Comprehensiveness of lab results • Breadth and sincerity of student journal entries

Suggested Resources

- Dann, Wanda, Stephen Cooper, and Randy Pausch. Learning to Program with Alice. Upper Saddle River, NJ: Pearson Prentice Hall, 2009.
- Dickbaldwin.com
- Aliceprogramming.net
- Cs.duke.edu

New Milford Public Schools

Committee Members: Daryl Daniels & Janice Perrone Unit 5: User Interaction with the Program	Course/Subject: Introduction to Programming Grade Levels: 10-12 # of Weeks: 1 Week

Identify Desired Results

State Standards

- RST4: Determine the meaning of symbols, key terms, and other domain specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.

Enduring Understandings Generalizations of desired understanding via essential questions (Students will understand that …)	**Essential Questions** Inquiry used to explore generalizations
• An event is created by a user. • Event handling methods are called when a user interacts with the program. This is "event driven programming."	• How do programs realize user interactions? • What kinds of events are associated with the user and how do we determine when to use them? • How and when can we use Incremental development?

Expected Performances
What students should know and be able to do

Students will know the following:

- An event is something that happens
- User input (keyboard press, mouse click, joystick movement) are events that trigger a response by the program
- The program responds to an event by linking the event to an event handling method
- Parameters allow the use of one method to handle several related events
- Incremental development is a strategy that makes it easier to debug a program
- A method that organizes a call to other methods is referred to as driver.

Students will be able to do the following:

- Use incremental development to allow for easier debugging of their program
- Create several user initiated events using the event editor
- Write and use an event handling method
- Insert parameters into an event handling method to allow its use for several related events
- Create an object using the *hebuilder* or *shebuilder* people building options and use the special built-in methods for these objects

Character Attribute
• Responsibility
Technology Competencies
• Students create graphic organizers to develop and structure ideas.

Develop Teaching and Learning Plan

Teaching Strategies:

- Teacher leads a discussion on the interactive and movie style programs.
- Teacher shows interactive Alice programs that have been created by former students.
- Teacher presents unit objectives using a PowerPoint presentation.
- Teacher demonstrates event handling methods and how they are linked to their events.

Learning Activities:

- Students will discuss types of events associated with Alice and how these events could be utilized in their projects to make the program more interactive.
- Students will work through two labs to practice creating and using different types of parameters, events, and event handling methods.
- Students will complete step-by-step instructions to create their own object using the people builder from the object gallery.
- Students work on their long-term-projects.
- Students will journalize/blog in their Google doc shared with the teacher.

Assessments

Performance Task Authentic application to evaluate student achievement of desired results designed according to GRASPS (one per marking period)	**Other Evidence** Application that is functional in a classroom context to evaluate student achievement of desired results
	• Answer questions without the use of a resource • Elaborate answers using peers and other resources • Participate in class discussions • Complete 2-3 exercises with varying point values • Complete a project to show one's ability to use events and keyboard controls • Unit test • Breadth and sincerity of student journal entries • Observation of student work habits, ability to use resources, designs, and inspirations • Comprehensiveness of lab results

Suggested Resources

- Dann, Wanda, Stephen Cooper, and Randy Pausch. Learning to Program with Alice. Upper Saddle River, NJ: Pearson Prentice Hall, 2009.
- Dickbaldwin.com
- Aliceprogramming.net
- Cs.duke.edu

New Milford Public Schools

Committee Members: Daryl Daniels & Janice Perrone Unit 6: Functions and Control Statements	Course/Subject: Introduction to Programming Grade Levels: 10-12 # of Weeks: 1 Week

Identify Desired Results

State Standards

- RST4: Determine the meaning of symbols, key terms, and other domain specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.

