



OREGON
DEPARTMENT OF
EDUCATION

ARTS, INFORMATION AND COMMUNICATIONS

Statewide Program of Study Framework: Information and Communication Technology Career Cluster

Knowledge and Skill Statements/Suggested Performance Indicators

Employability

Career Cluster

Focus Areas

Computer Programming
and Coding

Information Technology,
Networks, and Cybersecurity

Overview

The Arts, Information and Communications career learning area is comprised of two Career Clusters, which include (1) Arts, AV Technology and Communications, and (2) Information and Communication Technology. This document details the knowledge and skill statements comprising the Program of Study for the Information and Communication Technology Career Cluster. The Statewide Program of Study Framework addresses two focus areas: (1) Computer Programming and Coding, and (2) Information Technology, Networks, and Cybersecurity.

When reading the document, note that:

- **A Program of Study spans secondary and postsecondary education**, meaning that students are expected to master the identified skills upon completion of their programming. It is not expected that all Knowledge and Skill Statements will be taught at the high school level.
- **Knowledge and skill statements** (indicated in bold) identify the career readiness expectations that employers seek in entry-level workers.
- **Suggested performance indicators** illustrate how students might demonstrate their understanding of each knowledge and skill statement. They are offered as examples and are not required to be taught.

Secondary and postsecondary educators will collaborate to select the number, type, specificity, and educational level at which performance indicators will be taught.

For more detailed information, see the Information and Communication Technology Resource Guide contained in this Google Drive.

Information and Communication Technology Knowledge and Skill Statements

Employability Knowledge and Skill Statements

Applicable to all Career Clusters in the Statewide Program of Study Framework.

E-01	Adhere to workplace practices
E-02	Exhibit personal responsibility and accountability
E-03	Practice cultural competence
E-04	Demonstrate teamwork and conflict resolution
E-05	Communicate clearly and effectively
E-06	Employ critical thinking to solve problems
E-07	Demonstrate creativity and innovative thinking
E-08	Demonstrate fluency in workplace technologies
E-09	Plan, organize, and manage work
E-10	Make informed career decisions

Cluster Level Knowledge and Skill Statements

Applicable to all Programs of Study in the Information and Communication Technology Statewide Program of Study Framework.

CC-IT01	Describe how cross-functional teams collaborate to achieve project goals
CC-IT02	Demonstrate understanding of computer languages and software development processes
CC-IT03	Demonstrate knowledge of data science, virtualization, and cloud computing
CC-IT04	Demonstrate understanding of network communication and organization
CC-IT05	Demonstrate awareness of security threats and protection strategies
CC-IT06	Perform standard computer backup and restore procedures to protect information
CC-IT07	Demonstrate a basic understanding of user and customer supports
CC-IT08	Describe trends in emerging and evolving technologies and their influence
CC-IT09	Describe and demonstrate industry accepted ethical practices and behavior

Focus Area Level Knowledge and Skills

Knowledge and Skill Statements for the updated Statewide Program of Study Framework in (1) *Computer Programming and Coding* and (2) *Information Technology, Networks, and Cybersecurity*.

Computer Programming and Coding

FA-ITCP01	Demonstrate ability to describe, use, and troubleshoot various IT hardware Infrastructure
FA-ITCP02	Demonstrate an ability to build, test, and deploy code leading to a basic understanding of Unix commands and environment setup
FA-ITCP03	Demonstrate an understanding of basic software development in the cloud
FA-ITCP04	Demonstrate ability to effectively communicate coding concepts
FA-ITCP05	Demonstrate understanding of privacy and security concepts in computing situations

Information Technology, Networks, and Cybersecurity

FA-ITNC01	Demonstrate ability to describe, use, and troubleshoot various IT hardware Infrastructure
FA-ITNC02	Demonstrate ability to configure, manage, install, and maintain client machines in a common IT environment
FA-ITNC03	Demonstrate a functional understanding of networking basics
FA-ITNC04	Articulate basic security best practices and discuss their real-world implementation in an enterprise environment

Employability Knowledge and Skill Statements with Suggested Performance Indicators

