Unit 4- Arrays

Content Area: **CTE**
Course(s): **Sample Course**
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Arrays

Department of Curriculum and Instruction

Belleville Public Schools

Curriculum Guide

AP Computer Science A - Java

Arrays

Belleville Board of Education

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Board Approved:

Unit Overview

A: STUDENTS WILL KNOW:

- How to create and initialize 1D and 2D arrays
- How to sort and search an array
- How to call to various built-in methods when working with Arrays to perform tasks
- How to begin programming with objects in mind

B: STUDENTS WILL UNDERSTAND THAT:

- Array objects allow for more structure in collecting data
- Arrays can store a list of statements or information from which a program can choose to execute

C: STUDENTS WILL BE ABLE TO:

- Select and implement appropriate built in array methods to perform key tasks when writing programs
- Create arrays to increase the versatility and complexity when writing programs
- Understand the elements of an array and how to create, modify or refer to them
- Understand how one and two-dimensional arrays function and when to integrate them accordingly when writing programs
- Program with an object-oriented paradigm in mind through the creation of user-defined methods

- Understand the existence and scope of variables and how they are affected through various actions throughout the structure of a program
- Use various commands from the math library in the context of a program

- Examine and debug compiler and runtime errors within programs

Enduring Understanding

EU1: There is a difference between Array or ArrayList and the appropriate use of each.

EU2: Each searching and sorting method is efficient in different scenarios.

EU3: An Array of objects can be useful and is used everyday (business, sports, etc.)

Essential Questions

EQ1: How do Array or ArrayList differ?

EQ2: When is each searching and sorting method the most effective?

EQ3: What is the purpose of storing objects within an Array or ArrayList?

Exit Skills

K1: How to properly declare and store information to an Array or ArrayList.

K2: How to traverse an Array or ArrayList (one and two dimensional).

K3: How to search and sort an Array or ArrayList.

New Jersey Student Learning Standards (NJSLS-S)

CS.9-12.8.1.12.CS.1	Describe ways in which integrated systems hide underlying implementation details to simplify user experiences.
CS.9-12.8.1.12.CS.2	Model interactions between application software, system software, and hardware.
CS.9-12.8.1.12.CS.3	Compare the functions of application software, system software, and hardware.
CS.9-12.8.1.12.NI.2	Evaluate security measures to address various common security threats.
CS.9-12.8.1.12.NI.3	Explain how the needs of users and the sensitivity of data determine the level of security implemented.
CS.9-12.8.1.12.NI.4	Explain how decisions on methods to protect data are influenced by whether the data is at rest, in transit, or in use.
CS.9-12.CS	Computing Systems
TECH.9.4.12.CI	Creativity and Innovation
TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.CI.2	Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).
TECH.9.4.12.CI.3	Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).
TECH.9.4.12.CT	Critical Thinking and Problem-solving
TECH.9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).
TECH.9.4.12.CT.2	Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).
TECH.9.4.12.CT.3	Enlist input from a variety of stakeholders (e.g., community members, experts in the field) to design a service learning activity that addresses a local or global issue (e.g., environmental justice).
	Innovative ideas or innovation can lead to career opportunities.

Collaboration with individuals with diverse experiences can aid in the problem-solving process, particularly for global issues where diverse solutions are needed.

With a growth mindset, failure is an important part of success.

The usability, dependability, security, and accessibility of devices within integrated systems are important considerations in their design as they evolve.

A computing system involves interaction among the user, hardware, application software, and system software.