Enduring Understandings Generalizations of desired understanding via essential questions (Students will understand that …)	**Essential Questions** Inquiry used to explore generalizations
• If statements return a value directing the program to run code. • Logical operators (and, or, not) are necessary to create function specificity. • Functions are used in If Statements. • Random numbers are used to secure information by encrypting data stored in files to be transmitted across the net. • Encryption is used on the Internet to keep information safe and dissuade cyber crime	• Do computer programs, like humans, communicate responses to themselves? How would this help solve problems? • How are If Statements used in programming? How can one apply this to one's daily life? • When might abstraction be used? • What can programs do with answers to true or false questions? • How is information stored in the cloud or transmitted across the Internet safely?

Expected Performances
What students should know and be able to do

Students will know the following:

- Functions allow the programmer to check conditions in the world while the program is running.
- Alice provides simple functions, but programmers need to create functions and call them much like methods.
- Functions, like methods, are examples of abstraction – collecting lots of small steps into one meaningful idea allowing the programmer to think on a higher plane.
- Using the argument, as seen by, will make objects act relative to other objects instead of themselves.
- When a function is created, it must be given a specific type; the major types are number, Boolean, and object.
- Functions return values, so every function must have a return statement.

- If/Else statements make decisions based on the value of a condition as a program is running.
- One use of an If/Else statement is to control when or how a method will be called.
- Logical operators are used in functions to create a more generalized or specific condition.
- The random number function is used in many ways, such as forecasting weather using a simulator.

Students will be able to do the following:

- Show how the orient to method changes the perspective of an object.
- Change an argument in a method to obtain desired results.
- Use methods to call number, Boolean, and object functions.
- Use an If/Else control statement to decide which object will run a method.
- Institute relational operators into functions.
- Organize functions to be more specific or generalized in range for making decisions.
- Use a function to check a condition based on a user event.
- Employ a random motion function to chance movement by an object.

Character Attributes

- Responsibility
- Integrity

Technology Competencies

- Students use multiple resources, tools, and technologies to solve complex problems and to present solutions.

Develop Teaching and Learning Plan

Teaching Strategies:

- Teacher shows video regarding cyber security and leads a discussion on the importance of encryption and why the United States Government and so many private corporations need good programmers.
- Teacher shows a video regarding cyber phishing and leads a discussion on why and how to keep our personal information to ourselves and out of the hands of others.
- Teacher presents unit objectives using a PowerPoint presentation.
- Teacher demonstrates the random number function and its use in a lab.
- Teacher places students into groups of 2-3 to discuss the difference between the use of functions using logical operators and nested If/Else control structures to obtain the same results.

Learning Activities:

- Students will work through labs practicing the use of arguments, If/Else control structures, relational operators, creating functions, and parameters.
- Students will work on their long-term-projects.
- Students will journalize/blog in their Google doc shared with the teacher.

Assessments

Performance Task Authentic application to evaluate student achievement of desired results designed according to GRASPS (one per marking period)	**Other Evidence** Application that is functional in a classroom context to evaluate student achievement of desired results
	• End-of-unit questions without the use of a resource • Elaborate answers using peers and other resources. • Class discussion responses • Exercises with varying point values • Observation of student work habits, ability to use resources, designs, and inspirations • Comprehensiveness of lab results • Breadth and sincerity of student journal entries

Suggested Resources

- Dann, Wanda, Stephen Cooper, and Randy Pausch. Learning to Program with Alice. Upper Saddle River, NJ: Pearson Prentice Hall, 2009.
- Dickbaldwin.com
- Aliceprogramming.net
- Cs.duke.edu

New Milford Public Schools

Committee Members: Daryl Daniels & Janice Perrone Unit 7: Repetition – Definite and Control Loops	Course/Subject: Introduction to Programming Grade Levels: 10-12 # of Weeks: 2 Weeks

Identify Desired Results

State Standards

- RST4: Determine the meaning of symbols, key terms, and other domain specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.
- WHST2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
  a. Introduce a topic and organize complex ideas, concepts, and information so that each new elopement builds on that which precedes it to create a unified whole; including formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.

