Item 15:

Consider and Take Appropriate Action on Educator Standards for Technology Applications EC-12 and Computer Science 8-12

DISCUSSION AND ACTION

SUMMARY: The State Board for Educator Certification (SBEC) will have an opportunity to approve the entire set of Educator Standards, which define preparation and testing requirements, for the Technology Applications EC-12 and Computer Science 8-12 certificates, since a small part of the standards was inadvertently left out of the item presented to the SBEC on October 16, 2015. These standards delineate what the beginning teacher should know and be able to do. The standards will serve as the foundation for coursework and for new certification examinations.

STATUTORY AUTHORITY: The Texas Education Code (TEC), §21.041(b)(4).

PREVIOUS BOARD ACTION: The SBEC approved the Technology Applications EC-4 and 4-8 standards on May 5, 2000.The SBEC approved the Technology Applications 8-12 standards (which included the Computer Science standards) on October 6, 2000. The SBEC approved the Technology Applications EC-12 standards, which included the Computer Science 8-12 standards, on October 16, 2015.

BACKGROUND INFORMATION AND JUSTIFICATION: In Texas Administrative Code (TAC), §233.1(c), the SBEC determines that the standards underlying the certification examination for each category are aligned with the Texas Essential Knowledge and Skills (TEKS). Committees of stakeholders, practicing teachers and faculty in educator preparation, were assembled to review existing standards as well as latest TEKS. These committees identified gaps between the TEKS and older standards, proposed suggestions for revisions of standards to eliminate such gaps, and recommended these new standards for the certificates. Drafts of the standards were subsequently made available on the TEA website for public comment. The standards were then revised as necessary to incorporate feedback. Once approved, the standards presented here will guide the development of test frameworks for assessing educator candidates on the critical knowledge and skills for entry-level employment in each approved certificate field. The sections of the standards in Attachment III that apply to Technology Applications EC-12 are 1-7, 10, 12, and 13. The sections of the standards in Attachment III that apply to Computer Science 8-12 are 1-7, 8, 9, 11, and 14.

At the October 16, 2015 SBEC meeting, the board approved the Technology Applications EC-12 standards, which included the Computer Science 8-12 standards. However, it was discovered that the version of the standards included in the board item did not match the draft standards that were posted for public comment, and the draft standards included a typographical error that misreferenced the standards that apply to all educators. In addition, minor formatting revisions and a few minor errors were corrected in the standards. These errors occurred when a PDF version of the draft standards was converted to a Word document. The changes are outlined below and underlined in the attached standards for easy reference.

Standard II: The phrase "using digital tools and resources" was inadvertently not included in the summary page at the beginning of the standards document but did appear in the detail section for Standard II.

Standard IV: The detail section for this standard did not include teacher knowledge statements 4.1k-4.3k in the first column and skill statements 4.1s-4.9s in the second column.

Standard V: The words "and promote" were inadvertently not included in the description of Standard V at the top of the detail section but were included on the summary page at the beginning of the standards document.

Standard VI: The detail section for this standard did not include the last part of skill statement 6.19s and skill statements 6.20s-6.31s in the second column.

Standard VII: The detail section for this standard did not include teacher knowledge statements 7.1k-7.8k in the first column and skill statements 7.1s-7.9s in the second column.

Standard VIII: The detail section for this standard did not include knowledge statements 8.3k-8.6k in the first column and the last part of skill statement 8.8s as well as skill statements 8.9s-8.16s in the second column. One of the subsection headings was changed from "Technology operations, systems and concepts" to "Technology Operations and Concepts" to reflect wording and formatting for this heading in all other sections and in the wording of this standard.

Standards VIII-XIV: The last sentence in each of these standards should have ended with "Standards I-VII" instead of "Standards I-V" since Standards VI and VII also apply to all teachers.

Standard XII: The grade level reference for this standard was revised from 8-12 to 7-12 to reflect the grade level references of the other standards.

Standard XIII: The last two knowledge statements were misnumbered and should have been numbered as 13.5k and 13.6k.

Standard XIV: The last two lines of this standard were inadvertently not included in the summary page at the beginning of the standards document but did appear in the detail section for Standard XIV as follows: "… Knowledge and Skills (TEKS) in game/application development, in addition to the content described in Technology Applications Standards I-VII." The last seven knowledge statements were misnumbered and should have been numbered as 14.6k-14.12k.