Interdisciplinary Connections

LA.RL.11-12	Reading Literature
	Key Ideas and Details
LA.RL.11-12.1	Cite strong and thorough textual evidence and make relevant connections to support analysis of what the text says explicitly as well as inferences drawn from the text, including determining where the text leaves matters uncertain.
LA.RL.11-12.2	Determine two or more themes or central ideas of a text and analyze their development over the course of the text, including how they interact and build on one another to produce a complex account; provide an objective summary of the text.
LA.RL.11-12.3	Analyze the impact of the author's choices regarding how to develop and relate elements of a story or drama (e.g., where a story is set, how the action is ordered, how the characters are introduced and developed).
LA.L.11-12.4	Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grades 11–12 reading and content, choosing flexibly from a range of strategies.
LA.L.11-12.4.A	Use context (e.g., the overall meaning of a sentence, paragraph, or text; a word's position or function in a sentence) as a clue to the meaning of a word or phrase.
LA.L.11-12.4.B	Identify and correctly use patterns of word changes that indicate different meanings or parts of speech (e.g., conceive, conception, conceivable).
LA.L.11-12.4.C	Consult general and specialized reference materials (e.g., dictionaries, glossaries, thesauruses), both print and digital, to find the pronunciation of a word or determine or clarify its precise meaning, its part of speech, its etymology, or its standard usage.
LA.L.11-12.4.D	Verify the preliminary determination of the meaning of a word or phrase (e.g., by checking the inferred meaning in context or in a dictionary).

Learning Objectives

STUDENTS WILL BE ABLE TO:

- Select and implement appropriate built in array methods to perform key tasks when writing programs
- Create arrays to increase the versatility and complexity when writing programs
- Understand the elements of an array and how to create, modify or refer to them
- Understand how one and two-dimensional arrays function and when to integrate them accordingly when writing programs
- Program with an object-oriented paradigm in mind through the creation of user-defined methods
- Understand the existence and scope of variables and how they are affected through various actions throughout the structure of a program
- Use various commands from the math library in the context of a program

- Examine and debug compiler and runtime errors within programs

Suggested Activities & Best Practices

- Complete various written checkpoint exercises that focus on the explanation and description of computer hardware and Java basics.
- Develop a visual representation of the communication processes within a computer using appropriate terminology.
- Properly document a program using correct indentation, spacing, and comment style.
- Debug programs and determine the types of errors in the program.
- Create programs based on programming exercises that display various types of output using string and numeric expressions.
- -Student will be able to identify famous African Americans in the field of computer programming
- Students will also be introduced to the basic energy efficient models in the programming field to help reduce global warming

https://chortle.ccsu.edu/Java5/Notes/chap29/chap29quizRev2.html

Assessment Evidence - Checking for Understanding (CFU)

- Complete various written checkpoint exercises that focus on the explanation and description of computer basics.
- Develop a visual representation of the communication processes within a computer using appropriate ter **Assessment**
- Properly document a program using correct indentation, spacing, and comment style.
- Debug programs and determine the types of errors in the program.
- Create programs based on programming exercises that display various types of output using string and n **Benchmark Assessment**
- Unit 1 Assessment

Formative Evaluations:	**Summati**
Formative Assessment with polling codeIt! Nows Quizzes Long Programs (LP)/Lab Work Components of AP approved Lab #1	Unit 1 Te Assessme

Sequence and Scope

Day	***Topic/Activities***	
1	- **What is an Array?** - codeIt! Now	
2	- Continue **What is an Array?** - codeIt! Now	
3	- *LP #1*	

4	- *LP #1* - *Quiz Question #1*	
5	- **Array Elements and Loops** - codeIt! Now	
6	- Continue **Array Elements and Loops** - codeIt! Now	
7	- *LP #2*	
8	- *LP #2* - *Quiz Question #2*	Pr
9	- **Scope & Object-Oriented Programming** - codeIt! Now	I
10	- *LP #3*	I
11	- *LP #3*	
12	- *Quiz Question #3* - **2D Arrays**	I
13	- Continue **2D Arrays** - codeIt! Now	I
14	- Finish Long Programs/codeIt! Nows - CW-HW #35	
15	- Unit 4 Assessment	
16 - 19	- **MAGPIE LAB**	

- Admit Tickets
- Anticipation Guide
- Common Benchmarks
- Compare & Contrast
- Create a Multimedia Poster
- DBQ's
- Define
- Describe
- Evaluate
- Evaluation rubrics
- Exit Tickets
- Explaining
- Fist- to-Five or Thumb-Ometer
- Illustration
- Journals
- KWL Chart