Enduring Understandings Generalizations of desired understanding via essential questions (Students will understand that ...)	**Essential Questions** Inquiry used to explore generalizations
• There are several techniques to command that code be repeated during runtime. • Count loops repeat instruction a given number of times. • The count value, infinity, can be useful to a programmer. • Loop controls may enact other loops. • The While Statement is a conditional loop.	• Why are loops and While Statements used in programs? Why do we often purposely repeat tasks in our lives? • How are nested loops used daily in our lives?

Expected Performances
What students should know and be able to do

Students will know the following:

- If statements are used to control program execution
- The word count is used to describe the number of times a loop will be repeated
- The While Statement is used for repetition in a program when the count of repetition is unknown
- It is possible to have several loop statements within a loop statement, known as a nested loop
- Loops may use infinity as the count value allowing a section of code to loop until the program is stopped
- When using a While Statement, a condition must change to end the repetition
- The While Something Is True event links events to repeated actions

Students will be able to do the following:

- Use a loop to repeat a call to a method
- Nest a loop statement to repeat a section of code a determined amount of times dependent on the count of an outside loop
- Show how an infinite loop can be useful in a program
- Repeat instruction until a condition becomes true or false using a While Statement
- Illustrate how a condition must change in a While Statement to make the repletion end
- Incorporate a While Something Is True event into a world
- Use the constraint to point instruction to continuously adjust the position of an object according to the coordinates of another object

Character Attributes

- Perseverance
- Responsibility
- Honesty

Technology Competencies

- Students collaborate with peers and others to solve problems and to develop solutions using technology tools and resources.

Develop Teaching and Learning Plan

Teaching Strategies:

- Teacher leads discussion regarding the differences between definite and conditional loops.
- Teacher places students into groups of 2-3 to discuss how loops could be incorporated into their long-term-projects.
- Teacher presents unit learning objectives using a PowerPoint presentation.
- Teacher presents a more complex event by demonstrating the BDE (Beginning During End) event.

Learning Activities:

- Students will use resources to locate answers to unit questions.
- Students will complete a lab to practice the use of nested loops and techniques used to stop repetition by changing a condition.
- Students will take notes on the key concepts of the unit.
- Students will be organized into groups of 2-3 to share their notes and to develop what they feel are the three most important points of the unit. Results will be inserted into a wiki.
- Students will read and leave posts about the results.
- Students will work on their long-term-projects. They will then elect a spokesperson and share one of their ideas with the class.
- Students will journalize/blog in their Google doc shared with the teacher.

Assessments

Performance Task Authentic application to evaluate student achievement of desired results designed according to GRASPS (one per marking period)	**Other Evidence** Application that is functional in a classroom context to evaluate student achievement of desired results
Goal: Create a program as an animation movie or Interactive game using past and future knowledge gained from the course. The program will be used as part of your technological portfolio required for admittance to the school of your choice. **Role**: Programmer – future student **Audience**: Acceptance Board **Situation**: You have found your path for your future, and the first stop is _____ University where you will be majoring in Computer Science Engineering. Priority for admission to the school and the major you intend is a technological portfolio. The program you are about to begin is the main component to your technology portfolio. **Product**: Program for technology portfolio **Standard for Success**: Completion of working prototype of your image of a future product	• Answers to unit questions without the use of outside resources • Elaboration of answers using peers and other resources • Class discussion responses • Post to wiki • Completion of one to seven projects • Observation of student work habits, ability to use resources, designs, and inspirations • Comprehensiveness of lab results • Breadth and sincerity of student journal entries

Suggested Resources

- Dann, Wanda, Stephen Cooper, and Randy Pausch. Learning to Program with Alice. Upper Saddle River, NJ: Pearson Prentice Hall, 2009.
- Dickbaldwin.com
- Aliceprogramming.net
- Cs.duke.edu

New Milford Public Schools

Committee Members: Daryl Daniels Janice Perrone Unit 8: Repetition - Recursion	Course/Subject: Introduction to Programming/Business-Practical Arts Grade Levels: 10-12 # of Weeks: One Week

Identify Desired Results

State Standards

- RST4: Determine the meaning of symbols, key terms, and other domain specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.

