Information Technology Industry Sector
Model Curriculum Standards

Information Technology Career Pathways

Information Support and Services
Media Support and Services
Network Communications
Programming and Systems Development

Technology and the growing complexity of businesses have expanded the need for employees who can analyze, design, and manage information. Skills for evaluating data, the ability to work with people, and clear communication are companion components for careers in information technology systems. Employment opportunities for technically and professionally trained persons are outstanding in this emerging career path. After mastering basic technology skills, students can select one of many specializations in the field of technology.

Foundation Standards

1.0   *Academics*

Students understand the academic content required for entry into postsecondary education and employment in the Information Technology sector:

(The standards listed below retain the numbering in parentheses as specified in the original academic content standards documents.)

1.1   *Mathematics:*

Specific applications of Number Sense (grade seven)

(1.1)   Read, write, and compare rational numbers in scientific notation (positive and negative powers of 10) with approximate numbers using scientific notation.

(1.2)   Add, subtract, multiply, and divide rational numbers (integers, fractions, and terminating decimals) and take positive rational numbers to whole-number powers.

(1.3)   Convert fractions to decimals and percents and use these representations in estimations, computations, and applications.

(1.4)   Differentiate between rational and irrational numbers.

(1.5)   Know that every rational number is either a terminating or repeating decimal and be able to convert terminating decimals into reduced fractions.

(1.6)   Calculate the percentage of increases and decreases of a quantity.

(1.7)   Solve problems that involve discounts, markups, commissions, and profit and compute simple and compound interest.

Specific applications of Statistics, Data Analysis, and Probability (grade seven)

(1.1)   Know various forms of display for data sets, including a stem-and-leaf plot or box-and-whisker plot; use the forms to display a single set of data or to compare two sets of data.

(1.2)   Represent two numerical variables on a scatterplot and informally describe how the data points are distributed and any apparent relationship that exists between the two variables (e.g., between time spent on homework and grade level).

(1.3)   Understand the meaning of, and be able to compute, the minimum, the lower quartile, the median, the upper quartile, and the maximum of a data set.

Specific applications of Mathematical Reasoning (grade seven)

(1.1)   Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns.

(2.1)   Use estimation to verify the reasonableness of calculated results.

(2.2)   Apply strategies and results from simpler problems to more complex problems.

(2.3)   Estimate unknown quantities graphically and solve for them by using logical reasoning and arithmetic and algebraic techniques.

(2.4)   Make and test conjectures by using both inductive and deductive reasoning.

(2.5)   Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to explain mathematical reasoning.

(2.6)   Express the solution clearly and logically by using the appropriate mathematical notation and terms and clear language; support solutions with evidence in both verbal and symbolic work.

(2.7)   Indicate the relative advantages of exact and approximate solutions to problems and give answers to a specified degree of accuracy.

(2.8)   Make precise calculations and check the validity of the results from the context of the problem.

(3.1)   Evaluate the reasonableness of the solution in the context of the original situation.

(3.2)   Note the method of deriving the solution and demonstrate a conceptual understanding of the derivation by solving similar problems.

(3.3)   Develop generalizations of the results obtained and the strategies used and apply them to new problem situations.

Specific applications of Algebra I (grades eight through twelve)

(1.1)   Students use properties of numbers to demonstrate whether assertions are true or false.

(5.0)   Students solve multistep problems, including word problems, involving linear equations and linear inequalities in one variable and provide justification for each step.

(13.0) Students add, subtract, multiply, and divide rational expressions and functions. Students solve both computationally and conceptually challenging problems by using these techniques.

(15.0) Students apply algebraic techniques to solve rate problems, work problems, and percent mixture problems.

(24.1) Students explain the difference between inductive and deductive reasoning and identify and provide examples of each.

(24.2) Students identify the hypothesis and conclusion in logical deduction.

(24.3) Students use counterexamples to show that an assertion is false and recognize that a single counterexample is sufficient to refute an assertion.

(25.1) Students use properties of numbers to construct simple, valid arguments (direct and indirect) for, or formulate counterexamples to, claimed assertions.

(25.2) Students judge the validity of an argument according to whether the properties of the real number system and the order of operations have been applied correctly at each step.

(25.3) Given a specific algebraic statement involving linear, quadratic, or absolute value expressions or equations or inequalities, students determine whether the statement is true sometimes, always, or never.

1.2 *Science:*

Specific applications of Investigation and Experimentation (grades nine through twelve)

(1.a) Select and use appropriate tools and technology (such as computer-linked probes, spreadsheets, and graphing calculators) to perform tests, collect data, analyze relationships, and display data.

(1.d) Formulate explanations by using logic and evidence.

1.3 *History–Social Science:*

Specific applications of World History, Culture and Geography: The Modern World (grade ten)

(10.3) Students analyze the effects of the Industrial Revolution in England, France, Germany, Japan, and the United States.