- Learning Center Activities
- Multimedia Reports
- Newspaper Headline
- Outline
- Question Stems
- Quickwrite
- Quizzes
- Red Light, Green Light
- Self- assessments
- Socratic Seminar
- Study Guide
- Surveys
- Teacher Observation Checklist
- Think, Pair, Share
- Think, Write, Pair, Share
- Top 10 List
- Unit review/Test prep
- Unit tests
- Web-Based Assessments
- Written Reports

Primary Resources & Materials

NJCTL Curriculum

Curriculum development Resources/Instructional Materials/Equipment Needed Teacher Resources: • www.gliffy.com • Eclipse IDE • MS DOS Prompt • Computers

Ancillary Resources

Java Resources

- Java Review for the AP CS A Exam - Great review site with lots of practice questions.
- Aplus Compter Science Exam Review Material -Slide, Free Response, and more!
- Introduction to Java - a textbook for a first course in computer science for the next generation of scientists and engineers
- Guru-99 Introduction Java Material
- Oracles (owners of Java) has their own tutorials
- Dick Baldwin - ACC - Introduction and Advanced Java Material
- Introduction to Computer Science using Java - by Bradley Kjell

- Thinking in Java
- Blue Pelican Java
- Java Coding Bat - Lots of good practice problems
- Code Academy - No Java but good practice.