Enduring Understandings Generalizations of desired understanding via essential questions (Students will understand that ...)	**Essential Questions** Inquiry used to explore generalizations
• Recursion is used as a form of repetition when the count cannot be determined. • Generally, If Statements are used to create recursion.	• Why is one kind of repetition better than another? • How can instruction be written to call itself? • How does the puzzle "Towers of Hanoi" incorporate recursion? • How does one get the method to stop calling itself?

Expected Performances
What students should know and be able to do

Students will know the following:

- Recursion is a programming technique where a method or function calls itself
- Recursion can be used to repeat instruction
- Recursion can depend on the ability to break a problem down into smaller and smaller sub-problems to get to the "base case"
- An example of recursion and stepwise refinement is the puzzle, "Towers of Hanoi"
- The texture or appearance of Alice objects can be altered by changing the object's texture
- World properties can be used to change the mood or appearance of a scene

Students will be able to do the following:

- Use recursion to repeat instruction until a condition is met
- Apply recursion with the use of the random motion function to produce an animated game and define a winner
- Apply recursion methods incorporating functions and parameters to select and move specific objects accurately
- Import and change the texture of an object to give the illusion of a different object
- Manipulate world properties to create a different atmosphere in a world

Character Attributes

- Responsibility
- Honesty

Technology Competencies

- Students collaborate with peers and others to solve problems and to develop solutions using technology tools and resources.

Develop Teaching and Learning Plan

Teaching Strategies:

- Teacher presents unit objectives using a PowerPoint presentation.
- Teacher reviews unit vocabulary using a Prezi presentation.
- Teacher reviews repetition structures and incorporates recursion as an alternative way to create repetition in a program.
- Teacher demonstrates the playing of the games to be in the unit.
- Teacher demonstrates how to import and change the texture of objects to give them the illusion of differing objects and how to change world properties to change the atmosphere of the setting.

Learning Activities:

- Students will break into groups of 2-3 and discuss how recursion could be used in their long-term-projects.
- Students will play games modeled by the teacher.
- Students will view the code and discuss how it worked in the game.
- Students work through labs practicing recursion while completing a horse racing game and the “Towers of Hanoi” puzzle.
- Students will work on their long-term-projects.
- Students will journalize/blog in their Google doc shared with the teacher.

Assessments

Performance Task Authentic application to evaluate student achievement of desired results designed according to GRASPS (one per marking period)	**Other Evidence** Application that is functional in a classroom context to evaluate student achievement of desired results
	• Answer end of unit questions without the use of a resource • Elaborate answers using peers and other resources • Class discussion responses • Group response to the three most important points in the unit • Observation of student work habits, ability to use resources, designs, and inspirations • Completion of exercises with varying point values • Comprehensiveness of lab results

	• Breadth and sincerity of student journal entries

Suggested Resources

- Dann, Wanda, Stephen Cooper, and Randy Pausch. Learning to Program with Alice. Upper Saddle River, NJ: Pearson Prentice Hall, 2009.
- Dickbaldwin.com
- Aliceprogramming.net
- Cs.duke.edu

New Milford Public Schools

Committee Members: Daryl Daniels & Janice Perrone Unit 9: List and List Processing	Course/Subject: Introduction to Programming Grade Levels: 10-12 # of Weeks: 1 Week

Identify Desired Results

State Standards

- RST4: Determine the meaning of symbols, key terms, and other domain specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.

Enduring Understandings Generalizations of desired understanding via essential questions (Students will understand that …)	**Essential Questions** Inquiry used to explore generalizations
• The organization of items eliminates time spent writing a program. • Programmers can organize their data structures used in our daily lives called a list. • Parameters are necessary when lists contain objects that are to perform an action.	• What kind of lists do we make? • How do lists assist one in organizing him/herself? • What variables does one use to structure a list? • Why would one change a list or complete tasks out of order?