FISCAL IMPACT: None.

PUBLIC AND STUDENT BENEFIT: Standards for each field certify high quality educators upon entry into the profession as measured by rigorous examinations.

PROCEDURAL AND REPORTING IMPLICATIONS: None.

LOCALLY MAINTAINED PAPERWORK REQUIREMENTS: None.

PUBLIC COMMENTS: The standards were posted on the TEA website for public comment from July 27 – August 30, 2015. Five individuals provided input. Copies of the comments are available for viewing.

Comment: A professor from Sam Houston State University indicated the standards were too broad, requiring too diverse a set of skills with no real assurance of competence in all areas.

Agency Response: The TEA supports the standards as presented by the committee. The certification examination will reflect the updated standards after the standards are approved by the SBEC. Because the standards are based on the TEKS, the certification examination will provide an assurance that those who pass the examination have an understanding of the critical knowledge and skills for entry-level employment in each approved certificate field.

Comment: The Director of Career and Technical Education at Irving ISD indicated the test was dated and used for many programs that do not share the same skill set. He advocated for two different tests.

Agency Response: The TEA supports the committee in its conclusion that the standards are appropriate to the certification as currently configured. The certification examination will reflect the updated standards after the standards are approved by the SBEC. Whether or not the certification is appropriate to the assignments in 19 TAC §231 can be addressed when that chapter is reviewed.

Comment: Another individual provided specific edits to the standards.

Agency Response: The TEA supports the standards as presented by the committee.

Comment: A professor at Texas Christian University compared the standards favorably to the International Society for Technology (ISTE) in Education standards, but would prefer Texas simply use the ISTE standards.

Agency Response: While other standards are useful guides for developing Texas standards, the Educator Standards are ultimately aligned to the TEKS, and this alignment best identifies teachers prepared to teach Texas's students.

Comment: The Senior Director of Professional Development of the Texas Computer Education Association said "Excellent job."

Agency Response: The TEA agrees the committee did an excellent job and recommends the standards to the SBEC.

ALTERNATIVES: None.

OTHER COMMENTS AND RELATED ISSUES: None.

ASSOCIATE COMMISSIONER'S RECOMMENDATION: I recommend that the State Board for Educator Certification:

Approve the Educator Standards for Technology Applications EC-12 and Computer Science 8-12 as presented.

Staff Members Responsible: Marilyn Cook, Director
Educator Certification and Testing

Rebecca McCoy, Manager
Educator Testing

Attachments:
I. Statutory Citations
II. Standards Development Committee List
III. Proposed Educator Standards

ATTACHMENT I

Statutory Citations Relating to Educator Standards

Texas Education Code, §21.031, Purpose:

(a) The State Board for Educator Certification is established to recognize public school educators as professionals and to grant educators the authority to govern the standards of their profession. The board shall regulate and oversee all aspects of the certification, continuing education, and standards of conduct of public school educators.

(b) In proposing rules under this subchapter, the board shall ensure that all candidates for certification or renewal of certification demonstrate the knowledge and skills necessary to improve the performance of the diverse student population of this state.

Texas Education Code, §21.041, Rules; Fees (excerpt):

(b) The board shall propose rules that:

(1) provide for the regulation of educators and the general administration of this subchapter in a manner consistent with this subchapter;

(4) specify the requirements for the issuance and renewal of an educator certificate;

