# Unit 4  Arrays Copied from: AP Computer Science A, Copied on: 02/21/22

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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)

| CSTA Standards |
| --- |
| ***Computing Systems*** <br> • 3A-CS-03 Develop guidelines that convey systematic troubleshooting strategies that others can use to id <br> • 3B-CS-02 Illustrate ways computing systems implement logic, input, and output through hardware comp |
| ***Networks and the Internet*** <br> • 3B-NI-03 Describe the issues that impact network functionality (e.g., bandwidth, load, delay, topology). |
| ***Data and Analysis*** <br> • 3A-DA-09 Translate between different bit representations of real-world phenomena, such as characters, <br> • 3A-DA-12 Create computational models that represent the relationships among different elements of dat phenomenon or process. <br> • 3B-DA-06 Select data collection tools and techniques to generate data sets that support a claim or comm <br> • 3B-DA-07 Evaluate the ability of models and simulations to test and support the refinement of hypothes |
| ***Algorithms and Programming*** <br> • 3A-AP-13 Create prototypes that use algorithms to solve computational problems by leveraging prior stu personal interests. <br> • 3A-AP-15 Justify the selection of specific control structures when tradeoffs involve implementation, rea |

performance, and explain the benefits and drawbacks of choices made.

- 3A-AP-17 Decompose problems into smaller components through systematic analysis, using constructs s modules, and/or objects.
- 3A-AP-19 Systematically design and develop programs for broad audiences by incorporating feedback f
- 3A-AP-21 Evaluate and refine computational artifacts to make them more usable and accessible.
- 3A-AP-22 Design and develop computational artifacts working in team roles using collaborative tools.
- 3B-AP-10 Use and adapt classic algorithms to solve computational problems.
- 3B-AP-11 Evaluate algorithms in terms of their efficiency, correctness, and clarity.
- 3B-AP-14 Construct solutions to problems using student-created components, such as procedures, modu
- 3B-AP-20 Use version control systems, integrated development environments (IDEs), and collaborative documentation) in a group software project.
- 3B-AP-21 Develop and use a series of test cases to verify that a program performs according to its desig
- 3B-AP-22 Modify an existing program to add additional functionality and discuss intended and unintend breaking other functionality).
- 3B-AP-23 Evaluate key qualities of a program through a process such as a code review.

***Impacts of Computing***

- 3A-IC-25 Test and refine computational artifacts to reduce bias and equity deficits.
- 3A-IC-26 Demonstrate ways a given algorithm applies to problems across disciplines.
- 3A-IC-29 Explain the privacy concerns related to the collection and generation of data through automate be evident to users.

8.2.12.B.1 Research and analyze the impact of the design constraints (specifications and limits) for a product or technology driven by a cultural, social, economic or political need and publish for review. 8.2.12.B.3 Analyze ethical and unethical practices around intellectual property rights as influenced by human wants and/or needs. 8.2.12.C.1 Explain how open source technologies follow the design process. 8.2.12.E.1 Demonstrate an understanding of the problem-solving capacity of computers in our world. 8.2.12.E.2 Analyze the relationships between internal and external computer components. 8.2.12.E.3 Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games). 8.2.12.E.4 Use appropriate terms in conversation (e.g., troubleshooting, peripherals, diagnostic software, GUI, abstraction, variables, data types and 8.2.12.B.1 Research and analyze the impact of the design constraints (specifications and limits) for a product or technology driven by a cultural, social, economic or political need and publish for review. 8.2.12.B.3 Analyze ethical and unethical practices around intellectual property rights as influenced by human wants and/or needs. 8.2.12.C.1 Explain how open source technologies follow the design process. 8.2.12.E.1 Demonstrate an understanding of the problemsolving capacity of computers in our world. 8.2.12.E.2 Analyze the relationships between internal and external computer components. 8.2.12.E.3 Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games). 8.2.12.E.4 Use appropriate terms in conditional statements). Support Standards (CSTA): CPP.L2.04 Demonstrate an understanding of algorithms and their practical application CPP.L3A.05 Use Application Programming Interfaces (APIs) and libraries to facilitate programming solutions. CPP.L3A.08 Explain the program execution process. CRP Standards: 9.2.12.C.3 Identify transferable career skills and design alternate career plans. 9.2.12.C.5 Research career opportunities in the United States and abroad that require knowledge of world languages and diverse cultures. 9.2.12.C.6 Investigate

entrepreneurship opportunities as options for career planning and identify the knowledge, skills, abilities, and resources required for owning and managing a business. 9.2.12.C.7 Examine the professional, legal, and ethical responsibilities for both employers and employees in the global workplace. CRP2 Apply appropriate academic and technical skills. CRP10 Plan education and career paths aligned to personal goals. CRP11 Use technology to enhance conditional statements).