https://chortle.ccsu.edu/CS151/cs151java.html

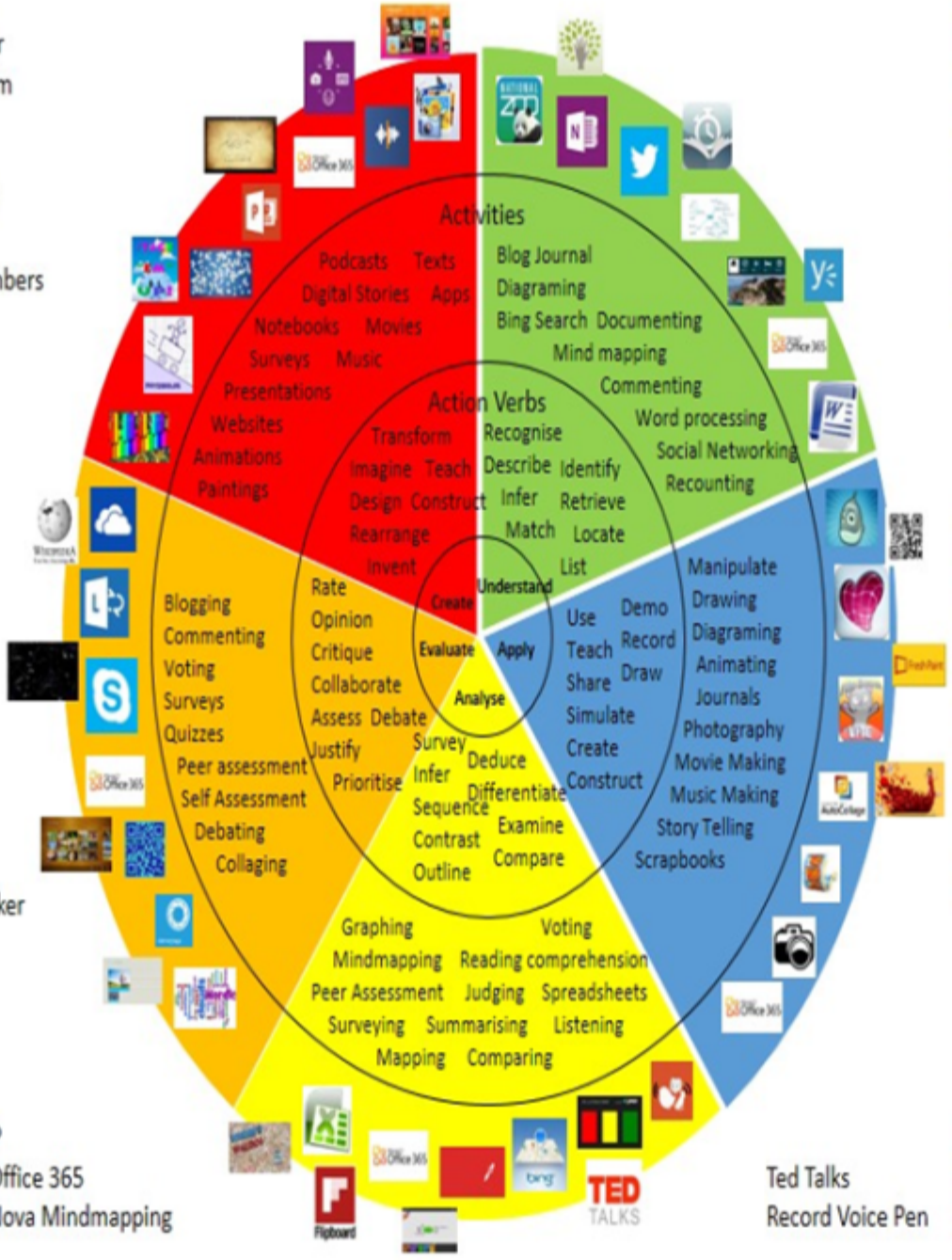
Technology Infusion

Technology Infusion and/or strategies include chromebooks online materials google/powerpoint slides

Win 8.1 Apps/Tools Pedagogy Wheel

Podcasts
Photostory 3
Kid Story Builder
Music Maker Jam
Paint A Story
Office 365
MS PowerPoint
Stack 'Em Up
NqSquared Numbers
Physamajig
Xylophone 8

Wikipedia
Skydrive
Lync
SkyMap
Skype
Office 365
Puzzle Touch
Easy QR
Memorylage
Life Moments
Word Cloud Maker



Where's Waldo?
MS Excel Office 365
Flipboard Nova Mindmapping

Ted Talks
Record Voice Pen

Originally taken from http://www.coetail.com/vzimmer/files/2013/02/iPadagogy-Wheel.001.jpg
And adapted for Windows 8.1 devices by Charlotte Beckhurst @CharBeckhurst

Alignment to 21st Century Skills & Technology

WRK.9.2.12.CAP	Career Awareness and Planning
WRK.9.2.12.CAP.1	Analyze unemployment rates for workers with different levels of education and how the economic, social, and political conditions of a time period are affected by a recession.
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.3	Investigate how continuing education contributes to one's career and personal growth.
TECH.9.4.12.CI	Creativity and Innovation
TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.CI.2	Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).
TECH.9.4.12.CI.3	Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).
TECH.9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).
TECH.9.4.12.CT.2	Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).
TECH.9.4.12.CT.3	Enlist input from a variety of stakeholders (e.g., community members, experts in the field) to design a service learning activity that addresses a local or global issue (e.g., environmental justice).
	Innovative ideas or innovation can lead to career opportunities.
	With a growth mindset, failure is an important part of success.

21st Century Skills/Interdisciplinary Themes

21st century themes: The unit will integrate the 21st Century Life and career standard 9.1 strands A-D. These strands include: critical thinking and problem solving, creativity and innovation, collaboration, teamwork, and leadership, and cross cultural understanding and interpersonal communication

21st Century/Interdisciplinary Themes that will be incorporated into this unit.

- 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

21st Century Skills that will be incorporated into this unit.

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

Differentiation

• Technology Resources • Teacher Tutoring • Peer Tutoring • Cooperative Learning Groups • Differentiated Instruction • Follow all IEP Modifications/504 Plan

One technique I use is when I teach a new Computer Science skill.
For example, let's say we are working with Scratch and I note that there is a student that knows more code beyond the 'basic' lesson I presented. That is a student that is already ready for a more difficult challenge. Now if you teach multiple grade levels (as I do) sometimes I just ask the student if they would like to try a challenge that I'm giving the next grade using the same tool.

Another technique I've used is having 'task cards' on hand. For example, if we are doing a lesson on loops and there is clearly a pair of students in the class that has mastered the skill, I then have task cards with challenges ready on different skills or a harder looping concept.

I've also used task cards in another way. I've printed twelve task cards and told the students they could move on once they have mastered one card. I've made it clear that some students would get further then other in the course of one period and that I was ok with that. Stressing the non-competition part is important when trying to use this differentiation technique because otherwise they just try to get through as many cards as possible without actually understanding what they are doing.

Differentiations:

- Small group instruction
- Small group assignments
- Extra time to complete assignments
- Pairing oral instruction with visuals

- Repeat directions
- Use manipulatives
- Center-based instruction
- Token economy
- Study guides
- Teacher reads assessments allowed
- Scheduled breaks
- Rephrase written directions
- Multisensory approaches
- Additional time
- Preview vocabulary
- Preview content & concepts
- Story guides
- Behavior management plan
- Highlight text
- Student(s) work with assigned partner
- Visual presentation
- Assistive technology
- Auditory presentations
- Large print edition
- Dictation to scribe
- Small group setting

Hi-Prep Differentiations:

- Alternative formative and summative assessments
- Choice boards
- Games and tournaments
- Group investigations
- Guided Reading
- Independent research and projects
- Interest groups
- Learning contracts
- Leveled rubrics
- Literature circles
- Multiple intelligence options
- Multiple texts
- Personal agendas
- Project-based learning
- Problem-based learning
- Stations/centers
- Think-Tac-Toes
- Tiered activities/assignments
- Tiered products
- Varying organizers for instructions

Lo-Prep Differentiations

- Choice of books or activities
- Cubing activities
- Exploration by interest
- Flexible grouping
- Goal setting with students

- Jigsaw
- Mini workshops to re-teach or extend skills
- Open-ended activities
- Think-Pair-Share
- Reading buddies
- Varied journal prompts
- Varied supplemental materials

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

Adapting existing materials, simplifying or supplementing materials

- **Adjust** the method of presentation or content.
- **Develop** supplemental material.
- **Tape-record** directions for the material.
- **Provide** alternatives for responding to questions.
- **Rewrite** brief sections to lower the reading level.
- **Outline** the material for the student before reading a selection.
- **Reduce** the number of pages or items on a page to be completed by thestudent.
- **Break** tasks into smaller subtasks.
- **Provide** additional practice to ensure mastery.
- **Substitute** a similar, less complex task for a particular assignment.
- **Develop** simple study guides to complement required materials.

Special Education Learning adaptations that will be employed in the unit, using the ones identified below.

- 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)

Exemplar:

Advance Notes

One way that we can make things easier is by preparing and distributing advance notes. This gives ELLs the opportunity to preview what will be taught and, in turn, aids in comprehension of the material.

Extended Time

It's obvious that response time for ELLs is significantly greater than it is for students proficient in English. Given this, we know that ELLs may require more time to process and communicate information on assessments. To support your students in this area, give them additional time on tests to help. Extra time will also help to decrease anxiety, which often has a significant impact on test performance.

- teaching key aspects of a topic. Eliminate nonessential information
- using videos, illustrations, pictures, and drawings to explain or clarif
- 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 workpresented 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:

Hands-On

As much as possible, think in concrete terms and provide hands-on tasks. This means a child doing math may require a calculator or counters. The child may need to tape record comprehension activities instead of writing them. A child may have to listen to a story being read instead of reading it him/herself. Always ask yourself if the child should have an alternate mode or additional learning materials to address the learning activity.

Seating

Where are your students at risk? Hopefully, they are near a helping peer or with quick access to the teacher. Those with hearing or sight issues need to be close to the instruction which often means near the front.

Parental Involvement

Planned intervention means involving parents. Do you have an agenda in place that goes home each night? Are parents also signing the agenda or contracts you have set up? How are you involving parental support at home for homework or additional follow up?

Please identify Intervention Strategies that will be employed in the unit, using the ones identified below.