ATTACHMENT II
Standards Development Committee List

Name	Grade Currently Teaching	Work/Institution	ESC
Karla Burkholdker	Director of Instructional Technology	Northside ISD	11
Ezequiel Cruz	PLTW Introduction to Engineering Design; AP Computer Science; Pre-Cal	Captain John L. Chapin High School, El Paso ISD	19
Nyree Doucette	Pre-K - 5th grade Multimedia; 3-5th grade Newspaper Advisor	Sinclair Elementary, Houston ISD	4
Noe Granado	6-8 Tech Apps; 9-12 Computer Maintenance	Gladys Porter High School, Brownsville ISD	1
Scott Hagedorn	Director of Technology	Hardin-Jefferson ISD	5
Monica Jones	Pre-K - 5th grade Computer Technologist	Whidby Health Science Magnet School, Houston ISD	4
Karen Kahan	Education Technology Manager	TEA	13
Euranie Patin	Technology Applications; Gifted and Talented	Martin Weiss Elementary School, Dallas ISD	10
Marty Daniel	Technology Integration Specialist	Houston ISD	4
Brian Ellyson	6-8th grade Electronic Media & Animation; 9-12th grade Graphic Design & Video Tech	Talkington School for Young Women Leaders, Lubbock ISD	17
Kim Arnold Garcia	Instructional Technology Coordinator	Georgetown ISD	13
Michele Hagood	9-12 Business Education	Canadian High School, Canadian High School	16
Frank Hammen	7-8th grade Technology Education; Web design; Concepts of Engineering; Principles of Arts/Audio Visual Technology	Ed White Middle School, North East ISD	20
Michelle Heard	7-8th grade Technology Applications Teacher; Campus Technology Specialist	Benjamin Franklin Middle School, Dallas ISD	10
Molly Kresta	9-12 grade; Commercial Photography; A/V Production; Professional Communications; Yearbook; Advisory	El Campo High School, El Campo ISD	3
Steve Tucker	9^{th} and 12^{th} grade Audio/Video Production I; Video Journalism; Studio Team; 11-12th grade IB Film	Hirschi High School, Wichita Falls ISD	9
Karen White	Technology Support Specialist; previously 6, 7,8, 12th grade Tech Apps Teacher	Central Texas College; Distance Learning	12

ATTACHMENT III
Technology Applications Standards

Standard I. All teachers use and promote creative thinking and innovative processes to construct knowledge, generate new ideas, and create products.

Standard II. All teachers collaborate and communicate both locally and globally using digital tools and resources to reinforce and promote learning

Standard III. All teachers acquire, analyze, and manage content from digital resources.

Standard IV. All teachers make informed decisions by applying critical-thinking and problem-solving skills.

Standard V. All teachers practice and promote safe, responsible, legal, and ethical behavior while using technology tools and resources.

Standard VI. All teachers demonstrate a thorough understanding of technology concepts, systems, and operations.

Standard VII. All teachers know how to plan, organize, deliver, and evaluate instruction for all students that incorporates the effective use of current technology for teaching and integrating the Technology Applications Texas Essential Knowledge and Skills (TEKS) into the curriculum.

Standard VIII. The computer science teacher has the knowledge and skills needed to teach the creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making; digital citizenship; and technology operations and concepts strands of the Technology Applications Texas Essential Knowledge and Skills (TEKS) in computer science, in addition to the content described in Technology Applications Standards I–VII.

Standard IX. The digital forensics teacher has the knowledge and skills needed to teach the creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making; digital citizenship; and technology operations and concepts strands of the Technology Applications Texas Essential Knowledge and Skills (TEKS) in digital forensics, in addition to the content described in Technology Applications Standards I–VII.

Standard X The digital art/animation teacher has the knowledge and skills needed to teach the creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making; digital citizenship; and technology operations and concepts strands of the Technology Applications Texas Essential Knowledge and Skills (TEKS) in digital art/animation, in addition to the content described in Technology Applications Standards I–VII.

Standard XI. The robotics teacher has the knowledge and skills needed to teach the creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making; digital citizenship; and technology operations and concepts strands of the Technology Applications Texas Essential Knowledge and Skills (TEKS) in robotics, in addition to the content described in Technology Applications Standards I–VII.

Standard XII. The digital communications teacher has the knowledge and skills needed to teach the creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making; digital citizenship; and technology operations and concepts strands of the Technology Applications Texas Essential Knowledge and Skills (TEKS) in digital communications, in addition to the content described in Technology Applications Standards I–VII.

Standard XIII. The Web design teacher has the knowledge and skills needed to teach the creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making; digital citizenship; and technology operations and concepts strands of the Technology Applications Texas Essential Knowledge and Skills (TEKS) in Web design, in addition to the content described in Technology Applications Standards I–VII.

Standard XIV. The game/application development teacher has the knowledge and skills needed to teach the creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making; digital citizenship; and technology operations and concepts strands of the Technology Applications Texas Essential Knowledge and Skill (TEKS) in game/application development, in addition to the content described in Technology applications Standards I-VII.

