PATERSON PUBLIC SCHOOLS

Preparing All Children for College and Career

Department of College and Career Readiness

Mobile CSP

Curriculum

5.0 Credits

Unit Three

Mobile CSP

Course Description

The Mobile Computer Science Principles course provides an introduction to the basic principles of computer science (CS) from the perspective of mobile computing, including programming in App Inventor, a graphical programming language for Android mobile devices. The lessons and materials used by students incorporate programming while also integrating all other AP CSP big ideas: creativity, abstraction, data and information, algorithms, the internet and global impact. The curriculum engages students and supports the development of problem solving skills honing in on the computational thinking practices as indicated in the AP CSP curriculum framework. Students learn to create socially useful computational artifacts using App Inventor as well as connect computing and learn about abstracting as they develop and analyze their programs. The curriculum also emphasizes communication and collaboration in a project-based approach and classroom environment. This course involves a strong writing component. Students will maintain a portfolio of their work, which will include several performance tasks in the areas of programming and the impact of computing technology.

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Pacing Guide		
Unit	**Topic**	**Suggested Timing**
Unit 1	Getting Started	approx. 8 weeks
Unit 2	Exploring Computing	approx. 8 weeks
Unit 3	Algorithms and Procedural Abstractions	approx. 7 weeks
Unit 4	Using and Analyzing Data & Information	approx. 12 weeks

Educational Technology Standards

8.1.12.A.1, 8.1.12.A.2, 8.1.12.A.3, 8.1.12.B.2, 8.1.12.C.1, 8.1.12.D.1, 8.1.12.D.4, 8.1.12.D.5,8.1.12.E.2, 8.1.12.F.1

- **Technology Operations and Concepts**
  - Create a personal digital portfolio which reflects personal and academic interests, achievements, and career aspirations by using a variety of digital tools and resources.
  - Produce and edit a multi-page digital document for a commercial or professional audience and present it to peers and/or professionals in that related area for review.
  - Collaborate in online courses, learning communities, social networks or virtual worlds to discuss a resolution to a problem or issue.
- **Creativity and Innovation**
  - Apply previous content knowledge by creating and piloting a digital learning game or tutorial.
- **Communication and Collaboration**
  - Develop an innovative solution to a real world problem or issue in collaboration with peers and experts, and present ideas for feedback through social media or in an online community.
- **Digital Citizenship**
  - Demonstrate appropriate application of copyright, fair use and/or Creative Commons to an original work.
  - Research and understand the positive and negative impact of one's digital footprint.
  - Analyze the capabilities and limitations of current and emerging technology resources and assess their potential to address personal, social, lifelong learning, and career needs.
- **Research and Information Literacy**
  - Research and evaluate the impact on society of the unethical use of digital tools and present your research to peers.
- **Critical Thinking, Problem Solving, Decision Making**
  - Evaluate the strengths and limitations of emerging technologies and their impact on educational, career, personal and or social needs.

Career Ready Practices

Career Ready Practices describe the career-ready skills that all educators in all content areas should seek to develop in their students. They are practices that have been linked to increase college, career, and life success. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

CRP1. **Act as a responsible and contributing citizen and employee**
Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.

CRP2. Apply appropriate academic and technical skills.
Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.

CRP4. Communicate clearly and effectively and with reason.
Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.

CRP5. Consider the environmental, social and economic impacts of decisions.
Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies, understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social

Career Ready Practices

condition, the environment and the profitability of the organization.

CRP6. Demonstrate creativity and innovation.
Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.

CRP7. Employ valid and reliable research strategies.
Career-ready individuals are discerning in accepting and using new information to make decisions, change practices or inform strategies. They use reliable research process to search for new information. They evaluate the validity of sources when considering the use and adoption of external information or practices in their workplace situation.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.

CRP9. Model integrity, ethical leadership and effective management.
Career-ready individuals consistently act in ways that align personal and community-held ideals and principles while employing strategies to positively influence others in the workplace. They have a clear understanding of integrity and act on this understanding in every decision. They use a variety of means to positively impact the directions and actions of a team or organization, and they apply insights into human behavior to change others' action, attitudes and/or beliefs. They recognize the near-term and long-term effects that management's actions and attitudes can have on productivity, morals and organizational culture.

CRP11. Use technology to enhance productivity.

Career Ready Practices

Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks-personal and organizational-of technology applications, and they take actions to prevent or mitigate these risks.