- 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 workpresented 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)

Exemplar:

In order to modify standard curricula for high-ability students, Lois Roets (1993) proposed three options:

- **lesson modifications,**
- **assignment modifications, and**
- **scheduling modifications.**

Lessons can be modified through acceleration or enrichment of content. Assignments can be modified through reducing regular classroom work or providing alternate assignments. Scheduling options include providing opportunities for high-ability students to work individually through independent study, shared learning in homogeneous groupings with peers of similar ability and interests, and participation in heterogeneous groupings of mixed-ability students.

Lesson Modifications

One way teachers can extend or enrich the content they present is by asking open-ended questions. Such questions stimulate higher order thinking skills and give students opportunities to consider and express personal opinions. Open-ended questions require thinking skills such as comparison, synthesis, insight, judgment, hypothesis, conjecture, and assimilation. Such questions can also increase student awareness of current events. Open-ended questions should be included in both class discussions and assignments. They can also be used as stimulation for the opening or conclusion of a lesson.

http://www.grandviewlibrary.org/CurriculumAdaptations/General_Gifted.pdf

Grouping • Group gifted students with other gifted students or higher-level learners. • Refrain from grouping gifted students with lower-level students for remediation.

Talented and Gifted adaptations that will be employed in this unit, using the ones identified below.

- 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 blog or social media page about their unit
- 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

https://runestone.academy/runestone/books/published/csawesome/Unit6-Arrays/toctree.html?highlight=arrays

Unit 4 Lesson Plan – Arrays

Teacher:	Corey Woodring	Time Frame:	20 days (Includes MagPie Lab)
Grade:	9-12	School:	Belleville High School
Subject:	AP Computer Science A		

AP Essential Knowledge

(Referenced from CollegeBoard AP CS A Course & Exam Description)

- Represent collections of related primitive or object reference data using onedimensional (1D) array objects.
- The use of array objects allows multiple related items to be represented using a single variable.
- The size of an array is established at the time of creation and cannot be changed.
- Arrays can store either primitive data or object reference data.
- When an array is created using the keyword new, all of its elements are initialized with a specific value based on the type of elements:

a. Elements of type int are initialized to 0

b. Elements of type double are initialized to 0.0

c. Elements of type boolean are initialized to false

d. Elements of a reference type are initialized to the reference value null. No objects are automatically created

- Initializer lists can be used to create and initialize arrays.
- Square brackets ([ ]) are used to access and modify an element in a 1D array using an index.
- The valid index values for an array are 0 through one less than the number of elements in the array, inclusive. Using an index value outside of this range will result in an ArrayIndexOutOfBoundsException being thrown.
- Traverse the elements in a 1D array.
- Iteration statements can be used to access all the elements in an array. This is called traversing the array.
- Traversing an array with an indexed for loop or while loop requires elements to be accessed using their indices.
- Since the indices for an array start at 0 and end at the number of elements − 1, "off by one" errors are easy to make when traversing an array, resulting in an ArrayIndexOutOfBoundsException being thrown.
- Traverse the elements in a 1D array object using an enhanced for loop.
- An enhanced for loop header includes a variable, referred to as the enhanced for loop variable.
- For each iteration of the enhanced for loop, the enhanced for loop variable is assigned a copy of an element without using its index.
- Assigning a new value to the enhanced for loop variable does not change the value stored in the array.
- Program code written using an enhanced for loop to traverse and access elements in an array can be rewritten using an indexed for loop or a while loop.
- Represent collections of related primitive or object reference data using two-dimensional (2D) array objects.
- 2D arrays are stored as arrays of arrays. Therefore, the way 2D arrays are created and indexed is similar to 1D array objects.

    a. EXCLUSION STATEMENT—2D array objects that are not rectangular are outside the scope of the course and AP Exam.

- For the purposes of the exam, when accessing the element at arr[first][second], the first index is used for rows, the second index is used for columns.