Standard I. **All teachers use and promote creative thinking and innovative processes to construct knowledge, generate new ideas, and create products.**	
Teacher Knowledge: What All Teachers Know ***Teachers of Students in Grades EC–12*** The beginning teacher knows and understands 1.1k how to use innovative technology and electronic communication to create new knowledge; 1.2k how to use prior knowledge to develop new ideas, products, and processes; and 1.3k how to demonstrate creative thinking, construct new knowledge, and develop innovative products and processes that use technology.	**Application: What All Teachers Can Do** ***Teachers of Students in Grades EC–12*** The beginning teacher is able to teach students to 1.1s design and create interdisciplinary multimedia presentations that include audio, video, text, and graphics; 1.2s explore complex systems or issues by using models, simulations, and new technologies to develop hypotheses, modify input, and analyze results; 1.3s analyze trends and forecast possibilities and develop steps for the creation of an innovative process or product; 1.4s apply prior knowledge to develop new ideas, products, and processes; and 1.5s create, present, publish, and copyright original works as a means of personal or group expression.

Standard II. **All teachers collaborate and communicate both locally and globally using digital tools and resources to reinforce and promote learning.**	
Teacher Knowledge: What All Teachers Know ***Teachers of Students in Grades EC–12*** The beginning teacher knows and understands 2.1k how to design and format digital information for appropriate and effective communication; 2.2k how to deliver a product electronically in a variety of media; 2.3k how to evaluate communication in terms of both process and product; and 2.4k how to use a variety of digital tools to create and manage personal and professional learning networks for collaboration, communication, and instruction.	**Application: What All Teachers Can Do** ***Teachers of Students in Grades EC–12*** The beginning teacher is able to teach students to 2.1s use technical writing strategies to create products such as a technical instruction guide; 2.2s participate in electronic communities as a learner, initiator, and contributor; 2.3s employ technological collaboration such as sharing information through online communications to complete tasks; 2.4s use groupware, collaborative software, and productivity tools to create products; 2.5s use technology in self-directed activities to create products for and share products with defined audiences; 2.6s evaluate student-created products through self- and peer review for relevance to the assignment or task prior to final submission; 2.7s use productivity tools, such as slide shows, posters, multimedia presentations, newsletters, banners, brochures, or reports, to create effective document files for defined audiences; 2.8s use a variety of media, formats, devices, and virtual environments to select, store, and deliver products; 2.9s design and create interdisciplinary multimedia presentations that include audio, video, text, and graphics for defined audiences; and 2.10s create and manage personal learning networks to collaborate and publish with peers, experts, or others by using digital tools such as blogs, wikis, audio/video communication, or other emerging technologies.

Standard III. **All teachers acquire, analyze, and manage content from digital resources.**	
Teacher Knowledge: What All Teachers Know ***Teachers of Students in Grades EC–12*** The beginning teacher knows and understands 3.1k how to use strategies for acquiring information from electronic resources in a variety of formats; 3.2k how to evaluate and validate acquired electronic information; and 3.3k how to access and use online help.	**Application: What All Teachers Can Do** ***Teachers of Students in Grades EC–12*** The beginning teacher is able to teach students to 3.1s use strategies to locate and acquire desired information from collaborative software and online resources; 3.2s apply appropriate electronic search strategies in the acquisition of information to guide inquiry, including keyword and Boolean search strategies; 3.3s use online help and other documentation; 3.4s determine and employ methods to evaluate electronic information for accuracy and validity; 3.5s resolve information conflicts and validate information by accessing, researching, and comparing data from multiple sources; 3.6s identify the source, location, media type, relevancy, and content validity of available information; and 3.7s process data and communicate results.

