Arkansas Computer Science Standards Level 1:

CSL1.2.2: Classify the types of information that can be stored as variables (e.g.: Booleans, characters, integers, floating points, strings).

CSL1.2.6: Demonstrate operator (e.g., +,-,/,%, concatenation) precedence in expressions and statements.

CSL1.3.2: Compare and contrast level appropriate numeric and non-numeric data representations.

CSL1.7.2: Identify desired technical and soft skills (e.g., collaboration, communication, problem solving, teamwork) that can be enhanced by computer science.

CSL. 1.7.3: Discuss diverse careers that are influenced by computer science and its availability to all regardless of background.

CSL1.8.2: Discuss the roll of internet service providers (ISP) in providing connectivity.

CSL 1.8.5: Identify common network protocols (e.g., DNS, HTTP/HTTPS, SMTP/POP/IMAP, Telnet/SSH)

CSL1.9.3: Classify layers of software (e.g., applications, drivers, operating systems) within various platforms.

CSL1.10.1: Categorize the risks associated with the utilization and implementation of digital technology.

- Legal
- Physical
- Psychological
- Social

Note: Legal issues include but are not limited to access, AFTRA, copyright, FAA, FCC, hacking, intellectual property, licensure, local computer-use policy, piracy, and plagiarism.

CSL1.10.2: Discuss issues related to personal security

Objectives:

- Students will be able to determine the various terms needed to write a simple program.
- Students will understand the language commonly used for internet providers and network protocols.
- Pupils will connect types of data used in computers and how to interact via computer when working as a group.
- Pupils will recognize the role of computer science in various careers.
- Students will understand the levels of software and hardware on a computer.
- Pupils will recognize the inherent risks associated with utilization and implementation of digital technology.

Assessment: students will successfully master several scenarios that relate to the objectives of this lesson.

Key Points: internet, software, hardware, program terms

Elicit:

Many students have access to either a smartphone, tablet or computer so they should have a basic knowledge of many of the terms in this lesson. Start the lesson by doing a KWL chart about what students know about computers. Ask questions like "What is a computer program?" or "How does your personal email get from point A to your computer?" Ask "What is data in computer terms?" Ask your students if they know what ISP means in regard to the internet. Do students know the risks of digital technology?

In today's world, students have a much broader knowledge of basic computer terms and operations than in the past so this will give you a good base to jump from. Once you ascertain what students need, you will now know what standards to cover.

Engage:

Tell the students they will be referring to a program called 'Rice Advisor' for this lesson. Students need to go to https://riceadvisor.uaex.edu/ to check out this agriculture application. (Ask the students if they know the difference between a http website and a https website!). Agriculture uses computers more than ever today, and this program is one example of how farmers are using digital technology to enhance crop production and sustainability.

Explore:

Tell the students they are farmers who will be referring to the computer application *Rice Advisor* for this lesson. They will also be given a series of agricultural scenarios that need to be answered based on the information covered in the *explain* section. There will be scenarios for all of the concepts below. You may pick and choose those you want to use for this lesson.

Explain:

Students should have a basic knowledge of the following:

- **Variables and operators:** Variables can store integer numbers, real numbers and string (text like your name). Operators determine how things are grouped in the absence of parenthesis.
- **Operator precedence:** An operator with the highest precedence are grouped with its operands first. Multiplication and division are done before addition and subtraction, left to right.
- **Numeric vs non-numeric data:** Numeric data is decimals, binary, octal, hexadecimal. Non-numeric data is symbols such as letters and symbol characters that are stored.
- **Desired skills enhanced by Computer Science:** Collaboration, teamwork, communication, problem solving, critical thinking, analytical thinking.
- **Computer Science and Agriculture:** Agriculture is a diverse career that is highly augmented by computer science. It is essential in all phases of agriculture production, pest control, harvest and research. The majority of today's farmers have an Agricultural degree and use computers throughout their farming business.
- **ISP:** ISP stands for Internet Service Provider. There are five requirements for these providers;
  1). Provide internet access
  2). Provide direct connection from network to the internet
  3). Provide such internet services as email, access to software, security, and web hosting.
  4). To build websites and host sites for business
  5). To be the mediator between the user and the internet
- **DNS, HTTP, HTTPS, SMTP/POP/IMAP, Telnet/SSH:** These are common network protocols. **DNS** is domain name system and it translates the domain into a computer readable IP. **HTTP/HTTPS** is hypertext transfer protocol. It defines the rules web browsers and web servers follow to transfer content efficiently. **HTTPS** is a variant of HTTP that has encryption built into it to provide security while the content is in transit. **SMTP** is the industry standard protocol for sending emails and **IMAP** is the common protocol for receiving email. **IMAP** syncs messages across all devices. **POP3** is another protocol for receiving email on a single device. Using **POP3** means your email will be accessible offline and deleted from the server. **IMAP** is more powerful and best when using multiple devices. **Telnet/SSH** is a client server application program that allows a user at one site to connect remotely to another site's computer. **Telnet** is less secure and transfers data in plain text. Because of this, it should only be used on private servers as it is vulnerable to hacks and has a low bandwidth. **SSH** is the logical substitution

for **Telnet** for vulnerable remote log-ins as it has a secure shell, and has a remote command execution.