CRP12. Work productively in teams while using cultural global competence.
Career-ready individuals positively contribute to every team, whether formal or informal. They apply an awareness of cultural difference to avoid barriers to productive and positive interaction. They find ways to increase the engagement and contribution of all team members. They plan and facilitate effective team meetings.

Differentiated Instruction

Strategies to Accommodate Students Based on Individual Needs

Time/General	Processing	Comprehension	Recall
• Extra time for assigned tasks • Adjust length of assignment • Timeline with due dates for reports and projects • Communication system between home and school • Provide lecture notes/outline	• Extra Response time • Have students verbalize steps • Repeat, clarify or reword directions • Mini-breaks between tasks • Provide a warning for transitions • Reading partners	• Precise step-by-step directions • Short manageable tasks • Brief and concrete directions • Provide immediate feedback • Small group instruction • Emphasize multi-sensory learning	• Teacher-made checklist • Use visual graphic organizers • Reference resources to promote independence • Visual and verbal reminders • Graphic organizers
Assistive Technology	**Tests/Quizzes/Grading**	**Behavior/Attention**	**Organization**
• Computer/whiteboard • Tape recorder • Spell-checker • Audio-taped books	• Extended time • Study guides • Shortened tests • Read directions aloud	• Consistent daily structured routine • Simple and clear classroom rules • Frequent feedback	• Individual daily planner • Display a written agenda • Note-taking assistance • Color code materials

Enrichment

Strategies Used to Accommodate Based on Students Individual Needs:

- Adaption of Material and Requirements
- Evaluate Vocabulary
- Additional Projects
- Independent Student Options
- Projects completed individual or with Partners
- Self Selection of Research
- Tiered/Multilevel Activities
- Learning Centers
- Individual Response Board
- Independent Book Studies
- Open-ended activities
- Community/Subject expert mentorships

Assessments

Suggested Formative/Summative Classroom Assessments

- Portfolios
- Reading and Homework assignments
- Labs
- Projects
- Oral and Video presentations
- Quizzes and exams
- Self-check and Live coding exercises

Interdisciplinary Connections

English Language Arts
- Journal writing
- Close reading of industry-related content
- Create a brochure for a specific industry
- Keep a running word wall of industry vocabulary

Social Studies
- Research the history of a given industry/profession
- Research prominent historical individuals in a given industry/profession
- Use historical references to solve problems

World Language
- Translate industry-content
- Create a translated index of industry vocabulary
- Generate a translated list of words and phrases related to information technology

Math
- Compare and contrast use of equations and variables in algebra and programming.
- Program graphics and use the properties of geometric shapes
- Compare the computer graphic coordinate system with the Cartesian coordinate plane in math
- Compare probability and the use of random numbers in computer programming.
- Track and track various data, such as industry's impact on the GDP, career opportunities or among of individuals currently occupying careers

Fine & Performing Arts
- Create a poster recruiting young people to focus their studies on a career in Information Technology

Science
- Research the environmental impact of a given career or industry
- Research latest developments in Information technology
- Investigate applicable-careers in STEM fields

New Jersey Student Learning Standards

8.2 Technology Education, Engineering, Design, and Computational Thinking - Programming

Technology and Society

- 8.2.12.B.3: Analyze ethical and unethical practices around intellectual property rights as influenced by human wants and/or needs.

Design

- 8.2.12.C.1: Explain how open source technologies follow the design process.

Computational Thinking: Programming

- 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.
- 8.2.12.E.4: Use appropriate terms in conversation.

New Jersey Student Learning Standards

9.3– Career and Technical Education

Career Cluster: Information Technology (IT)

- 9.3.12.IT.11: Demonstrate knowledge of the hardware components associated with information systems.
- 9.3.12.IT-SUP.9: Employ technical writing and documentation skills in support of an information system.

Pathway: Programming & Software Development (IT-PRG)

- 9.3.12.IT-PRG.4: Demonstrate the effective use of software development tools to develop software applications.
- 9.3.12.IT-PRG.5: Apply an appropriate software development process to design a software application.
- 9.3.12.IT-PRG.6: Program a computer application using the appropriate programming language.
- 9.3.12.IT-PRG.7: Demonstrate software testing procedures to ensure quality products.

Common Career Technical Core (CCTC)
Career Cluster Information Technology

IT.11 – Demonstrate knowledge of the hardware components associated with information systems.

- IT.11.1 - None available at this time.