Standard IV. **All teachers make informed decisions by applying critical-thinking and problem-solving skills.**	
Teacher Knowledge: What All Teachers Know ***Teachers of Students in Grades EC–12*** The beginning teacher knows and understands 4.1k how to use appropriate computer-based productivity tools to create and modify solutions to problems; 4.2k how to use technology applications to facilitate evaluation of work, including both process and product; and 4.3k how to evaluate and modify steps to accomplish a task or the development of a process or product.	**Application: What All Teachers Can Do** ***Teachers of Students in Grades EC–12*** The beginning teacher is able to teach students to 4.1s discuss, explain, and evaluate the impact of technology applications on society and in various areas of study through research, interviews, and personal observation; 4.2s plan and manage activities to develop a solution, design a computer program, or complete a project; 4.3s collect and analyze data to identify solutions, make informed decisions, and support reasoning; 4.4s use multiple processes and diverse perspectives to explore alternative solutions; 4.5s evaluate and modify steps to make informed decisions and support reasoning to accomplish a task or the development of a process or product; 4.6s identify and define relevant problems and significant questions for investigation; 4.7s transfer current knowledge to the learning of newly encountered technologies; 4.8s evaluate the appropriateness of a digital tool to achieve the desired product; 4.9s use tools such as word processing, spreadsheets, databases, graphic organizers, charts, multimedia, simulations, models, and programming languages to collect, analyze, and represent data; 4.10s design and implement procedures to track trends, set timelines, and review/evaluate progress for continual improvement in process and product; 4.11s design and implement procedures for tracking trends, setting timelines, and reviewing and evaluating products through the use of technology tools such as database managers, daily/monthly planners, and project management tools; and 4.12s determine and employ technology specifications to evaluate projects for design, content delivery, purpose, and audience and demonstrate that established criteria or rubrics can be used to evaluate the process and product.

Standard V. **All teachers practice and promote safe, responsible, legal, and ethical behavior while using technology tools and resources.**	
Teacher Knowledge: What All Teachers Know ***Teachers of Students in Grades EC–12*** The beginning teacher knows and understands 5.1k laws and issues regarding the use of technology in society; 5.2k how to practice and explain ethical acquisition of information and standard methods for citing sources; 5.3k how to practice and explain safe and appropriate online behavior, personal security guidelines, digital etiquette, and acceptable use of technology.	**Application: What All Teachers Can Do** ***Teachers of Students in Grades EC–12*** The beginning teacher is able to teach students to 5.1s understand copyright laws, fair use guidelines, digital safety rules, creative commons, free and open source, public domain, violations, and issues including but not limited to computer hacking, computer piracy, intentional virus setting, and invasion of privacy; 5.2s model ethical acquisition and use of digital information, including using established methods to cite sources; 5.3s demonstrate proper etiquette and knowledge of acceptable use of electronic information and products while in an individual classroom, a lab, or on the Internet or an intranet; 5.4s model respect for intellectual property when manipulating, morphing, and editing graphics, video, text, and sound; 5.5s understand and explain the negative impact of inappropriate technology use, including online bullying and harassment, hacking, intentional virus setting, invasion of privacy, and piracy of software, music, video, and other media; and 5.6s understand and practice safe and responsible online behavior, personal security guidelines, digital etiquette, and acceptable use of technology.

Standard VI. **All teachers demonstrate a thorough understanding of technology concepts, systems, and operations.**	
Teacher Knowledge: What All Teachers Know ***Teachers of Students in Grades EC–12*** The beginning teacher knows and understands 6.1k the correct use of hardware components, software programs and various systems and their connections; 6.2k how to use software applications, including selecting and using software for a defined task; 6.3k how to compare and contrast various network systems; and 6.4k how to apply basic design principles.	**Application: What All Teachers Can Do** ***Teachers of Students in Grades EC–12*** The beginning teacher is able to teach students to 6.1s demonstrate knowledge and appropriate use of operating systems, hardware systems, network systems, virtual systems, learning systems, software applications, and communication and networking components; 6.2s manipulate files by using appropriate naming conventions, file management (including folder structures and tagging), file conversions, and emerging digital organizational strategies; 6.3s compare, contrast, and appropriately use various input, processing, output, and primary/secondary storage devices; 6.4s navigate systems and applications accessing peripherals both locally and remotely; 6.5s select and use software and Internet tools for a defined task according to quality, appropriateness, effectiveness, and efficiency; 6.6s delineate and make necessary adjustments regarding compatibility issues, including but not limited to digital file formats and cross-platform connectivity; 6.7s use and understand technology terminology appropriate to the task; 6.8s perform basic software application functions, including but not limited to opening an application program and creating, modifying, printing, and saving documents; 6.9s apply techniques and available resources (such as online help and knowledge bases) to troubleshoot minor technical problems with hardware and software; 6.10s evaluate and select technology tools based on licensing, application, and support; 6.11s how to compare and contrast LANs, WANs, the Internet, and intranets;