(10.3.1) Analyze why England was the first country to industrialize.

(10.3.2) Examine how scientific and technological changes and new forms of energy brought about massive social, economic, and cultural change (e.g., the inventions and discoveries of James Watt, Eli Whitney, Henry Bessemer, Louis Pasteur, Thomas Edison).

(10.3.3) Describe the growth of population, rural to urban migration, and growth of cities associated with the Industrial Revolution.

(10.3.4)   Trace the evolution of work and labor, including the demise of the slave trade and the effects of immigration, mining and manufacturing, division of labor, and the union movement.

(10.3.5)   Understand the connections among natural resources, entrepreneurship, labor, and capital in an industrial economy.

(10.3.6)   Analyze the emergence of capitalism as a dominant economic pattern and the responses to it, including Utopianism, Social Democracy, Socialism, and Communism.

Specific application of United States History and Geography: Continuity and Change in the Twentieth Century (grade eleven)

(11.11)   Students analyze the major social problems and domestic policy issues in contemporary American society.

(11.11.1) Discuss the reasons for the nation's changing immigration policy, with emphasis on how the Immigration Act of 1965 and successor acts have transformed American society.

(11.11.2) Discuss the significant domestic policy speeches of Truman, Eisenhower, Kennedy, Johnson, Nixon, Carter, Reagan, Bush, and Clinton (e.g., with regard to education, civil rights, economic policy, environmental policy).

(11.11.3) Describe the changing roles of women in society as reflected in the entry of more women into the labor force and the changing family structure.

(11.11.4) Explain the constitutional crisis originating from the Watergate scandal.

(11.11.5) Trace the impact of, need for, and controversies associated with environmental conservation, expansion of the national park system, and the development of environmental protection laws, with particular attention to the interaction between environmental protection advocates and property rights advocates.

(11.11.6) Analyze the persistence of poverty and how different analyses of this issue influence welfare reform, health insurance reform, and other social policies.

(11.11.7) Explain how the federal, state, and local governments have responded to demographic and social changes such as population shifts to the suburbs, racial concentrations in the cities, Frostbelt-to-Sunbelt migration, international migration, decline of family farms, increases in out-of-wedlock births, and drug abuse.

Specific application of Principles of Economics (grade twelve)

(12.1)   Students understand common economic terms and concepts and economic reasoning.

(12.1.1) Examine the causal relationship between scarcity and the need for choices.

(12.1.2) Explain opportunity cost and marginal benefit and marginal cost.

(12.1.3) Identify the difference between monetary and nonmonetary incentives and how changes in incentives cause changes in behavior.

(12.1.4) Evaluate the role of private property as an incentive in conserving and improving scarce resources, including renewable and nonrenewable natural resources.

(12.1.5) Analyze the role of a market economy in establishing and preserving political and personal liberty (e.g., through the works of Adam Smith).

(12.2) Students analyze the elements of America's market economy in a global setting.

(12.2.1) Understand the relationship of the concept of incentives to the law of supply and the relationship of the concept of incentives and substitutes to the law of demand.

(12.2.2) Discuss the effects of changes in supply and/ or demand on the relative scarcity, price, and quantity of particular products.

(12.2.3) Explain the roles of property rights, competition, and profit in a market economy.

(12.2.4) Explain how prices reflect the relative scarcity of goods and services and perform the allocative function in a market economy.

(12.2.5) Understand the process by which competition among buyers and sellers determines a market price.

(12.2.6) Describe the effect of price controls on buyers and sellers.

(12.2.7) Analyze how domestic and international competition in a market economy affects goods and services produced and the quality, quantity, and price of those products.

(12.2.8) Explain the role of profit as the incentive to entrepreneurs in a market economy.

(12.2.9) Describe the functions of the financial markets.

(12.2.10) Discuss the economic principles that guide the location of agricultural production and industry and the spatial distribution of transportation and retail facilities.

(12.3) Students analyze the influence of the federal government on the American economy.

(12.3.1) Understand how the role of government in a market economy often includes providing for national defense, addressing environmental concerns, defining and enforcing property rights, attempting to make markets more competitive, and protecting consumers' rights.

(12.3.2) Identify the factors that may cause the costs of government actions to outweigh the benefits.

(12.3.3) Describe the aims of government fiscal policies (taxation, borrowing, spending) and their influence on production, employment, and price levels.

(12.3.4)   Understand the aims and tools of monetary policy and their influence on economic activity (e.g., the Federal Reserve).

(12.4)   Students analyze the elements of the U.S. labor market in a global setting.

(12.4.1)   Understand the operations of the labor market, including the circumstances surrounding the establishment of principal American labor unions, procedures that unions use to gain benefits for their members, the effects of unionization, the mini-mum wage, and unemployment insurance.