IT-SUP.9 - Employ technical writing and documentation skills in support of an information system.

- IT-SUP.9.3 - Design technical documentation.

IT-PRG.4 - Demonstrate the effective use of software development tools to develop software applications.

- IT-PRG.4.1 - Employ tools in developing software applications.
- IT-PRG.4.3 - Apply language-specific programming tools/techniques.

IT-PRG.5 - Apply an appropriate software development process to design a software application.

- IT-PRG.5.1 - Describe software development processes and methodology.

IT-PRG.6 - Program a computer application using the appropriate programming language.

- IT-PRG.6.1 - Explain programming language concepts.
- IT-PRG.6.2 - Summarize program development methodology.
- IT-PRG.6.3 - Demonstrate proficiency in developing an application using an appropriate programming language.
- IT-PRG.6.4 - Explain basic software systems implementation.
- IT-PRG.6.6 - Resolve problems with integration.

IT-PRG.7 - Demonstrate software testing procedures to ensure quality products.

- IT-PRG.7.1 - Develop a software test plan.

Common Core State Standards (CCSS)

CCSS - English-Language Arts

Key Ideas and Details:

- CCSS.ELA-LITERACY.RL.11-12.1 Cite strong and thorough textual evidence 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.

Integration of Knowledge and Ideas:

- CCSS.ELA-LITERACY.W.11-12.1 Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

Production and Distribution of Writing:

- CCSS.ELA-LITERACY.W.11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

Research to Build and Present Knowledge:

- CCSS.ELA-LITERACY.W.11-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

Range of Writing:

- CCSS.ELA-LITERACY.W.11-12.10 Write routinely over extended time frames (time 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

Common Core State Standards (CCSS)

CCSS - Mathematics

Reason quantitatively and use units to solve problems:

- CCSS.MATH.CONTENT.HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling.

Create equations that describe numbers or relationships:

- CCSS.MATH.CONTENT.HSA-CED.A.1 Create equations and inequalities in one variable and use them to solve problems.

Analyze functions using different representations:

- CCSS.MATH.CONTENT.HSF-IF.C.7 Graph functions expressed symbolically and show key features of the graph.

Apply geometric concepts in modeling situations:

- CCSS.MATH.CONTENT.HSG-MG.A.1 Use geometric shapes, their measures, and their properties to describe objects

Calculate expected values and use them to solve problems:

- CCSS.MATH.CONTENT.HSS-MD.A.1 Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space;
- CCSS.MATH.CONTENT.HSS-MD.A.2 Calculate the expected value of a random variable;

Practice Standards - Mathematics

- 1. Make sense of problems and persevere in solving them.
- 2. Reason abstractly and quantitatively.
- 3. Construct viable arguments and critique the reasoning of others.
- 4. Model with mathematics.
- 5. Use appropriate tools strategically.
- 6. Attend to precision.
- 7. Look for and make use of structure.
- 8. Look for and express regularity in repeated reasoning.

Course: Mobile CSP **Unit: 3** – Algorithms and Procedural Abstractions **Grade Level:** 9-12	Unit Overview: This unit focuses on algorithms and procedures in more detail. The Logo apps introduce the concept of procedural abstraction and students learn to define and use procedures. Students are also introduced to the analysis of algorithms. Algorithm efficiency is examined for searching and sorting.
New Jersey Student Learning Standards (NJSLS): 8.2.12.E.1, 8.2.12.E.3, 8.2.12.E.4 9.3.12.IT.11, 9.3.12.IT-SUP.9.3, 9.3.12.IT-PRG.4.1, 9.3.12.IT-PRG.4.3, 9.3.12.IT-PRG.5.1, 9.3.12.IT-PRG.6.1, 9.3.12.IT-PRG.6.3, 9.3.12.IT-PRG.6.4, 9.3.12.IT-PRG.6.6, 9.3.12.IT-PRG.7.1	
Common Career Technical Core (CCTC): IT.11, IT-SUP.9.3, IT-PRG.4.1, IT-PRG.4.3, IT-PRG.5.1, IT-PRG.6.1, IT-PRG.6.3, IT-PRG.6.4, IT-PRG.6.6, IT-PRG.7.1	
Common Core State Standards (CCSS): RL.11-12.1; W.11-12.1; W.11-12.4; W.11-12.7; W.11-12.10; HSF-IF.C.7; HSG-MG.A.1; HSS-MD.A.1; HSS-MD.A.2;	