E-01	Adhere to workplace practices
Suggested Performance Indicators	<ul style="list-style-type: none"> A. Explain and follow workplace standards, rules, and regulations B. Show up on time and prepared to work C. Demonstrate the ability to take direction, be proactive, and work independently
E-02	Exhibit personal responsibility and accountability
Suggested Performance Indicators	<ul style="list-style-type: none"> A. Apply professional and ethical standards of the industry to personal conduct B. Maintain integrity and promote personal and professional integrity in co-workers C. Take responsibility and carry out work assignments
E-03	Practice cultural competence
Suggested Performance Indicators	<ul style="list-style-type: none"> A. Demonstrate awareness of issues related to diversity, equity, and inclusion B. Work effectively with colleagues of differing abilities, cultures, and backgrounds C. Describe issues relating to workplace harassment D. Model behaviors that are respectful and sensitive of others
E-04	Demonstrate teamwork and conflict resolution
Suggested Performance Indicators	<ul style="list-style-type: none"> A. Demonstrate the ability to collaborate and contribute to the work of a diverse team B. Explain when it is appropriate to lead and when to follow another's lead C. Demonstrate strategies for resolving issues with coworkers
E-05	Communicate clearly and effectively
Suggested Performance Indicators	<ul style="list-style-type: none"> A. Listen attentively, and speak and write clearly to convey information correctly B. Interpret information and instructions presented in verbal and written form C. Demonstrate effective communication with colleagues, supervisors, customers, and suppliers D. Demonstrate the ability to communicate verbally, in writing, and using electronic communication tools
E-06	Employ critical thinking to solve problems
Suggested Performance Indicators	<ul style="list-style-type: none"> A. Recognize problems in the workplace and diagnose their root causes B. Develop well-reasoned plans to solve identified challenges C. Apply and follow through on plans to ensure that problems are resolved

E-07	Demonstrate creativity and innovative thinking
Suggested Performance Indicators	<ul style="list-style-type: none"> A. Develop ideas to solve problems in new and different ways B. Investigate one's own and others' ideas to find those with greatest applicability C. Develop and deploy plans to implement new ideas in the workplace
E-08	Demonstrate fluency in workplace technologies
Suggested Performance Indicators	<ul style="list-style-type: none"> A. Demonstrate knowledge and application of general technology skills, including hardware and software commonly used in the industry B. Use online communication, networking tools and social networks to access, manage, evaluate, and create information to successfully function in a knowledge economy C. Describe and demonstrate a fundamental understanding of the ethical, legal, and security issues surrounding access to and use of information technologies
E-09	Plan, organize, and manage work
Suggested Performance Indicators	<ul style="list-style-type: none"> A. Identify an intended project outcome including available inputs, materials, labor, timeline for producing work, and job-site obligations B. Effectively plan, monitor, and complete projects on time and within budget using available resources and materials C. Demonstrate ability to write coherent reports and project summaries to communicate the progress of project work and its adherence to schedule
E-10	Make informed career decisions
Suggested Performance Indicators	<ul style="list-style-type: none"> A. Identify job and entrepreneurial opportunities in the industry and the required education and credentials to obtain employment B. Set short- and long-term career goals based on personal interests and aptitudes C. Maintain a project portfolio D. Develop a professional resume E. Explain and demonstrate how to cultivate and maintain a professional presence in an online environment, including the appropriate use of social media and networking platforms

Career Cluster Knowledge and Skill Statements with Suggested Performance Indicators

CC-IT01	Describe how cross-functional teams collaborate to achieve project goals
Suggested Performance Indicators	<ul style="list-style-type: none"> A. Summarize the importance of cross-functional teams in achieving project goals B. Identify desired group and team behavior C. Describe the roles and responsibilities of team members typically engaged in implementing hardware and/or software technology solutions D. Describe strategies for maximizing productivity in a high-tech environment
CC-IT02	Demonstrate understanding of computer languages and software development processes
Suggested Performance Indicators	<ul style="list-style-type: none"> A. Explain why various computer languages exist B. Describe computer languages used to build desktop, server, mobile, and web applications C. Explain how programmers use various languages to solve problems D. Explain the processes involved in designing, writing, testing, and maintaining source code of computer programs to manage and maintain software E. Describe the software development life cycle F. Demonstrate knowledge of current coding languages and software development trends
CC-IT03	Demonstrate knowledge of data science, virtualization, and cloud computing
Suggested Performance Indicators	<ul style="list-style-type: none"> A. Describe the features, benefits, and concepts of virtualization and cloud computing B. Describe the characteristics and pros and cons of types of cloud services C. Demonstrate how to maintain and use databases D. Demonstrate ability to design data collection systems and implement strategies that maximize data quality E. Describe data analytics, how it is performed and also impacted by Big Data and related technologies
CC-IT04	Demonstrate understanding of network communication and organization
Suggested Performance Indicators	<ul style="list-style-type: none"> A. Explain the functionality of common networking protocols B. Explain the purpose of routing, network configuration, and monitoring C. Explain how to use hardware and software to facilitate communication between people and computer systems D. Explain the pros and cons of and recommend various types of network components to address industry needs E. Describe the purpose and function of fundamental end-user devices such as switches, routers, wireless access points