- **Software layers:** There are three layers of software; *applications, drivers and operating systems*. **Applications** allow the network to interpret requests made by programs and allow the program to interpret data. They are the most superficial layer. **Drivers** are software provided by device manufacturers that allow hardware devices to communicate with computer operating systems. Without drivers, the computer would not be able to send and receive data correctly to hardware devices, such as a printer. **Operating Systems** control peripheral functions such as scheduling tasks and running applications.

- **Risks and personal security:** There are several types of risks, **legal** (copyrights, FCC issues, hacking, intellectual property, piracy, plagiarism), **physical** (eye strain, headaches, carpal tunnel), **psychological** (addiction, cyber bullying, cyber-suicide, online scams, cyber grooming, online gambling), **social** (cyberbullying, cyber suicide, cyber racism). **Personal Security:** Students need to understand they should not be sharing personal information nor sharing their phones and computers. This sets them up for online grooming by pedophiles and sex offenders.

Which elements you cover will depend on your students' prior knowledge. Please note: as there will not be any actual programming in this level.

White-boarding is a good way to help students with terms and get them invested in the lesson.

Elaborate:

Break the students into groups and hand out the scenarios located at the end of this lesson. Some of these scenarios will require access to a computer; others will not. Students will work on the scenarios and answer them based on a group consensus.

Evaluate:

Students can be given the scenarios again (with slight changes) as an assessment tool or they can be given a standardized test.

Evidence of Student Proficiency:

Students will understand the above concepts and be able to successfully apply them in writing to the scenarios presented to them.

Range of typical student responses:

Descriptors of grade-level appropriate student responses:

Full understanding: The student answers all circumstances and can integrate the concepts of variables, operators, numeric/non-numeric data, ISP, types of internet network protocols and software layers into the scenarios. The student will understand and communicate how computer science enhances careers and impacts agriculture.

Partial Understanding: The student will understand broad concepts such as desired skills enhanced by computer science, computer science and agriculture and Risks/Personal Safety. The student will have a basic understanding of operator precedence and numeric vs non-numeric data. The student struggles with understanding variables and operators, ISP, Internet protocol and software layers.

Limited Understanding: The student understands the importance of computer science skills, can see the importance of computer science in agriculture and agrees that there are risks to computer science and the internet. The student does not understand variables and operators, operator precedence, numeric vs non-numeric data, ISP, Internet protocol or software layers.

Acting on Evidence of Learning:

Description of instruction action and response to support student learning:

Action for student who displays partial or limited understanding: Concepts will be retaught using visual clues, white-board and hands-on activities. Students will be paired with student mentors to during the re-teaching period.

Extensions of learning for student who displays full understanding: Student will be encouraged to research and explore basic programming of one additional item to add to the Rice Advisor Application.

Extend:

Have a local farmer as a speaker come to your classroom so he/she can explain how computer technology has changed the role of farming.

Ask the manager of a local John Deere facility if there are any computer programmers who can come to your class and talk about the current role of computer technology in today's farming equipment.

SCENARIO 1

When writing programs, one needs to recall that there is a lot of math involved! This includes operator precedence.

Based on the equation below, note, in order of precedence, how should this be solved:

$A + (B \times C) - D$

Remember, any data that is built into a program (like the program above) is called _____ data.

The program for rice pricing and bushel cost requires using _____ data, while character variables are considered _____ data. Digital code is actually _____ data.

SCENARIO 2

In your group, brainstorm how farming with computer technology today can help you improve production and crop sustainability. Be sure to think not only locally but also on a global scale. Also include how farming skills have been enhanced by computer science.

Computers are considered a boon and a bane. They have revolutionized our world in farming and business, yet they have a dark side that affects millions of people daily. As a group, list as many risks and security issues that you can think a farmer could be exposed to involving computers (or the internet) and then explain why this would be considered a risk.

SCENARIO 3

Go to the *Rice Advisor* https://riceadvisor.uaex.edu/ and click on 'rice seed calculator'. You will see that there are a series of choices you can pick from when determining the amount of rice seed for planting. Being able to plug choices into an application allows a farmer to only plant the *necessary* seed amount for crop, which saves both time and money.

This application requires connection to the internet. What are the requirements (there are five) that a company must meet to be an ISP (Internet Service Provider)?

So let's look behind the scenes of this application. Right click on the opened rice seed calculator and click on 'page source'. What comes up is the programming language behind the rice seed calculator.

You will notice there is a lot of writing, this is called _____.

If you jump down to row 92, you will see what looks like a calculation. These use _____ and real _____ and math _____.

You will notice that 289-351 have numbers that represent descriptions and numbers that represent values. These number representations are called _____ data representations.

Let's talk about the application. Its location has https on it. This means it is _____.

Rice Advisor is an application. What is the definition of an application?

If you wanted to print the information from *Rice Advisor*, your computer would need a _____ to communicate with your printer.

You decide you want to send this information to a fellow rice grower. You would need a _____ and he/she would need a _____ to receive your email.

You are having issues with your computer and have subscribed to a remote computer management system. The management system will need a program like _____ to fix your computer via remotely.