- The initializer list used to create and initialize a 2D array consists of initializer lists that represent 1D arrays.
- The square brackets [row][col] are used to access and modify an element in a 2D array.
- “Row-major order” refers to an ordering of 2D array elements where traversal occurs across each row, while “column-major order” traversal occurs down each column.
- For 2D array objects: Traverse using nested for loops and Traverse using nested enhanced for loops.
- Nested iteration statements are used to traverse and access all elements in a 2D array. Since 2D arrays are stored as arrays of arrays, the way 2D arrays are traversed using for loops and enhanced for loops is similar to 1D array objects.
- Nested iteration statements can be written to traverse the 2D array in “row-major order” or “column-major order.”
- The outer loop of a nested enhanced for loop used to traverse a 2D array traverses the rows. Therefore, the enhanced for loop variable must be the type of each row, which is a 1D array. The inner loop traverses a single row. Therefore, the inner enhanced for loop variable must be the same type as the elements stored in the 1D array
- For algorithms in the context of a particular specification that requires the use of array traversals: Identify standard algorithms, Modify standard algorithms, Develop an algorithm.
- There are standard algorithms that utilize array traversals to:
    a. Determine a minimum or maximum value
    b. Compute a sum, average, or mode
    c. Determine if at least one element has a particular property
    d. Determine if all elements have a particular property
    e. Access all consecutive pairs of elements
    f. Determine the presence or absence of duplicate elements
    g. Determine the number of elements meeting specific criteria
- There are standard array algorithms that utilize traversals to:
    a. Shift or rotate elements left or right
    b. Reverse the order of the elements
- For algorithms in the context of a particular specification that requires the use of 2D array traversals Identify standard algorithms, Modify standard algorithms, Develop an algorithm.
- When applying sequential/linear search algorithms to 2D arrays, each row must be accessed then sequential/linear search applied to each row of a 2D array.

- All standard 1D array algorithms can be applied to 2D array objects.

Enduring Understanding & CTP Skills

(Referenced from CollegeBoard AP CS A Course & Exam Description)
VAR-2 To manage large amounts of data or complex relationships in data, programmers write code that groups the data together into a single data structure without creating individual variables for each value.

CON-2 Programmers incorporate iteration and selection into code as a way of providing instructions for the computer to process each of the many possible input values.

1.B Determine code that would be used to complete code segments.

1.C Determine code that would be used to interact with completed program code.

2.B Determine the result or output based on statement execution order in a code segment without method calls (other than output).

2.D Determine the number of times a code segment will execute.

3.D Write program code to create, traverse, and manipulate elements in 1D array or ArrayList objects.

3.E Write program code to create, traverse, and manipulate elements in 2D array objects.

4.A Use test-cases to find errors or validate results.

4.B Identify errors in program code.

4.C Determine if two or more code segments yield equivalent results.

5.A Describe the behavior of a given segment of program code.

5.B Explain why a code segment will not compile or work as intended.

5.D Describe the initial conditions that must be met for a program segment to work as intended or described.

Essential Questions

(Some referenced from CollegeBoard AP CS A Course & Exam Description)

(What questions will the student be able to answer as a result of the instruction?)

1. How can arrays provide selection and searching options within a program?

2. programming?

3. How can an array be declared, created, and initialized?
4. Why might you want to use a 2D array to store the spaces on a game board or the pixels in a picture, rather than a 1D array or ArrayList?
5. Why does the order in which elements are accessed in 2D array traversal matter in some situations?
6. How can knowing standard algorithms be useful when solving new problems?