CC-IT05	Demonstrate awareness of security threats and protection strategies
Suggested Performance Indicators	<ul style="list-style-type: none"> A. Describe potential security threats to networked information systems B. Describe the standards and applications needed to protect the confidentiality, integrity, and availability of information and information systems C. Describe and demonstrate strategies to assess and protect against security threats (e.g., firewalls, user authentication, passwords, and restricted access) D. Demonstrate procedures to contain and remove viruses and malware
CC-IT06	Perform standard computer backup and restore procedures to protect information
Suggested Performance Indicators	<ul style="list-style-type: none"> A. Explain the need for regular backup procedures B. Configure, perform, and maintain backup procedures C. Describe and demonstrate the use of surge suppression protection tools D. Identify and describe batter backup equipment and its uses E. Demonstrate ability to select and employ commonly used platforms, technology, and tools
CC-IT07	Demonstrate a basic understanding of user and customer supports
Suggested Performance Indicators	<ul style="list-style-type: none"> A. Describe the type of services used to provide assistance and technical support to users B. Help users implement and solve problems related to information technology C. Demonstrate ability to assist customers in implementing and solving problems in a professional manner
CC-IT08	Describe trends in emerging and evolving technologies and their influence
Suggested Performance Indicators	<ul style="list-style-type: none"> A. Identify new information technologies (e.g., AI, IoT) and their social impacts B. Assess the importance of new technologies (e.g., Internet of Things - IoT) to future development, productivity, and knowledge C. Identify new and emerging drivers and inhibitors of information technology change D. Assess the potential importance and impact of new IT technologies in the future E. Describe how varying types of computer systems are used in business/industry/government and other institutions and impact people's workday F. Describe the impact of computers on career pathways in business/industry (e.g., how computers have eliminated and created jobs) G. Describe the impact of computers on access to information and information exchange worldwide
CC-IT09	Describe and demonstrate industry accepted ethical practices and behavior
Suggested Performance Indicators	<ul style="list-style-type: none"> A. Describe legal issues faced by IT professionals B. Describe legal issues associated with a company security policy C. Summarize the rights and responsibilities of IT workers D. Demonstrate knowledge of ethical issues that have surfaced in the information age

Focus Area. Computer Programming and Coding Knowledge and Skill Statements with Suggested Performance Indicators

FA-ITCP01	Demonstrate capability to implement foundational computer programming concepts
Suggested Performance Indicators	<ul style="list-style-type: none"> A. Implement conditionals B. Implement loops C. Implement variable scope D. Implement algorithms and complexity E. Demonstrate knowledge of Common Data Structures F. Implement Software and Application Architecture Paradigms (ex. web/app/DB) G. Implement Object-Oriented Programming (OOP) H. Understand and utilize abstractions
FA-ITCP02	Demonstrate an ability to build, test, and deploy code leading to a basic understanding of Unix commands and environment setup
Suggested Performance Indicators	<ul style="list-style-type: none"> A. Demonstrate capability to build software using modern tooling B. Demonstrate working knowledge of the different types of testing (e.g., unit, functional, performance, security, etc.) C. Use multiple debugging/troubleshooting strategies D. Demonstrate capability to deploy tested code E. Demonstrate working knowledge of Error Handling F. Setup Unix-based machine) G. Setup source control like Git H. Setup developer tools and library dependencies I. Demonstrate basic knowledge of common Unix commands like grep, awk, sed
FA-ITCP03	Demonstrate an understanding of basic software development in the cloud
Suggested Performance Indicators	<ul style="list-style-type: none"> A. Demonstrate ability to use an API B. Describe the features, benefits, and concepts behind various application architectures (e.g., serverless, microservices, IaaS vs PaaS, High Availability [HA], etc.) C. Demonstrate basics of cloud monitoring (e.g., AWS Cloudwatch, GCP Operations Suite, etc.)
FA-ITCP04	Demonstrate ability to effectively communicate coding concepts
Suggested Performance Indicators	<ul style="list-style-type: none"> A. Write pseudocode and construct a flowchart for a process before starting to develop the program code B. Write maintainable code (code comments, external documentation, clarity of code, identifying code smells) B. Articulate the nature of program designs and why that design was chosen