(12.4.2)   Describe the current economy and labor market, including the types of goods and services produced, the types of skills workers need, the effects of rapid technological change, and the impact of international competition.

(12.4.3)   Discuss wage differences among jobs and professions, using the laws of demand and supply and the concept of productivity.

(12.4.4)   Explain the effects of international mobility of capital and labor on the U.S. economy.

(12.5)   Students analyze the aggregate economic behavior of the U.S. economy.

(12.5.1)   Distinguish between nominal and real data.

(12.5.2)   Define, calculate, and explain the significance of an unemployment rate, the number of new jobs created monthly, an inflation or deflation rate, and a rate of economic growth.

(12.5.3)   Distinguish between short-term and long-term interest rates and explain their relative significance.

(12.6)   Students analyze issues of international trade and explain how the U.S. economy affects, and is affected by, economic forces beyond the United States borders.

(12.6.1)   Identify the gains in consumption and production efficiency from trade, with emphasis on the main products and changing geographic patterns of twentieth-century trade among countries in the Western Hemisphere.

(12.6.2)   Compare the reasons for and the effects of trade restrictions during the Great Depression compared with present-day arguments among labor, business, and political leaders over the effects of free trade on the economic and social interests of various groups of Americans.

(12.6.3)   Understand the changing role of international political borders and territorial sovereignty in a global economy.

(12.6.4)   Explain foreign exchange, the manner in which exchange rates are determined, and the effects of the dollar's gaining (or losing) value relative to other currencies.

2.0   *Communications*

Students understand the principles of effective oral, written, and multimedia communication in a variety of formats and contexts:

(The standards listed below retain the numbering in parentheses as specified in the original academic content standards documents.)

2.1 *Reading:*

Specific applications of English–language arts (grades nine and ten)

(2.1)   Analyze the structure and format of functional workplace documents, including the graphics and headers, and explain how authors use the features to achieve their purposes.

(2.2)   Prepare a bibliography of reference materials for a report using a variety of consumer, workplace, and public documents.

(2.3)   Generate relevant questions about readings on issues that can be researched.

(2.4)   Synthesize the content from several sources or works by a single author dealing with a single issue; paraphrase the ideas and connect them to other sources and related topics to demonstrate comprehension.

(2.5)   Extend ideas presented in primary or secondary sources through original analysis, evaluation, and elaboration.

(2.6)   Demonstrate use of sophisticated learning tools by following technical directions (e.g., those found with graphic calculators and specialized software programs and in access guides to World Wide Web sites on the Internet).

(2.7)   Critique the logic of functional documents by examining the sequence of information and procedures in anticipation of possible reader misunderstandings.

Specific applications of English–language arts (grades eleven and twelve)

(2.3)   Verify and clarify facts presented in other types of expository texts by using a variety of consumer, workplace, and public documents.

2.2 *Writing:*

Specific applications of English–language arts (grades nine and ten)

(1.3)   Use clear research questions and suitable research methods (e.g., library, electronic media, personal interview) to elicit and present evidence from primary and secondary sources.

(1.4)   Develop the main ideas within the body of the composition through supporting evidence (e.g., scenarios, commonly held beliefs, hypotheses, definitions).

(1.5)   Synthesize information from multiple sources and identify complexities and discrepancies in the information and the different perspectives found in each medium (e.g., almanacs, microfiche, news sources, in-depth field studies, speeches, journals, technical documents).

(1.6)   Integrate quotations and citations into a written text while maintaining the flow of ideas.

(1.7) Use appropriate conventions for documentation in the text, notes, and bibliographies by adhering to those in style manuals (e.g., *Modern Language Association Handbook, The Chicago Manual of Style).*

(1.8) Design and publish documents by using advanced publishing software and graphic programs.

(1.9) Revise writing to improve the logic and coherence of the organization and controlling perspective, the precision of word choice, and the tone by taking into consideration the audience, purpose, and formality of the context.

(2.3) Write expository compositions, including analytical essays and research reports:

    a. Marshal evidence in support of a thesis and related claims, including information on all relevant perspectives.

    b. Convey information and ideas from primary and secondary sources accurately and coherently.

    c. Make distinctions between the relative value and significance of specific data, facts, and ideas.

    d. Include visual aids by employing appropriate technology to organize and record information on charts, maps, and graphs.

    e. Anticipate and address readers' potential misunderstandings, biases, and expectations.

    f. Use technical terms and notations accurately.

(2.4) Write persuasive compositions:

    a. Structure ideas and arguments in a sustained and logical fashion.

    b. Use specific rhetorical devices to support assertions (e.g., appeal to logic through reasoning; appeal to emotion or ethical belief; relate a personal anecdote, case study, or analogy).

    c. Clarify and defend positions with precise and relevant evidence, including facts, expert opinions, quotations, and expressions of commonly accepted beliefs and logical reasoning.

    d. Address readers' concerns, counterclaims, biases, and expectations.