Assessment

(What is acceptable evidence to show desired results (rubrics, exam, etc.)? Attach Copy

- Complete various written checkpoint exercises that focus on the explanation and description of computer hardware and Java basics.
- Develop a visual representation of the communication processes within a computer using appropriate terminology.
- Properly document a program using correct indentation, spacing, and comment style.
- Debug programs and determine the types of errors in the program.
- Create programs based on programming exercises that display various types of output using string and numeric expressions.
- Unit 4 Assessment

Formative Evaluations:

Formative Assessment with polling

codeIt! Nows

Quizzes

AP Classroom AP Computer Science A Topic Questions

Long Programs (LP)/Lab Work

Components of AP approved Lab #1

Summative Evaluations:

Unit 4 Test/ReTest

AP Classroom AP Computer Science A Progress Checks

Sequence and Scope

Day	Topic/Activities	CW-HW
1	• What is an Array? • codeIt! Now	Problems #1 - 2
2	• Continue What is an Array? • codeIt! Now	LP# 1

3	• LP #1	LP# 1
4	• LP #1 • Quiz Question #1	Problems #9 - 10
5	• Array Elements and Loops • codeIt! Now	Problems #3 - 5
6	• Continue Array Elements and Loops • codeIt! Now	Problems #6 – 7, AP Classroom topic questions 6.1 – 6.2
7	• LP #2	LP #2
8	• LP #2 • Quiz Question #2	Problems #11 – 12, 25
9	• Scope & Object-Oriented Programming • codeIt! Now	Problems #21 - 24
10	• LP #3	Problems #26 - 30
11	• LP #3	Problems #30- 34, AP Classroom topic questions 5.1, 5.6. 5.8
12	• Quiz Question #3 • 2D Arrays	Problems #13 - 16
13	• Continue 2D Arrays • codeIt! Now	Problems #17 – 20, AP Classroom topic questions 8.1 – 8.2, 6.3 – 6.4
14	• Finish Long Programs/codeIt! Nows • CW-HW #35	Study for Test
15	• Unit 4 Assessment	None
MAGPIE LAB: Instructions & Activities		
16	1. Intro to Natural Language Processing 2. Objectives: Magpie Lab 3. Complete Activity 1 using the provided	Work on Magpie Lab

	Activity 1 worksheet. 1. Pseudocode	
17	2. Import and run without analyzing the Magpie2 and Magpie2Runner classes into the IDE. 3. Complete Activity 2 worksheet	Work on Magpie Lab
18	1. Activity 3 Directions 2. Complete Activity 3 worksheet handwritten	Work on Magpie Lab
19	1. Activity 4 Directions 2. Import Magpie3 into the IDE and trace the method calls using the code in Magpie3 and the Activity 4 worksheet.	Work on Magpie Lab
20	1. Activity 5 Directions 2. Use Activity 5 to rewrite the transform() method based on the keywords found. 3. Include the handwritten code into Magpie3, run, and execute the code 4. Complete the challenge exercises.	Work on Magpie Lab

CS.9-12.8.1.12.CS.1	Describe ways in which integrated systems hide underlying implementation details to simplify user experiences.
CS.9-12.8.1.12.CS.2	Model interactions between application software, system software, and hardware.
CS.9-12.8.1.12.CS.3	Compare the functions of application software, system software, and hardware.
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.CS	Computing Systems
TECH.9.4.12.CI	Creativity and Innovation
TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.CI.2	Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).
TECH.9.4.12.CI.3	Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).
TECH.9.4.12.CT	Critical Thinking and Problem-solving

TECH.9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).
TECH.9.4.12.CT.2	Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).
TECH.9.4.12.CT.3	Enlist input from a variety of stakeholders (e.g., community members, experts in the field) to design a service learning activity that addresses a local or global issue (e.g., environmental justice).
TECH.9.4.12.CT.4	Participate in online strategy and planning sessions for course-based, school-based, or other project and determine the strategies that contribute to effective outcomes.
	Network connectivity and computing capability extended to objects, sensors and everyday items not normally considered computers allows these devices to generate, exchange, and consume data with minimal human intervention. Technologies such as Artificial Intelligence (AI) and blockchain can help minimize the effect of climate change.
	The usability, dependability, security, and accessibility of devices within integrated systems are important considerations in their design as they evolve.
	Innovative ideas or innovation can lead to career opportunities.
	Successful troubleshooting of complex problems involves multiple approaches including research, analysis, reflection, interaction with peers, and drawing on past experiences.
	With a growth mindset, failure is an important part of success.