Expected Performances
What students should know and be able to do

Students will know the following:

- An organizing structure in programming is known as a data structure
- One type of data structure is a list
- Programmers can use certain items in a list or iterate through a list repeating the same tasks or steps on each item
- How to create a list variable in the world properties tab
- List will likely be created at the world level because they normally contain multiple objects
- The “for all in order” and “For all together” control statements work with items in a list
- A list search is a common operation used in programming to iterate through a list of items to check each to see if it is what one is looking for
- Alice has an ability to remember positions of its components parts. Together, these positions give objects a pose.

Students will be able to do the following:

- Use the world properties to create and add objects to a list variable.

- Manage the “for all in order” control statement to generate an instruction to move one after the other using the same motion
- Manage the “for all together” control statement to generate an instruction to move all objects in a list simultaneously
- Incorporate a list search to randomly select an item in a list to complete a specific set of instructions. When the action is finished, another item from the list is selected to perform a specific set of instructions, etc.

Character Attributes

- Responsibility
- Honesty

Technology Competencies

- Students effectively use a variety of search engines, online databases, and search techniques.
- Students solve routine technical problems using online help and troubleshooting strategies.

Develop Teaching and Learning Plan

Teaching Strategies:

- Teacher presents unit objectives using a PowerPoint presentation.
- Teacher presents text images created in Wordle using the terms generated by student concept maps.
- Teacher develops a discussion regarding what we use lists for and how these lists are added to and subtracted from in our everyday lives.
- Teacher demonstrates steps taken to create a list variable with five items.
- Teacher points out the two control structures we have yet to use, their association with data structures, and the difference between the two.
- Teacher demonstrates a list search or how a program can be made to iterate through the elements of a list.

Learning Activities:

- Students will individually create concept maps with beginning terms given by the teacher.
- Students will work in groups of 2-3 to collaborate, recreate, and connect their concept maps.
- Students will work on their long-term-projects.
- Students will journalize/blog in their Google doc shared with the teacher.
- Students will work through a lab, creating a list and applying the “for all in order” and “for all together” control structures.

Assessments	
Performance Task Authentic application to evaluate student achievement of desired results designed according to GRASPS (one per marking period)	**Other Evidence** Application that is functional in a classroom context to evaluate student achievement of desired results
	• Answer end of unit questions without the use of other resources • Elaborate answers using peers and other resources • Class discussion responses • Student completion of concept maps • Completion of exercises with varying point values • Completion of projects for extra credit • Observation of student work habits, ability to use resources, designs, and inspirations • Comprehensiveness of lab results • Breadth and sincerity of student journal entries

Suggested Resources

- Dann, Wanda, Stephen Cooper, and Randy Pausch. Learning to Program with Alice. Upper Saddle River, NJ: Pearson Prentice Hall, 2009.
- Dickbaldwin.com
- Aliceprogramming.net
- Cs.duke.edu

New Milford Public Schools

Committee Members: Daryl Daniels & Janice Perrone Unit 10: Variables and Arrays	Course/Subject: Introduction to Programming Grade Levels: 10-12 # of Weeks: 2 Weeks

Identify Desired Results

State Standards

- SL5: Make strategic use of digital media (e.g., textual, graphical, audio, visual and interactive elements (in presentations to enhance understanding of findings, reasoning, evidence, and to add interest).
- L2: Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.
- RST4: Determine the meaning of symbols, key terms, and other domain specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.

Enduring Understandings Generalizations of desired understanding via essential questions (Students will understand that …)	**Essential Questions** Inquiry used to explore generalizations
• Bits of storage that hold onto a value while a program is running give programmers a functional tool for development. • Set instruction allows for these bits of storage or variables to be changed while the program is running. • Class level variables keep track of information about specific objects and can be changed. • Arrays like lists are data structures used to organize a collection of elements.	• Why would we want storage space to be mutable? • What kind of analogy can one use to explain an array? • How might we use a collection of elements (think about one's daily life), and what if one wants to use just one object that is in an array?

Expected Performances
What students should know and be able to do

Students will know the following:

- Mutable variables, better known as variables, are pieces of storage that hold a value while a program is running
- Mutable represents mutate or change, meaning the value of mutable variables can be changed during program execution
- The state of an object is a description of the object's property values
- Arrays allow the use of index variable to keep track of the position of each item in the array

- The position of an element (object) in an array is numbered beginning with zero
- To access a random index (object) in an array, random number function can be used
- Objects can be swapped in order of index by using the mathematical operation
- Permutation which creates a temporary location to move one object while another vacates in place and takes that of the first
- Alice allows the user to view properties of objects using the “watch” or the “print” instruction

Students will be able to do the following:

- Construct a timer that counts down using a variable to store the number of seconds and displaying this value as a string in a 3D text object
- Create an array of several objects
- Access and run code for individual objects in an array with the index variable
- Relocate elements in an array
- Create a watch using a variable to identify specific property values of an object
- Print instruction to indicate a property’s value using a variable

Character Attributes

- Responsibility
- Honesty
- Courage
- Compassion

Technology Competencies

- Students create electronic portfolios to demonstrate technology skills and content area knowledge.
- Students collaborate with peers and others to solve problems and to develop solutions using technology tools and resources.
- Students show respect for the work of others.
- Students develop and implement a project using online resources.
- Students use multiple resources, tools, and technologies to solve complex problems and to present solutions.

Develop Teaching and Learning Plan

Teaching Strategies:

- Teacher presents unit objectives using a PowerPoint presentation.
- Teacher shows MIT computer science professor video regarding variables.
- Teacher shows completed version of a timer using variables.
- Teacher demonstrates the completion of a timer using variables.
- Teacher discusses the difference between the data structure lists and arrays.
- Teacher discusses the purpose of Alice’s array visualization.
- Teacher demonstrates the creation of an array and the mathematical operation known as permutation.
- Teacher leads discussion regarding presentation skills.
- Teacher leads discussion regarding communication skills.

Learning Activities:

- Students work on their long-term-projects.
- Students journalize/blog in their Google doc shared with the teacher.
- Students work through two labs.
- Students create a watch and a print instruction.
- Students view videos regarding presentations skills.
- Students view videos regarding communications.
- Students respond to written questions regarding presentation skills.
- Students respond to written questions regarding communication skills.

Assessments

Performance Task Authentic application to evaluate student achievement of desired results designed according to GRASPS (one per marking period)	**Other Evidence** Application that is functional in a classroom context to evaluate student achievement of desired results
Goal: To be successful in your pursuit of a grant in order to continue your work on the program you have been developing. **Role**: Programmer, entrepreneur, and participant **Audience**: Board of Directors of the KClarke International Technology Firm. **Situation**: A local entrepreneur/CEO/president of a well-known technology company has a grant that he awards every year to an individual with an idea for a new product, company, or service in the line of technology. You have an idea, design, the knowledge to complete, and almost a working prototype of a piece of software that is deserving of this grant. **Product and Performance**: The presentation of your product and a persuasive letter written to the Director of Publicity for KClarke International meant to get you into the finals **Standard for Success**: Rubric for presentation and persuasive writing	• Answer unit questions without the use of any resources • Elaborate answers using peers and other resources • Class discussion responses • Responses to video • Student completion of concept maps • Observation of student work habits, ability to use resources, designs, and inspirations • Comprehensiveness of lab results • Breadth and sincerity of student journal entries • Completion of exercises with varying point values • Completion of project(s) for extra credit • Student self-evaluation of long-term-project • Peer evaluation of long-term-project • Teacher evaluation of long-term-project • Teacher evaluation of student presentation of long-term-project.

Suggested Resources

- Dann, Wanda, Stephen Cooper, and Randy Pausch. Learning to Program with Alice. Upper Saddle River, NJ: Pearson Prentice Hall, 2009.Dickbaldwin.com
- Dickbaldwin.com
- Aliceprogramming.net
- Cs.duke.edu