Student Learning Objectives (SLOs)	Essential Questions	Skills & Indicators	Sample Activities	Resources
Understand that an algorithm is a precise sequence of instructions for a process that can be executed on a computer. **NJSLS:** 8.2.12.E.3; 8.2.12.E.4 9.3.12.IT.11.1; 9.3.12.IT-SUP.9.3 9.3.12.IT-PRG.4.1; 9.3.12.IT-PRG.4.3;	• What is an algorithm? • How are algorithms expressed (pseudocode or programming language)? • Is it more important for an algorithm to be written more efficiently or for clarity? • What is the power of procedures in programs?	• Develop simple algorithms to solve increasingly complex maze puzzles. • See differences between algorithms in terms of efficiency, correctness and clarity • Define procedures to help manage the complexity in an algorithm	• Blockly Maze Activity • Algorithm Video • Write an algorithm on how to make a peanut butter and jelly sandwiches • Interactive exercises • Reflection questions • Logo Part 1 app • Logo Part 2 app	Mobile CSP Unit 5.2 https://ram8647.appspot.com/mobileCSP/unit?unit=24&lesson=72 Mobile CSP Unit 5.3 https://ram8647.appspot.com/mobileCSP/unit?unit=24&lesson=73 Mobile CSP Unit 5.4 https://ram8647.appspot.com/mobileCSP/unit?unit

Student Learning Objectives (SLOs)	Essential Questions	Skills & Indicators	Sample Activities	Resources
9.3.12.IT-PRG.5.1; 9.3.12.IT-PRG.6.1; 9.3.12.IT-PRG.6.3; 9.3.12.IT-PRG.6.4; 9.3.12.IT-PRG.6.6; 9.3.12.IT-PRG.7.1 **CCTC:** IT.11.1; IT-SUP.9.3 IT-PRG.4.1; IT-PRG.4.3; IT-PRG.5.1; IT-PRG.6.1; IT-PRG.6.3; IT-PRG.6.4; IT-PRG.6.6; IT-PRG.7.1 **CCSS:** W.11-12.4; W.11-12.10 HSS-MG.A.1	• Why are parameters in a procedure useful?	• Define for range loops to help manage repetition in an algorithm		=24&lesson=74
Understand simple examples of searching algorithms and when they may be applied.	• What is a binary search? • What is a linear search? • In what ways are	• Explain the details of a binary search • Explain the details of a linear search • See differences	• Play guess a number from 1 to 100 to demonstrate binary searches • Interactive exercises	Mobile CSP Unit 5.5 https://ram8647.appspot.com/mobileCSP/unit?unit=24&lesson=75

Student Learning Objectives (SLOs)	Essential Questions	Skills & Indicators	Sample Activities	Resources
NJSLS: 8.2.12.E.1; 8.2.12.E.4 **CCSS:** W.11-12.4; W.11-12.10 HSF-IF.C.7	some search algorithms better than others?	between search algorithms • Record and graph experimental data	• Write directions for a sequential search and binary search • Linear search video • Conduct an experimental investigation of search algorithms • Reflection questions	Mobile CSP Unit 5.7 https://ram8647.appspot.com/mobileCSP/unit?unit=24&lesson=95
Understand simple examples of sorting algorithms and when they may be applied. **NJSLS:** 8.2.12.E.1; 8.2.12.E.4 **CCSS:** W.11-12.4; W.11-12.10 HSF-IF.C.7	• What is a bubble sort? • What is a merge sort? • What is a bucket sort? • In what ways are some sort algorithms better than others?	• Explain details of a bubble sort • Explain details of a merge sort • Explain details of a bucket sort • See differences between sort algorithms • Record and graph experimental data	• Sorting a deck of cards contest • Bubble Sort Video • Merge Sort Video • Bucket Sort Video • Interactive exercises • Conduct an experimental investigation of search algorithms • Reflection questions	Mobile CSP Unit 5.6 https://ram8647.appspot.com/mobileCSP/unit?unit=24&lesson=76 Mobile CSP Unit 5.7 https://ram8647.appspot.com/mobileCSP/unit?unit=24&lesson=95
Think theoretically and abstractly about the efficiency of algorithms. **NJSLS:**	• What is the difference between solvable and unsolvable problems? • How are algorithms classified?	• Conduct an experimental investigation • Determine efficiency category (logarithmic,	• Classifying algorithms video • Classifying algorithms experiment • Reflection questions	Mobile CSP Unit 5.9 https://ram8647.appspot.com/mobileCSP/unit?unit=24&lesson=120