(2.5) Write business letters:

    a. Provide clear and purposeful information and address the intended audience appropriately.

    b. Use appropriate vocabulary, tone, and style to take into account the nature of the relationship with, and the knowledge and interests of, the recipients.

    c. Highlight central ideas or images.

    d. Follow a conventional style with page formats, fonts, and spacing that contribute to the documents' readability and impact.

(2.6) Write technical documents (e.g., a manual on rules of behavior for conflict resolution, procedures for conducting a meeting, minutes of a meeting):

    a. Report information and convey ideas logically and correctly.

    b. Offer detailed and accurate specifications.

    c. Include scenarios, definitions, and examples to aid comprehension (e.g., troubleshooting guide).

    d. Anticipate readers' problems, mistakes, and misunderstandings.

Specific applications of English–language arts (grades eleven and twelve)

(1.1)   Demonstrate an understanding of the elements of discourse (e.g., purpose, speaker, audience, form) when completing narrative, expository, persuasive, or descriptive writing assignments.

(1.3)   Structure ideas and arguments in a sustained, persuasive, and sophisticated way and support them with precise and relevant examples.

(1.6)   Develop presentations by using clear research questions and creative and critical research strategies (e.g., field studies, oral histories, interviews, experiments, electronic sources).

(1.7)   Use systematic strategies to organize and record information (e.g., anecdotal scripting, annotated bibliographies).

(1.8)   Integrate databases, graphics, and spreadsheets into word-processed documents.

(2.5)   Write job applications and resumes:
    a. Provide clear and purposeful information and address the intended audience appropriately.
    b. Use varied levels, patterns, and types of language to achieve intended effects and aid comprehension.
    c. Modify the tone to fit the purpose and audience.
    d. Follow the conventional style for that type of document (e.g., resume, memorandum) and use page formats, fonts, and spacing that contribute to the readability and impact of the document.

(2.6)   Deliver multimedia presentations:
    a. Combine text, images, and sound and draw information from many sources (e.g., television broadcasts, videos, films, newspapers, magazines, CD-ROMs, the Internet, electronic media-generated images).
    b. Select an appropriate medium for each element of the presentation.
    c. Use the selected media skillfully, editing appropriately and monitoring for quality.
    d. Test the audience's response and revise the presentation accordingly.

2.3 *Written and Oral English Language Conventions:*

Specific applications of English–language arts (grades nine and ten)

(1.1)   Identify and correctly use clauses (e.g., main and subordinate), phrases (e.g., gerund, infinitive, and participial), and mechanics of punctuation (e.g., semicolons, colons, ellipses, hyphens).

(1.2)   Understand sentence construction (e.g., parallel structure, subordination, proper placement of modifiers) and proper English usage (e.g., consistency of verb tenses).

(1.3) Demonstrate an understanding of proper English usage and control of grammar, paragraph and sentence structure, diction, and syntax.

(1.4) Produce legible work that shows accurate spelling and correct use of the conventions of punctuation and capitalization.

(1.5) Reflect appropriate manuscript requirements, including title page presentation, pagination, spacing and margins, and integration of source and support material (e.g., in-text citation, use of direct quotations, paraphrasing) with appropriate citations.

2.4 *Listening and Speaking:*

Specific applications of English–language arts (grade nine and ten)

(1.1) Formulate judgments about the ideas under discussion and support those judgments with convincing evidence.

(1.2) Compare and contrast the ways in which media genres (e.g., televised news, news magazines, documentaries, online information) cover the same event.

(1.3) Choose logical patterns of organization (e.g., chronological, topical, cause and effect) to inform and to persuade, by soliciting agreement or action, or to unite audiences behind a common belief or cause.

(1.7) Use props, visual aids, graphs, and electronic media to enhance the appeal and accuracy of presentations.

(2.3) Apply appropriate interviewing techniques:
   a. Prepare and ask relevant questions.
   b. Make notes of responses.
   c. Use language that conveys maturity, sensitivity, and respect.
   d. Respond correctly and effectively to questions.
   e. Demonstrate knowledge of the subject or organization.
   f. Compile and report responses.
   g. Evaluate the effectiveness of the interview.

(2.4) Deliver oral responses to literature:
   a. Advance a judgment demonstrating a comprehensive grasp of the significant ideas of works or passages (i.e., make and support warranted assertions about the text).
   b. Support important ideas and viewpoints through accurate and detailed references to the text or to other works.
   c. Demonstrate awareness of the author's use of stylistic devices and an appreciation of the effects created.
   d. Identify and assess the impact of perceived ambiguities, nuances, and complexities within the text.