CPP.L2.04 Demonstrate an understanding of algorithms and their practical application CPP.L3A.05 Use Application Programming Interfaces (APIs) and libraries to facilitate programming solutions. CPP.L3A.08 Explain the program execution process. CRP Standards: 9.2.12.C.3 Identify transferable career skills and design alternate career plans. 9.2.12.C.5 Research career opportunities in the United States and abroad that require knowledge of world languages and diverse cultures. 9.2.12.C.6 Investigate entrepreneurship opportunities as options for career planning and identify the knowledge, skills, abilities, and resources required for owning and managing a business. 9.2.12.C.7 Examine the professional, legal, and ethical responsibilities for both employers and employees in the global workplace. CRP2 Apply appropriate academic and technical skills. CRP10 Plan education and career paths aligned to personal goals. CRP11 Use technology to enhance.

| | |
|---|---|
| LA.RH.11-12.7 | Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, qualitatively, as well as in words) in order to address a question or solve a problem. |
| LA.RST.11-12.1 | Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions. |
| TECH.8.1.12 | Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge. |
| TECH.8.1.12.A.CS1 | Understand and use technology systems. |
| TECH.8.1.12.F | Critical thinking, problem solving, and decision making: Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources. |
| TECH.8.2.12.E | Computational Thinking: Programming: Computational thinking builds and enhances problem solving, allowing students to move beyond using knowledge to creating knowledge. |
| | Functions |

## Interdisciplinary Connections

Primary interdisciplinary connections:

Infused within the unit are connections to the 2009 NJCCCS for Language Arts Literacy and Business, Science and Technology.

Critical reading, writing, and mathematical modeling skills are promoted within the problem solving process and as a means to explain solutions.

## 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.

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<br><br>codeIt! Nows<br><br>Quizzes<br><br>Long Programs (LP)/Lab Work<br><br>Components of AP approved Lab #1 | Unit 1 Te<br>Assessme |

**Sequence and Scope**

| *Day* | *Topic/Activities* | |
|---|---|---|
| 1 | - **What is an Array?**<br>- codeIt! Now | |
| 2 | - Continue **What is an Array?**<br>- codeIt! Now | |

| | | |
|---|---|---|
| | | |
| 3 | - *LP #1* | |
| 4 | - *LP #1*<br>- *Quiz Question #1* | |
| 5 | - **Array Elements and Loops**<br>- codeIt! Now | |
| 6 | - Continue **Array Elements and Loops**<br>- codeIt! Now | |
| 7 | - *LP #2* | |
| 8 | - *LP #2*<br>- *Quiz Question #2* | Pr |
| 9 | - **Scope & Object-Oriented Programming**<br>- codeIt! Now | |
| 10 | - *LP #3* | |
| 11 | - *LP #3* | |
| 12 | - *Quiz Question #3*<br>- **2D Arrays** | |
| 13 | - Continue **2D Arrays**<br>- codeIt! Now | |
| 14 | - Finish Long Programs/codeIt! Nows<br>- 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