Student Learning Objectives (SLOs)	Essential Questions	Skills & Indicators	Sample Activities	Resources
8.2.12.E.1; 8.2.12.E.4 **CCSS:** W.11-12.4; W.11-12.10 HSF-IF.C.7	• What limits to algorithms have? • In what ways are some algorithms better than others?	linear, n log n or quadratic)	• Interactive exercises	
Demonstrate how different web searches use different search algorithms. **NJSLS:** 8.2.12.E.1; 8.2.12.E.4 **CCSS:** RL.11-12.1; W.11-12.1; W.11-12.4; W.11-12.7; W.11-12.10	• How has Google search technology impacted the world? • How do search engines work? • If you use another search engine besides Google, do you get the same results? • Which search engine is “right”? Which is “better”? • How are search engines the same or better? • Do you think it is appropriate for your searches to be tracked?	• Describe search trends • Identify the benefits of captchas for preventing spam on websites • Explain Google’s PageRank algorithm • Analyze Google web history • Explain caching	• Read Blown to Bits (BB) Chapter 4 • Answer BB Chapter 4 questions in a jigsaw • Reflection questions • Video and article on NSA program	Blown to Bits Chapter 4 https://ram8647.appspot.com/mobileCSP/unit?unit=24&lesson=98 Mobile CSP Unit 5.11 https://ram8647.appspot.com/mobileCSP/unit?unit=24&lesson=98

Student Learning Objectives (SLOs)	Essential Questions	Skills & Indicators	Sample Activities	Resources
Understand how to make incremental additions to an existing program. **NJSLS:** 8.2.12.E.1; 8.2.12.E.3; 8.2.12.E.4 9.3.12.IT-SUP.9.3 9.3.12.IT-PRG.4.1; 9.3.12.IT-PRG.4.3; 9.3.12.IT-PRG.5.1; 9.3.12.IT-PRG.6.1; 9.3.12.IT-PRG.6.3; 9.3.12.IT-PRG.6.4; 9.3.12.IT-PRG.6.6; 9.3.12.IT-PRG.7.1 **CCTC:** IT-SUP.9.3 IT-PRG.4.1; IT-PRG.4.3; IT-PRG.5.1; IT-PRG.6.1; IT-PRG.6.3; IT-PRG.6.4; IT-PRG.6.6; IT-PRG.7.1	• What is the best way to add enhancements to an existing app and why? • What is the difference between syntax and semantic errors? • Why do programmers write test plans for their program? • Why do programmers write pseudocode before they write their program?	• Define and use if/else statement to evaluate more than one condition • Define and use a procedure with a parameter • Animate sprites • Write pseudocode for the enhancement • Write a test plan for the enhancements • Find and fix bugs in a program	• History of Pong game • Video of original Pong game • Pong game app • Reflection questions • Interactive exercises • Pong with Bugs app	Mobile CSP Unit 5.8 https://ram8647.appspot.com/mobileCSP/unit?unit=24&lesson=96 Mobile CSP Unit 5.10 https://ram8647.appspot.com/mobileCSP/unit?unit=24&lesson=97

Student Learning Objectives (SLOs)	Essential Questions	Skills & Indicators	Sample Activities	Resources
CCSS: W.11-12.4; W.11-12.10 HSS-MD.A.1 HSS-MD.A.2				

Unit 3 Vocabulary	
Algorithm Procedures Abstractions Pseudocode Parameters Boolean Condition Logarithmic algorithm Linear algorithm n log n algorithm Quadratic algorithm Intractability Undecidability unsolvable	**Blown to Bits Chapter 4 Vocabulary** Background binary bot. cache firewall foreground HTML URL

Suggested Unit Projects *Choose At Least One*	
Explore: Impact of Computing Innovations Performance Task #2 https://ram8647.appspot.com/mobileCSP/assessment?name=115	**Create an original Pong game on scratch** https://scratch.mit.edu/projects/10000036/ https://scratch.mit.edu/projects/13152172/

Suggested Structured Learning Experiences	
Arrange Code.org volunteers to visit your school and share their work experiences in technology with the students https://code.org see Volunteer	**Tour of Kean University's NSF funded automatic virtual environment (CAVE)** https://www.kean.edu/~cssc/workshops.html