(2.5) Deliver persuasive arguments (including evaluation and analysis of problems and solutions and causes and effects):
   a. Structure ideas and arguments in a coherent, logical fashion.

     b. Use rhetorical devices to support assertions (e.g., by appeal to logic through reasoning; by appeal to emotion or ethical belief; by use of personal anecdote, case study, or analogy).

     c. Clarify and defend positions with precise and relevant evidence, including facts, expert opinions, quotations, expressions of commonly accepted beliefs, and logical reasoning.

     d. Anticipate and address the listener's concerns and counterarguments.

(2.6)   Deliver descriptive presentations:

     a. Establish clearly the speaker's point of view on the subject of the presentation.

     b. Establish clearly the speaker's relationship with that subject (e.g., dispassionate observation, personal involvement).

     c. Use effective, factual descriptions of appearance, concrete images, shifting perspectives and vantage points, and sensory details.

Specific applications of English–language arts (grades eleven and twelve)

(2.4)   Deliver multimedia presentations:

     a. Combine text, images, and sound by incorporating information from a wide range of media, including films, newspapers, magazines, CD-ROMs, online information, television, videos, and electronic media-generated images.

     b. Select an appropriate medium for each element of the presentation.

     c. Use the selected media skillfully, editing appropriately and monitoring for quality.

     d. Test the audience's response and revise the presentation accordingly.

2.4 Students understand written business communication modes, such as memos, e-mail messages, one-page executive summaries, etc.

3.0 *Career Planning and Management*

Students understand how to make effective decisions, use information about careers, and manage personal career plans:

3.1 Know the personal qualifications, interests, aptitudes, knowledge, and skills necessary to succeed in careers.

3.2 Understand the scope of career opportunities and know the requirements for education, training, and licensure.

3.3 Develop a career plan that is designed to reflect career interests, pathways, and postsecondary options.

3.4 Understand the role and function of professional organizations, industry associations, and organized labor in a productive society.

3.5 Understand the past, present, and future trends that affect careers, such as technological developments and societal trends, and the resulting need for lifelong learning.

3.6 Know key strategies for self-promotion in the hiring process, such as job applications, résumé writing, interviewing skills, and portfolio preparation.

3.7 Explore career opportunities in business through such programs as virtual enterprise, work experience, and internships.

4.0   *Technology*

Students know how to use contemporary and emerging technological resources in diverse and changing personal, community, and workplace environments:

   4.1   Understand past, present, and future technological advances as they relate to a chosen pathway.
   4.2   Understand the use of technological resources to access, manipulate, and produce information, products, and services.
   4.3   Understand the influence of current and emerging technology on selected segments of the economy.
   4.4   Understand effective technologies used in Web site development and Internet usage.
   4.5   Know procedures for maintaining secure information, preventing loss, and reducing risk.

5.0   *Problem Solving and Critical Thinking*

Students understand how to create alternative solutions by using critical and creative thinking skills, such as logical reasoning, analytical thinking, and problem solving techniques:

   5.1   Apply appropriate problem-solving strategies and critical thinking skills to work-related issues and tasks.
   5.2   Understand the systematic problem-solving models that incorporate input, process, outcome, and evaluation components.
   5.3   Use critical thinking skills to make informed decisions and solve problems.
   5.4   Understand how financial systems and tools are used to solve business problems.

6.0   *Health and Safety*

Students understand health and safety policies, procedures, regulations, and practices, including equipment and hazardous material handling:

   6.1   Know policies, procedures, and regulations regarding health and safety in the workplace, including employers' and employees' responsibilities.
   6.2   Understand critical elements for health and safety practices related to storing, cleaning, and maintaining tools, equipment, and supplies.
   6.3   Understand the environmental and ergonomic risks associated with the use of business equipment and the financial impact of an unsafe work environment.

7.0   *Responsibility and Flexibility*

Students know the behaviors associated with the demonstration of responsibility and flexibility in personal, workplace, and community settings:

   7.1   Understand the qualities and behaviors that constitute a positive and professional work demeanor.
   7.2   Understand the importance of accountability and responsibility in fulfilling personal, community, and workplace roles.
   7.3   Understand the need to adapt to varied roles and responsibilities.
   7.4   Understand that individual actions can affect the larger community.

8.0   *Ethics and Legal Responsibilities*

Students understand professional, ethical, and legal behavior consistent with applicable laws, regulations, and organizational norms:

  8.1   Know major local, district, state, and federal regulatory agencies and entities that affect industry and how they enforce laws and regulations.
  8.2   Understand the concept and application of ethical and legal behavior consistent with workplace standards.
  8.3   Understand the role of personal integrity and ethical behavior in the workplace.
  8.4   Understand major local, state, and federal laws and regulations that affect business as well as the procedural requirements necessary for compliance.
  8.5   Know how to design systems and applications to allow access to all users.

