

Roanoke Valley Governor’s School for Science and Technology
Python Coding
Competency List, 2023-2024

Python Coding is an introduction to object-oriented software development using the Python programming language. The major themes include: decision making structures, functions, various looping structures, objects, and graphical user interface design. Each student will design, develop, and test a computer application as part of a research project. This research project will include a research paper and a class presentation.

This course is taught using best practices in gifted education. Each competency is aligned with Hockett’s five principles of gifted education:

Gifted Education Principles:

(Hockett, J.A. (2009) “Curriculum for Highly Able Learners That Conforms to General Education and Gifted Education Quality Indicators.” *Journal of Education for the Gifted*. Vol. 32, No. 3, p. 394-440)

1. High-quality curriculum for gifted learners uses a conceptual approach to organize or explore content that is discipline based and integrative.
2. High-quality curriculum for gifted learners pursues advanced levels of understanding beyond the general education curriculum through abstraction, depth, breadth, and complexity.
3. High-quality curriculum for gifted learners asks students to use processes and materials that approximate those of an expert, disciplinarian, or practicing professional.
4. High-quality curriculum for gifted learners emphasizes problems, products, and performances that are true to life, and outcomes that are transformational.
5. High-quality curriculum for gifted learners is flexible enough to accommodate self-directed learning fueled by student interests, adjustments for pacing, and variety.

COMPETENCY I

Students will learn the basics of working with the Python programming language

Enabling Objectives:

1. Create and compile simple programs
2. Use simple math operation to perform calculations
3. Declare and utilize variables of different types
4. Display output using concatenation
5. Insert helpful comments into code

COMPETENCY 2

Students will develop programs that make use of conditional statements and loops

Enabling Objectives:

1. Use different types of inequalities
2. Construct decisions structures
3. Utilize for loops and while loops

COMPETENCY 3

Students will develop programs that use lists

Enabling Objectives:

1. Name and define lists
2. Access elements in a list
3. Modify elements in a list
4. Add items to a list
5. Sort a list
6. Remove an item form a list
7. Make use of tuples

COMPETENCY 4

Students will create and use functions in programs

Enabling Objectives:

1. Learn what functions are and how they are programmed
2. Write program that make use of functions

COMPETENCY 5

Students will develop programs that use recursion

Enabling Objectives:

1. Learn what recursion is and how it is programmed
2. Examine the role of recursion with functions

COMPETENCY 6

Students will be write classes in Python

Enabling Objectives:

1. Learn about the concept of classes in programs
2. Learn how to define classes
3. Learn about class attributes and behavior
4. Learn about the keyword self
5. Learn how to write and use constructors
6. Create the getters and setters for a class

COMPETENCY 7

Students will create computer programs in Python that contain graphics

Enabling Objectives:

1. Work with colors
2. Create a Graphical User Interface
3. Program Lines, Points, Circles, Rectangles, Ovals, and Polygons
4. Insert text into a program
5. Insert images into a program

COMPETENCY 8

Gather and analyze relevant background information.

Enabling Objectives:

1. Identify relevant library, database, and web resources for specific research problems.
2. Effectively use relevant library, database, and web resources for research and information.
 - a. Use search engines to find information on various topics.
 - b. Explain strengths and weaknesses of various search engines.
 - c. Demonstrate proficiency using advanced search engines.
 - d. Properly use and cite information taken from a variety of sources.
 - e. Recognize and distinguish between different types of websites.
3. Use professionals in industry or academia as resource people for research project information as necessary and document these contacts.
4. Obtain the most relevant articles and books found in library and internet searches.
5. Analyze articles and books for information relevant to a specific research problem and take notes from them, using proper documentation.

COMPETENCY 9

Complete the steps necessary to design, implement, and analyze a complex experiment or engineering goal.

Enabling Objectives:

1. Design a complex experiment which includes repeated measures over time or subjects, one or more independent variables, and correlation of variables.
2. Successfully meet the established time lines for the performance objectives.
3. Maintain a current, organized, and accurate laboratory logbook.
4. Construct appropriate data tables and graphs for data derived from your experiment.
5. Apply concepts of inferential and descriptive statistics to support conclusions from the experiment.
6. Participate in the RVGS Project Forum and, if appropriate, in the district, regional, state, and international science fairs, and the annual VJAS meeting.

COMPETENCY 10

Create a project display board or poster to depict the work done on the project for use at Project Forum.

Enabling Objectives:

1. All content should be easily read on the board and free of spelling and grammatical errors.
2. All components of the board should be clearly labeled with appropriate headings (Introduction, Purpose, etc.).
3. All graphs and photographs should be clearly labeled with appropriate annotations and citations when necessary.
4. The name of the student should **not** appear anywhere on the display.
5. Size specifications for project display board (ISEF regulations) are followed.

COMPETENCY 11

Construct a formal research paper following the format approved by the Virginia Junior Academy of Science.

Enabling Objectives:

1. Create an integrated document.
2. Use information obtained from research to write an introduction and bibliography for the paper.
3. Write a methods and materials section that outlines the procedures followed in the project.
4. Write a results section that includes appropriate tables, graphs, statistics and diagrams. Include a narrative of the results obtained.
5. Analyze the results obtained in the discussion and conclusions section. Relate the project's work to already published work.
6. Submit the research paper, in VJAS format, to the elective teacher.

COMPETENCY 12

Create a presentation of the research project and present the research to the class.

Enabling Objectives:

1. Incorporate text and graphics into a presentation.
2. Add appropriate transitions between elements in a slide and transitions between slides.
3. Effectively use color for backgrounds and text to add visual value.
4. Organize key points so that the presentation flows logically and is easy to follow.
5. Use proper enunciation, pronunciation, pace, and volume in communicating the research to one's peers.