FA-ITCP05	Demonstrate understanding of privacy and security concepts in computing situations
Suggested Performance Indicators	<ul style="list-style-type: none"> A. Exhibit proper handling of private and confidential data B. Demonstrate awareness of basic security concepts/practices C. Explain concepts involved in IT security technologies, including cyber terrorism and its countermeasures, and various auditing and monitoring tools and techniques D. Recognize and draw attention to potential IT security threats and risks, including common attacks, vulnerabilities, and methods used to compromise a system

Focus Area. Information Technology, Networks, and Cyber Security Knowledge and Skill Statements with Suggested Performance Indicators

FA-ITNC01	Demonstrate ability to describe, use, and troubleshoot various IT hardware infrastructure
Suggested Performance Indicators	<ul style="list-style-type: none"> A. Identify and troubleshoot the major hardware components unique to mobile devices B. Configure both the hardware and software unique to mobile devices to ensure best use for a typical end-user C. Summarize the major elements of a network, including its hardware components and underlying protocols D. Classify and compare different basic networking configurations and implementations E. Use appropriate networking tools to accomplish or troubleshoot a given situation F. Identify various hardware components and understand their use within a given system G. Properly install and troubleshoot desktop hardware and validate that installation H. Identify, configure, and install peripheral technologies often found in a typical Small Office / Home Office (SOHO) environment I. Explain the core philosophy of virtualization and cloud computing and show this by explaining its infrastructure and cost impacts to traditional computing J. Set up and configure client-side virtualization given a particular scenario
FA-ITNC02	Demonstrate ability to configure, manage, install, and maintain client machines in a common IT environment
Suggested Performance Indicators	<ul style="list-style-type: none"> A. Perform basic system administration tasks such as OS installation, network configuration, storage management, troubleshooting, and other basic sysadmin tasks B. Competently engage with systems by using their basic tools and operating system environment for daily tasks C. Summarize the key concepts of and perform basic actions in relation to information security as it applies to a SOHO environment including account security, antimalware installation, familiarity with basic OS-level security tools, and basic security for mobile devices D. Perform basic troubleshooting methodologies to resolve simple or common software-related issues, such as security issues, malware removal, mobile syncing, and general OS-level problems E. Identify various operational policies and procedures that commonly pertain to an IT environment and articulate their importance, such as change management concepts, disaster recovery, privacy, and licensing

FA-ITNC03	Demonstrate a functional understanding of networking basics
Suggested Performance Indicators	<ul style="list-style-type: none"> A. Identify basic networking ports and protocols, network topologies, and logical routing infrastructure and explain how these concepts interrelate B. Identify the basic concepts and characteristics of routing and switching technologies and infrastructure C. Distinguish the unique differences of wireless infrastructure and categorize and identify the basic components of that infrastructure D. Identify and manipulate the essential physical networking infrastructure found in common network deployments (this includes the devices as well as the connection media) E. Identify and categorize essential networking infrastructure and demonstrate functional understanding of each individual node as well as how they impact the greater network F. Explain and draft the basic documentation often found in developing and maintaining a network (this includes network topologies and disaster recovery planning, as well as policies and best practices) G. Identify and configure the unique tools and infrastructure that can be deployed to best protect a network H. Demonstrate a functional understanding of the common attacks that can be leveraged against the network as well as the mitigations that can be put into place to stop them I. Use a well-developed troubleshooting methodology to troubleshoot common wired and wireless connectivity issues often found in a network J. Identify common networking tools and functions and explain how they can be used in the initial creation of the network and in troubleshooting or maintaining it

FA-ITNC04	Articulate basic security best practices and discuss their real-world implementation in an enterprise environment
Suggested Performance Indicators	<ul style="list-style-type: none"> A. Classify various attack, malware, and exploitation types commonly found in contemporary cyber-attacks and take steps to redress safety/security hazards in an enterprise environment B. Identify various threat actors as well as common vulnerabilities C. Explain the importance of designing good security practices by considering the unique challenges and context of an enterprise environment D. Articulate basic workflows, concepts, tools, and best practices associated with incident response E. Articulate secure application and coding development practices F. Summarize the techniques and approaches that are used in security assessments and penetration tests G. Identify key best practices and policies often used when implementing and auditing compliance and governance frameworks and describe NIST CSF and RMF H. Summarize risk management processes and concepts I. Given a scenario, identify and implement security configurations or changes to applications, hosts, networks, mobile devices, and cloud environments J. Articulate the importance of governance, risk, and compliance to daily security tasks and the field of information security as a whole K. Summarize the basics of cryptographic concepts often found in enterprise security environments L. Explain the key concepts of digital forensics usually associated with an enterprise environment