9.0   *Leadership and Teamwork*

Students understand effective leadership styles, key concepts of group dynamics, team and individual decision making, the benefits of workforce diversity, and conflict resolution:

  9.1   Understand the characteristics and benefits of teamwork, leadership, and citizenship in the school, community, and workplace settings.
  9.2   Understand the ways in which preprofessional associations, such as DECA—A Marketing Association and Future Business Leaders of America (FBLA), and competitive career development activities enhance academic skills, promote career choices, and contribute to employability.
  9.3   Understand how to organize and structure work individually and in teams for effective performance and attainment of goals.
  9.4   Know multiple approaches to conflict resolution and their appropriateness for a variety of situations in the workplace.
  9.5   Understand how to interact with others in ways that demonstrate respect for individual and cultural differences and the attitudes and feelings of others.

10.0   *Technical Knowledge and Skills*

Students understand the essential knowledge and skills common to all pathways within the Information Technology sector:

  10.1   Know how to use a variety of business- and industry-standard software and hardware, including major proprietary and open standards.
  10.2   Understand the information technology components of major business functions (e.g., marketing, accounting, and human resource management) and their interrelationships.
  10.3   Understand the economic effects of technology on a business in the global marketplace.
  10.4   Know how financial systems and tools are used to perform business transactions through the use of technology.
  10.5   Use technology and electronic media to manage the work flow and to provide feedback.
  10.6   Understand the interrelationships between hardware components and supportive software.
  10.7   Analyze the functions, features, and limitations of different operating systems, environments, applications, and utilities.

10.8 Know how to use appropriate help resources (e.g., help desks, online help, and manuals) to install, configure, upgrade, diagnose, and repair operating systems, environments, applications, and utilities.

11.0 *Demonstration and Application*

Students demonstrate and apply the concepts contained in the foundation and pathway standards.

Pathway Standards

A. Information Support and Services Pathway

Students in the Information Support and Services Pathway prepare for careers that involve the implementation of computer services and software, the provision of technical assistance, and the creation of technical documentation and management of information systems. Mastery of information technologies is the foundation for all successful business organizations today. Persons with expertise in information support and services are in high demand for a variety of positions in business and industry.

A1.0 Students understand the potential impact of information systems in different organizations:

A1.1 Evaluate the systems-development life cycle and develop appropriate plans to maintain a given system after assessing its impact on resources.
A1.2 Evaluate support needs for different data and systems configurations.
A1.3 Understand the necessity of and procedures for communicating and documenting technical support provided.

A2.0 Students understand the process of systems implementation:

A2.1 Understand how to develop the purpose and scope of a systems project.
A2.2 Understand the criteria and processes for evaluating the functions of information systems.
A2.3 Know the processes needed to install and maintain systems.
A2.4 Know appropriate documentation support for information systems.

A3.0 Students understand key aspects of project management:

A3.1 Analyze business problems by using functional and cost-benefit perspectives.
A3.2 Know common organizational, technical, and financial risks associated with the implementation and use of systems.
A3.3 Know the functions of various tools used to manage projects involving the development of information systems.

A4.0 Students understand the process necessary to accomplish a task by using effective resource management:

A4.1 Know how to acquire, use, and manage both internal and external resources needed when supporting various organizational systems.
A4.2 Understand how to identify and integrate various organizational systems to achieve maximum efficiency and effectiveness.

A5.0   Students understand the dynamics of systems management and control:

    A5.1   Know appropriate policies and procedures to ensure the security and integrity of management systems.

    A5.2   Investigate, evaluate, select, and use major types of systems applications and vendors, including retail, manufacturing, and service management.

A6.0   Students understand how training and support ensure efficient, productive systems operations:

    A6.1   Analyze technical support needs.

    A6.2   Use technical writing and communication skills to work effectively with diverse groups of people.

    A6.3   Understand the principles of a customer-oriented service approach to users.

A7.0   Students understand software applications and life-cycle phases:

    A7.1   Know common industry-standard software and its applications.

    A7.2   Evaluate the effectiveness of software to solve specific problems.

    A7.3   Know a variety of sources for reference materials (e.g., online help, vendors' Web sites, online discussion groups, tutorials, and manuals).

    A7.4   Diagnose and solve software application problems.

    A7.5   Know current and emerging industry-standard technology and trends.

A8.0   Students understand the importance of reading, writing, and comprehending documentation in a technical environment:

    A8.1   Know appropriate search procedures for different types of information, sources, and queries.

    A8.2   Evaluate the accuracy, relevance, and comprehensiveness of retrieved information.

    A8.3   Analyze the effectiveness of online information resources to support collaborative tasks, research, publications, communications, and increased productivity.

A9.0   Students understand and implement quality assurance processes:

    A9.1   Know the characteristics and functions of available quality assurance tools and procedures for a variety of situations.

    A9.2   Understand techniques for optimizing quality assurance processes.

A10.0 Students understand and implement database management systems:

    A10.1   Know the variety of data types that are stored in database management systems.

    A10.2   Understand the ways in which tools for developing applications can be used to create information systems.

    A10.3   Understand the various structures appropriate for specific applications within database management systems.

    A10.4 Understand the development process of database schema.

    A10.5 Understand the possibilities for and limitations of converting data between databases and various applications.

B. Media Support and Services Pathway

Students in the Media Support and Services Pathway prepare for careers that involve creating, designing, and producing multimedia products and services, including the development of digitally generated or computer-enhanced media used in business. Organizations of all types and sizes use digital media (e.g., CDs, DVDs, Web sites) to communicate with existing and potential customers. Media support experts can find jobs in organizations doing such work as creating e-business Web sites.

B1.0   Students understand the effective use of tools for media production, development, and project management:

    B1.1   Know the basic functions of media design software, such as keyframe animation, two-dimensional design, and three-dimensional design.

    B1.2   Use appropriate software to design and produce professional-quality images, documents, and presentations.

    B1.3   Analyze the purpose of the media to determine the appropriate file format and level of compression.

    B1.4   Analyze media and develop strategies that target the specific needs and desires of the audience.

    B1.5   Understand the development and management process of a show (e.g., television programs, musicals, and radio programs).

    B1.6   Know the basic design elements necessary to produce effective print, video, audio, and Web-based media.

    B1.7   Use technical skills (e.g., pagination, printing, folding, cutting, and binding) to produce publishable materials.

B2.0   Students understand the effective use of communication software to access and transmit information:

    B2.1   Know multiple ways in which to transfer information and resources (e.g., text, data, sound, video, and still images) between software programs and systems.

    B2.2   Understand the differences between various Internet protocols (e.g., http, ftp, mailto, and telnet).

    B2.3   Use multiple online search techniques and resources to acquire information.

    B2.4   Know the appropriate ways to validate and cite Internet resources.

B3.0   Students understand the use of different types of peripherals and hardware appropriate to media and technology:

    B3.1   Understand the appropriate peripherals and hardware needed to achieve maximum productivity for various projects.

    B3.2   Know how to identify and integrate various types of peripherals and hardware to meet project requirements.

    B3.3   Use various types of audio and video equipment (e.g., digital cameras, recorders, scanners, Web cams, and CD and DVD recorders), as appropriate, for different projects.

    B3.4   Understand the types of media storage and the use of appropriate file formats, and know how to convert data between media and file formats.

B4.0   Students apply technical and interpersonal skills and knowledge to support the user:

B4.1   Use a logical and structured approach to isolate and identify problem sources and to resolve problems.

B4.2   Know the available resources for identifying and resolving problems.

B4.3   Use technical writing and communication skills to work effectively with diverse groups of people.

B4.4   Understand the principles of a customer-oriented service approach to users.

B5.0   Students understand and apply knowledge of effective Web page design and management:

B5.1   Understand the purpose, scope, and development of a Web site.

B5.2   Know the relative features, strengths, and weaknesses of different authoring programs and cross-platform issues.

B5.3   Use industry-standard programs to produce a Web-based business operation or simulation.

B5.4   Know the tools needed to enable multimedia capabilities (e.g., still images, animated graphics, sound, and video) for Web sites.

B5.5   Know strategies for optimizing Web design for fast delivery and retrieval.

B5.6   Know the tools needed to enable databases to collect data from Web site visitors (e.g., how to create forms and create a database of collected information and how to manage an online database) and the tools needed for general Web site management, including basic HTML coding, Web site statistical tracking, standard scripting languages, and advanced communications protocols.

B5.7   Know the full process of Web hosting, including registering domain names, setting up Web hosting, setting up e-mail addresses, and recognizing privacy issues.

B5.8   Understand the hardware (server) and software required for Web hosting.

B5.9   Know the tools and process for registering Web sites with search directories and engines and for enabling e-commerce capabilities (e.g., sell products, create a shopping cart, and handle credit card transactions).

B5.10   Differentiate among various versions of Internet programming languages.

C. Network Communications Pathway

Students in the Network Communications Pathway prepare for careers that involve network analysis, planning, and implementation, including the design, installation, maintenance, and management of network systems. The successful establishment and maintenance of information technology infrastructure is critical to the success of almost every twenty-first-century organization. Employment continues to grow for persons with expertise in network communications.

C1.0   Students understand how to identify and analyze the customer's organizational network system needs and requirements:

C1.1   Evaluate emerging products, services, and business models in relation to the creation, setup, and management of network communication products and services.

C1.2   Evaluate, create, and process voice, video, and data transmissions.

C1.3   Understand the effective management of human, financial, and communications resources from the standpoints of the user and the provider.