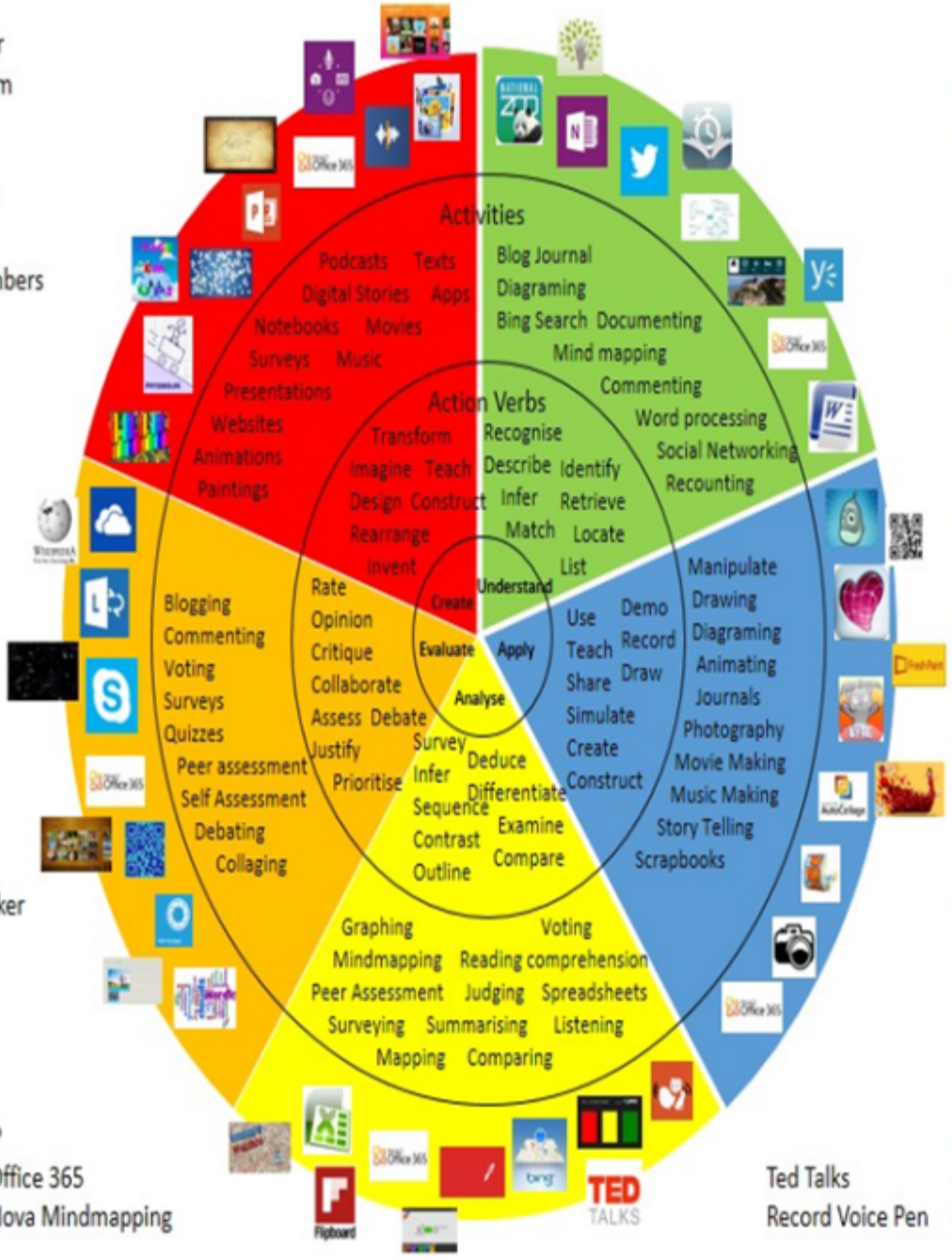
## Technology Infusion

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
Flipboard
Office 365
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

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

Mastery and infusion of 21st Century Skills & Technology and their Alignment to the core content areas is essential to student learning. The core content areas include:

- English Language Arts;
- Mathematics;
- Science and Scientific Inquiry (Next Generation);
- Social Studies, including American History, World History, Geography, Government and Civics, and Economics;
- World languages;
- Technology;
- Visual and Performing Arts.

## 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
- multiple test sessions
- multi-sensory presentation
- 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

Using the template below, please develop a **Sample Lesson** for the first unit only.

Unit Name:

NJSLS:

Interdisciplinary Connection:

Statement of Objective:

Anticipatory Set/Do Now:

Learning Activity:

Student Assessment/CFU's:

Materials:

21st Century Themes and Skills:

Differentiation/Modifications:

Integration of Technology: