

## South Dakota Information Technology

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Sioux Falls

### Participants:

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Todd Wohlwend, Southeast Technical Institute, Sioux Falls, SD

Participants introduced themselves stating name, location, and curricular area of expertise.

An introductory video, *Success in the New Economy* written and narrated by Kevin Fleming and produced by Bryan Y. Marsh, was shared. This video (available on the Internet at <https://vimeo.com/67277269>), describes a fallacy in the traditional “college for all” model of education and encourages individuals to select career paths based on interests and skills.

It was noted that the purpose of the work was to develop South Dakota’s state standards for information technology to ensure that they:

- Are aligned with industry needs
- Prepare students to be successful in employment and in postsecondary training
- Establish a sequence of courses leading to completion of a program of study.

It was clarified that standards describe “what” is to be learned, not “how” it is to be learned.

Program of study was defined as:

- A nonduplicative sequence of both academic and technical courses
- Beginning no later than grade 11 and continuing for at least two years beyond high school
- Culminating in a degree, diploma or certification recognized as valuable by business/industry partners.

A program of study was viewed as the bridge connecting preparatory and advanced work in high school with further study at the postsecondary level through a collegiate program or advanced training through work.

A summary of a recent labor market analysis for South Dakota was presented, with separate slides shown identifying the 20 largest industry clusters, the fastest growing industry clusters by percentage growth and increase in employment demand, and the occupations with a projected demand of 50 or more.

Participants were asked to identify industry trends by describing what was new in the industry, what is emerging in the industry but not yet routinely practiced, and what is no longer done in the industry. It

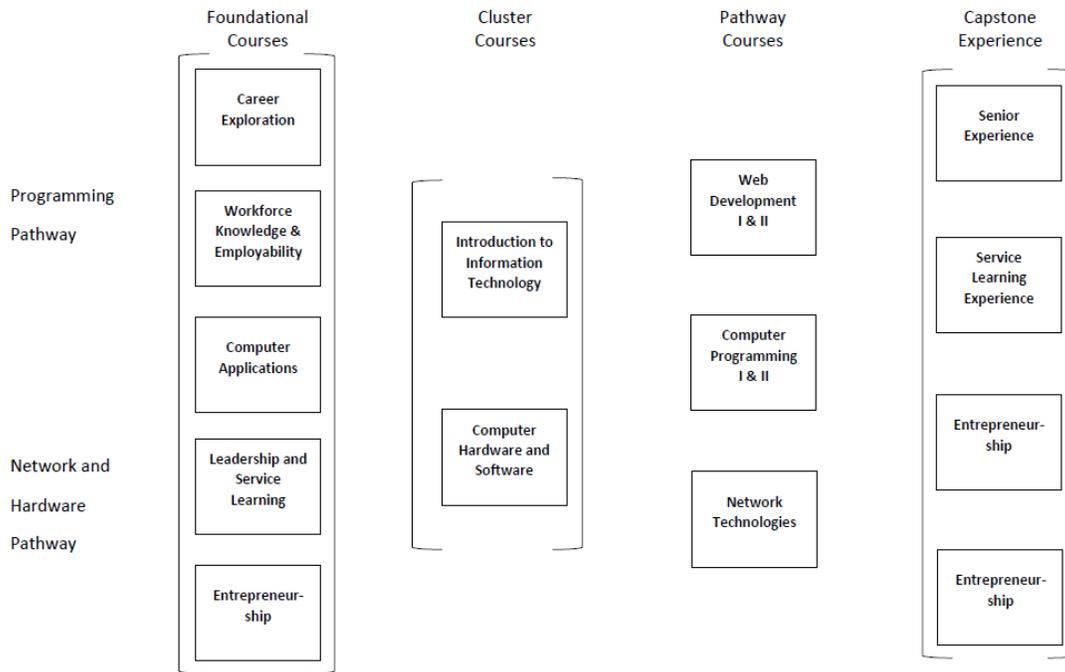
was intended that this information would guide discussion about where new standards were needed and where existing standards could be deleted. For information technology the results of this discussion were incorporated into the developed standards.

Results of a recent survey of employers were shared. The survey was designed to ascertain if employers were having hiring difficulties, if applicants were deficient in either soft or technical skills, and options for a state response. 140 survey responses were included in the results with largest participation from hospitality and tourism (30), architecture and construction (19), manufacturing (15), agriculture, food and natural resources (14), and transportation, distribution and logistics (10). In general:

- Four out of five employers noted having hiring difficulties in the previous 12 months.
- Primary reasons for this hiring difficulty were:
  - Low number of applicants (97)
  - Lack of work experience (67)
  - Lack of technical or occupational skills (34)
  - Inability to pass drug tests or having a criminal record (30)
  - Unwillingness to accept offered wages (29)
- Occupational areas noting the greatest hiring difficulties were hospitality (20), architecture & construction (16) and manufacturing (14) though these results are skewed by the response rate from the individual sector
- The most highly noted soft skills lacking were:
  - Initiative (85)
  - Attendance/dependability (84)
  - Communications (74)
  - Customer service (64)
  - Problem solving (55)
- Similarly, employers noted the highest needs for additional training in:
  - Attendance/timeliness/work ethic (75%)
  - Customer service (58%)
  - Problem-solving (53%)
  - Teamwork (41%)
- Two out of five employers noted that applicants lacked technical skills.
- Employers asked that the state response focus on:
  - Promotion of opportunities (11)
  - Teaching of ethics (11)
  - Teaching soft skills (6)

Participants were asked to chart out a new program of study incorporating course titles for which standards would be developed. The process involved placing course titles on post-it notes on the wall with an open process to place courses where deemed appropriate and add courses deemed necessary. It was decided by the group that the most effective structure would show the state's five foundational courses, two cluster courses of introduction to information technology and computer hardware and software, three pathway courses of web development I & II, computer programming I & II and network technologies, followed by capstone experiences. The resulting structure is shown in the chart below. The structure gives broad exposure to students for either of two pathways: programming, and network and hardware. The senior capstone experience is maintained.

## Information Technology Pathways



Information was provided about what makes good standards. These criteria included:

- Essential – does it define knowledge and skills that an individual must have to participate fully and effectively in programs that prepare them to enter careers with livable salaries, and to engage in career advancement in growing, sustainable industries?
- Rigorous – does it ask a student to demonstrate deep conceptual understanding through the application of knowledge and skills to new situations?
- Clear and specific – does it convey a level of performance without being overly prescriptive? Is it written in a way that the general public would understand?
- Teachable and Learnable – does it provide guidance to the development of curricula and instructional materials? Is it reasonable in scope?
- Measurable – Can it be determined by observation or other means that the student has gained the knowledge and skills to be demonstrated to show attainment of the standard?
- Coherent – Does it fit within the progression of learning that is expected for the program of study?
- Sequential – Does it reinforce prior learning without being unnecessarily repetitive? Does it provide knowledge and skills that will be useful as the student continues through the program of study?
- Benchmarked – Can the standard be benchmarked against industry or international standards? Does it prepare the student to be successful in the regional, state and global economies?

State agency staff met in May to review the processes to be used for standards review. During that session the staff identified other criteria to be considered when writing standards:

- Connections to postsecondary programs

- Relevant across the content area
- Compatible with virtual learning
- Reflects business/industry input
- Adaptable to change over time
- Allows for instructional creativity
- Appropriate for the target audience
- Aligned with relevant academic content
- Applicable to student organizations
- Recognizes unique features of CTE

These additional criteria were shared with participants for their consideration during standards development.

Participants were encouraged to identify a “big picture” concept statement describing what was to be accomplished within the course before developing standards. This “big picture” statement would eventually be revised to be an executive summary statement at the time that the standards were drafted.

A Standards Template was shared with the participants. A template was completed for each course. The elements of the template were reviewed with the group:

- The course title was inserted at the top.
- A grid of administrative information was completed to the extent the information was known. This grid included:
  - The Career Cluster [Information technology]
  - The Course Code [to be added by state staff]
  - Any prerequisites or recommended prior coursework
  - Credits [generally established by the individual school district]
  - Graduation requirement [generally established by the individual school district]
  - Program of study and sequence [a listing of the components of the program of study]
  - Student organization
  - Coordinating work-based learning [refer to spectrum of work-based learning activities]
  - Industry certifications [if appropriate for the course]
  - Dual-credit or dual enrollment
  - Teacher certification requirements
  - Resources
- Course description. Eventually this will be an executive summary describing the course, but in the process participants were encouraged to develop a “big picture” statement about the course to serve as a reminder when developing standards.
- Program of study application: a more detailed description of the elements within the program of study and where the particular course fits within a sequence.
- Course Standards and prods
  - “Prods” is a list of topics to keep in mind when developing standards to see that related topics are included. The prods identified by state staff include:
    - Safety
    - Soft skills
    - Reinforcing academic concepts in math, language arts, science and social studies
    - Addressing all aspects of the industry
    - Trends [so that students are thinking of the direction that an industry is moving]

- Indicators – the main topics written in terms of a demonstration of knowledge and skills
- Sub-indicators – statements identifying in more detail how the indicator will be demonstrated
- Integrated content – A space that allows for examples, explanation, reference to credentials, alignment with other academic standards or other useful information to bring clarity to the understanding about the intent of the sub-indicator
- Notes – a place for additional information to clarify the intent and expectations of the indicator.

An example was shared to ensure understanding.

Working teams were then established to write the standards. Each team selected a course to begin the work. Early drafts were reviewed by the consultants and participants were led with guiding questions so that they could refine their own work. Eventually, when standards had been developed for all courses, the participants did a final group review of all standards to give their approval. Final documents were then reviewed by the consultants for format and structure, and saved to the shared Dropbox. Participants were given two weeks to make any final comments or suggestions, at which time the Dropbox was put into a “read-only” status.

For Information Technology, the following course standards were developed:

### **Introduction to Information Technology**

IT 1 Understand the need and impact of technology.

IT 1.1 Define the relationship between electronic devices and computers

IT 1.2 Describe the functional areas in which computers assist people

IT 1.3. Describe how technology is impacting community

IT 1.4 List physical and mental health dangers associated with computer use

IT 2 Understand computer hardware required to meet specific needs

IT 2.1 Understand how computer information is represented

IT 2.2 Identify hardware components and their relationship to computer usage

IT 2.3 Understand different types of memory and storage

IT 2.4 Identify input and output devices to meet the needs of users

IT 2.5 Understand the decision-making process involved in purchasing computer systems

IT 3 Understand software solutions for personal and professional use

IT 3.1 Explain how software is created, distributed, installed and maintained

IT 3.2 Describe the functions of system software and operating systems

IT 3.3 Describe different types and purposes of productivity software

IT 4 Understand technology used for the Internet

IT 4.1 Describe how the Internet developed

IT 4.2 Explain how hardware, protocols, and software work together to create the Internet

IT 4.3 Explain the underlying structures and technologies used to support the Internet

IT 5 Understand computer network and telecommunications technologies

IT 5.1 Understand the fundamentals of data communications

IT 5.2 List the types of media, devices, and software needed for networking services

IT 5.3 List and describe the popular forms of wireless technologies

IT 6 Understand the needs and uses for digital media

IT 6.1 Understand the uses of digital media

IT 6.2 Discuss how interactive media is used to educate and entertain

IT 7 Understand computer crime and information security

- IT 7.1 Describe methods of keeping electronic devices secure
- IT 7.2 Discuss the threats and defenses for networks
- IT 7.3 Describe the threats posed by hackers, software, scams and the methods of defending against them
- IT 8 Understand technology ethics in a global society
  - IT 8.1 Describe the negative and positive impacts of social media
  - IT 8.2 Explain the ways in which technology is used to invade personal privacy
  - IT 8.3 Identify ethical issues related to digital technology
- IT 9 Explore careers in information technology
  - IT 9.1 Identify skills, interests and abilities related to information technology
  - IT 9.2 Compare personal interest survey results with information technology occupations
  - IT 9.3 Research labor market information for information technology
  - IT 9.4 Demonstrate necessary job skills needed for information and technology industries
- IT 10 Demonstrate knowledge of the software development process
  - IT 10.1 Apply tools for developing software applications
  - IT 10.2 Demonstrate knowledge of programming structures

### **Computer Hardware and Software**

- CIT 1 Apply knowledge of hardware design, operation and maintenance
  - CIT 1.1 Understand how to design and assembly systems that use computer programs to interact with hardware
  - CIT 1.2 Install and configure essential computer hardware and software components
- CIT 2 Understand the relationships among computer hardware, networks and operating systems
  - CIT 2.1 Identify new IT technologies relevant to computer hardware
  - CIT 2.2 Determine compatibility of hardware and software
  - CIT 2.3 Understand the different between an operating system, utility programs and application software
- CIT 3 Understand basic networking services
  - CIT 3.1 Understand the basics of Internet protocol (IP) addressing
  - CIT 3.2 Troubleshoot basic network problems
- CIT 4 Explore careers in information technology
  - CIT 4.1 Identify skills, interests, and abilities related to information technology
  - CIT 4.2 Identify personal interests using survey instruments with information technology occupations
  - CIT 4.3 Research labor market information for information technology
  - CIT 4.4 Demonstrate necessary job skills needed for information and technology industries

### **Web Development I & II**

- WD 1 Identify basic principles of how the Internet is constructed, how it functions and how it is used
  - WD 1.1 Identify the infrastructure required to access the Internet
  - WD 1.2 Summarize Internet development and functions
  - WD 1.3 Recognize the purpose of domains
  - WD 1.4 Define the function of a Domain Name Server (DNS)
  - WD 1.5 Define important Internet communications protocols and their roles in delivering basic Internet services
  - WD 1.6 Demonstrate knowledge of standard copyright rules
  - WD 1.7 Explain the use and purpose of acceptable use policy (AUP)
- WD 2 Demonstrate creation of web pages

- WD 2.1 Demonstrate knowledge required to create a web page
- WD 2.2 Demonstrate appropriate file structure and naming
- WD 2.3 Create web pages with appropriate HTML structure and standards that can be validated using World Wide Web Consortium validator (W3C)
- WD 2.4 Demonstrate the use of elements and attributes
- WD 2.5 Incorporate meta tags for page documentation and search engine optimization (SEO)
- WD 2.6 Implement advanced elements to create web pages
- WD 3 Format web pages using Cascading Style Sheets (CSS)
  - WD 3.1 Apply essential aspects of the CSS
  - WD 3.2 Apply CSS to a website
  - WD 3.3 Use selectors in a CSS
  - WD 3.4 Format page layout with advanced CSS
- WD 4 Plan, design, implement and maintain website(s)
  - WD 4.1 Analyze project requirements
  - WD 4.2 Plan site design and page layout
  - WD 4.3 Create content for website
  - WD 4.4 Upload and maintain a site
- WD 5 Explore advanced web concepts
  - WD 5.1 Demonstrate the use of scripting and other interactive tools
  - WD 5.2 Explore other web technologies
- WD 6 Explore careers in web development
  - WD 6.1 Explore information technology (IT) web development careers
  - WD 6.2 Demonstrate job skills for programming industries

### **Computer Programming I & II**

- CP 1 Identify and use a programming environment
  - CP 1.1 Demonstrate knowledge of external and internal computer hardware
  - CP 1.2 Demonstrate knowledge of software concepts
  - CP 1.3 Demonstrate the ability to compile, debug and execute programs
- CP 2 Employ standard conventions for creation and design of a software program
  - CP 2.1 Demonstrate the ability to use a standard programming style
  - CP 2.2 Recognize software development processes
  - CP 2.3 Identify the syntactical components of a program
- CP 3 Properly use language-fundamental commands and operations
  - CP 3.1 Demonstrate the ability to use basic elements of a specific language
  - CP 3.2 Employ basic arithmetic expressions in programs
  - CP 3.3 Demonstrate the ability to use data types in programs
  - CP 3.4 Incorporate functions/methods
- CP 4 Apply control structures
  - CP 4.1 Demonstrate the ability to use relational and logical operators in programs
  - CP 4.2 Investigate conditional statements
  - CP 4.3 Implement loops in programs
- CP 5 Explore career opportunities in programming
  - CP 5.1 Identify personal interests and abilities related to computer programming/software engineering careers
  - CP 5.2 Investigate career opportunities, trends and requirements related to computer programming/software engineering careers
  - CP 5.3 Demonstrate job skills for programming industries

CP 6 Integrate arrays

CP 6.1 Demonstrate the ability to use arrays in programs

CP 6.2 Demonstrate the ability to use strings in programs

CP 7 Implement object-oriented programming techniques

CP 7.1 Demonstrate the ability to use existing classes

CP 7.2 Demonstrate the ability to create user-defined classes

CP 7.3 Demonstrate proper design principles with classes

**Network Technologies**

NT 1 Demonstrate knowledge of designing and implementing a networking system

NT 1.1 Demonstrate knowledge of basic networking communications

NT 1.2 Demonstrate knowledge of basic network classifications and topologies

NT 1.3 Demonstrate knowledge of common network hardware

NT 1.4 Apply knowledge of local area network (LAN) physical media

NT 1.5 Demonstrate knowledge of communication standards for networks

NT 1.6 Plan, design and create network architecture

NT 1.7 Demonstrate knowledge of Network Operating Systems (NOS)

NT 2 Perform network operating system installation and configuration

NT 2.1 Install a network operating system

NT 2.2 Configure a network operating system

NT 2.3 Troubleshoot and resolve network problems

NT 3 Apply knowledge of network security systems

NT 3.1 Apply proper procedures for securing a network

NT 3.2 Demonstrate penetration testing and ethical hacking

NT 4 Demonstrate knowledge of common help desk tools, resources and techniques

NT 4.1 Use proper documentation and incident reporting

NT 4.2 Incorporate customer service skills

NT 5 Explore careers in network technology

NT 5.1 Identify skills, interests and abilities related to network technology

NT 5.2 Compare personal interest survey results with network technology occupations

NT 5.3 Research labor market information for network technology

NT 5.4 Demonstrate necessary job skills needed for information technology industries

NT 6 Maintain a safe and environmentally conscious environment

NT 6.1 Determine safe working practices to avoid or eliminate physical and electrical hazards

NT 6.2 Research environmental considerations when disposing of material

A cover letter has been drafted to guide business/industry feedback to the standards developed through this process. The seven standards documents will be reformatted with three columns for business/industry feedback at the sub-indicator level utilizing a 1 (low) to 5 (high) scale:

- Is the sub-indicator essential?
- Is the sub-indicator clear and specific?
- Is the sub-indicator measurable?

Business/industry partners are also asked if the standards reflect the preparation necessary for a student to enter her/his particular occupational field. A sample of the reformatted document follows.

**Course Standards**

CE 1: Analyze information about career opportunities to make informed career decisions.

|                              |  |                           | Essential<br>1 (low) – 5 (high) | Clear and Specific<br>1 (low) – 5 (high) | Measurable<br>1 (low) – 5 (high) |
|------------------------------|--|---------------------------|---------------------------------|--|----------------------------------|
| <i>Webb Level</i>            | <i>Sub-indicator</i>   | <i>Integrated Content</i> |                                 |  |                                  |
| Four<br>Extended<br>Thinking | CE 1.1 Investigate the knowledge and skills associated within the 16 career clusters.<br><i>Examples:</i> <ul style="list-style-type: none"> <li>• Complete hands-on activities related to each of the 16 career clusters to identify knowledge and skills (for example: a wax museum portraying different occupations from each cluster)</li> <li>• Interview people from each of the 16 career clusters.</li> <li>• Utilize guest speakers to share information about their careers.</li> <li>• Participate in face to face or virtual field trips to places of employment.</li> <li>• Use resources available on SD <a href="#">MyLife</a> to explore clusters and careers (for example: business networks, career coach discussion boards, career information, etc.).</li> </ul> |                           |                                 |  |                                  |

Following business/industry review, state staff will revise the standards documents as necessary to incorporate business/industry suggestions. The revised documents will be shared with participants in the standards development process and, eventually, with teachers of law and public safety courses throughout the state for their feedback. Final documents will be taken through public hearings and delivered to the State Board of Education for adoption.