C1.4   Diagram physical and logical layouts of network communication systems.

C2.0   Students understand and use various types of networking models:

C2.1   Know the types of networks and their features and applications.

C2.2   Know how to implement a functional wired and wireless network, including the installation and configuration of components, software, and plug-ins.

C2.3   Understand the functions of various network devices, including network connectivity hardware.

C2.4   Distinguish between the topologies and protocols of local area networks and those of wide area networks.

C2.5   Understand the differences between various network environments (e.g., peer-to-peer, client-server, thin client, n-tier, internetworks, intranets, and extranets).

C2.6   Evaluate, select, and deploy a variety of network architectures and protocols.

C2.7   Apply appropriate technologies to improve network performance.

C2.8   Identify, analyze, and evaluate emerging communications technologies for use in organizations.

C3.0   Students understand network maintenance and user-support services:

C3.1   Know common customer policies and procedures, including those for management of incidents.

C3.2   Understand the security procedures necessary to maintain and support a network.

C3.3   Know the functions of common help-desk tools and resources, such as incident tracking, knowledge database, and staffing.

C3.4   Understand effective methods of disseminating information and instruction to users.

C4.0   Students understand network project management:

C4.1   Analyze network system interdependencies and constraints.

C4.2   Understand the processes used in managing and maintaining various types of electronic networks.

C4.3   Understand implications of key protocols and international standards and their impact on data transmission.

C5.0   Students understand network communication applications and infrastructure:

C5.1   Know the appropriate uses of communication services, products, and applications.

C5.2   Use a variety of online services (e.g., purchasing, selling, tracking, communicating, banking, and investing).

C5.3   Evaluate the features of communications software products in terms of their appropriateness to organizational tasks.

C5.4   Configure compatible systems across various platforms and types of media.

C6.0   Students understand network administration through the monitoring of the information and network systems:

C6.1   Understand the importance of classifying appropriate monitoring devices and procedures for quick identification and prevention of security violations.

C6.2   Know policies and procedures for routine administration (e.g., user agreement, incident reporting, and recovery for users).

C6.3   Know common potential risks and entrance points, including internal and external risks, and the tools used to neutralize them (e.g., firewalls; monitoring; and antivirus, spyware, and spam protection).

C6.4   Know common techniques for disaster prevention and recovery.

D. Programming and Systems Development Pathway

Students in the Programming and Systems Development Pathway prepare for careers that involve the design, development, and implementation of computer systems and software. Those careers require knowledge of computer operating systems, programming languages, and software development. Persons with expertise in programming and software development work with cutting-edge technologies to develop tomorrow's products for use by businesses and consumers.

D1.0   Students understand the strategies necessary to define and analyze systems and software requirements:

D1.1   Develop information technology-based strategies and project plans to solve specific problems.

D1.2   Know how systems and software requirements are determined in various situations.

D1.3   Know the effective use of tools for software development.

D1.4   Know the software development process.

D2.0   Students understand programming languages:

D2.1   Know the fundamentals of programming languages and concepts.

D2.2   Compare programs by using control structures, procedures, functions, parameters, variables, error recovery, and recursion.

D2.3   Understand digital logic, machine-level representation of data, memory-system organization, and use of assembly-level programming architecture.

D3.0   Students understand the creation and design of a software program:

D3.1   Analyze customers' needs and requirements for software.

D3.2   Know how specifications and codes are developed for new and existing software applications.

D3.3   Understand the abstract organization of information and how programs maintain the properties of the data structure while they perform such operations as search, insert, or load-balancing.

D3.4   Know multiple ways in which to store, retrieve, and access information.

D3.5   Understand how to track software versions.

D4.0   Students understand the process of testing, debugging, and maintaining programs to meet specifications:

D4.1   Know the steps involved in the software-testing process.

D4.2   Know the methodologies of program maintenance to preserve intended program applications and the operation of scheduled batch jobs and real-time jobs.

D4.3   Know how different systems and associated utilities perform such functions as file management, backup and recovery, and execution of programs.

D4.4   Understand the differences between simple and multiuser operating systems.

D5.0   Students understand the importance of quality assurance tasks in producing effective and efficient products:

D5.1   Know the standards and requirements for software quality assurance.

D5.2   Know common quality assurance tasks and their place in the development process.

D5.3   Understand the ways in which specification changes and technological advances can require the modification of programs.

D5.4   Know various sorting and searching methods and their comparative advantages.

D5.5   Know the characteristics of reliable, effective, and efficient products.

D6.0   Students understand the importance of effective interfaces in the interaction between humans and computer systems:

D6.1   Understand how to support access, privacy, and high ethical standards in computing.

D6.2   Use knowledge of cognitive, physical, and social interactions to create and design user-friendly computer practices and applications that meet the needs of the market.