Standard VI. **All teachers demonstrate a thorough understanding of technology concepts, systems, and operations.**	
	6.12s use a variety of input and storage devices such as mouse/track pad, keyboard, microphone, digital camera, digital voice recorder, scanner, disk/disc, modem, and controller; 6.13s demonstrate keyboarding proficiency in technique and posture while building speed and accuracy; 6.14s use digital keyboarding standards for data input such as one space after punctuation, the use of em/en dashes, and smart quotation marks; 6.15s identify, create, and use files in various appropriate formats such as text, bitmapped/vector and raster graphics, image, video, and audio files; 6.16s access, manage, and manipulate information from secondary storage and remote devices; 6.17s use digital typography standards such as readable fonts, alignment, page setup, tabs, table properties, and ruler settings to plan, create, and edit word processing documents; 6.18s use advanced computational and graphic components, trending tools, all data types, formulas and functions, and chart information to plan, create, and edit spreadsheet documents; 6.19s plan, create, and edit databases by manipulating components, including defining fields, entering data, and designing layouts appropriate for reporting; 6.20s use relevant publication standards and graphic design principles to plan, create, and edit a digital publication; 6.21s demonstrate proficiency in the use of multimedia authoring programs by creating linear or nonlinear projects that incorporate text, audio, video, and graphics; 6.22s integrate two or more technology tools to create a new digital project; 6.23s differentiate between and demonstrate the appropriate use of a variety of graphic tools found in draw and paint applications and photo editing software; 6.24s create a variety of spreadsheet layouts containing descriptive labels and page settings;

Standard VI. **All teachers demonstrate a thorough understanding of technology concepts, systems, and operations.**	
	6.25s use a variety of media, formats, devices, and virtual environments to select and store products; 6.26s match the chart style to the data when creating and labeling charts; 6.27s discuss, explain, and evaluate the relevance of technology as it applies to college and career readiness, life-long learning, and daily living; 6.28s select and use appropriate collaboration tools; 6.29s evaluate products for relevance to the assignment or task; 6.30s use font attributes, color, white space, and graphics to ensure that products are appropriate for multiple communication media, including monitor display, Web, and print; and 6.31s discuss, explain, and evaluate the impact of technology applications through history and in various areas of study through research, interviews, and personal observation.

Standard VII. **All teachers know how to plan, organize, deliver, and evaluate instruction for all students that incorporates the effective use of current technology for teaching and integrating the Technology Applications Texas Essential Knowledge and Skills (TEKS) into the curriculum.**	
Teacher Knowledge: What All Teachers Know ***Teachers of Students in Grades EC–12*** The beginning teacher knows and understands 7.1k planning techniques to ensure that students have time to learn the Technology Applications TEKS in order to meet grade-level benchmark expectations; 7.2k where to find and how to use technological resources to implement the TEKS, to support instruction, to extend communication, to enhance classroom management, and to become more productive in daily tasks; 7.3k instructional strategies for teaching the Technology Applications TEKS and for integrating them into the curriculum; 7.4k strategies that students with diverse strengths and needs can use to determine word meaning in content-related texts; 7.5k strategies that students with diverse strengths and needs can use to develop content-area vocabulary; 7.6k strategies that students with diverse strengths and needs can use to facilitate comprehension before, during, and after reading content-related texts; 7.7k how to evaluate the effectiveness of technology-based instruction; and 7.8k how to set goals for ongoing professional development in teaching the Technology Applications TEKS and integrating them into the curriculum.	**Application: What All Teachers Can Do** ***Teachers of Students in Grades EC–12*** The beginning teacher is able to teach students to 7.1s use a range of instructional strategies for individuals and small/whole groups to plan applications-based technology lessons; 7.2s identify and address equity issues related to the use of technology, including but not limited to gender, ethnicity, language, disabilities, and student access to technology; 7.3s plan, select, and implement instruction that allows students to use technology applications in problem-solving and decision-making situations; 7.4s use technology applications to develop and implement tasks that emphasize collaboration and teamwork among members of a structured group or project team; 7.5s provide adequate time for teaching the Technology Applications TEKS; 7.6s identify and use resources to keep current with technology education; 7.7s create project-based learning activities that integrate the Technology Applications TEKS into the curriculum and meet the Technology Applications TEKS benchmarks; 7.8s follow guidelines for the legal and ethical use of technology resources; 7.9s select and use developmentally appropriate instructional practices, activities, and materials to improve student learning of the Technology Applications TEKS;

Standard VII. **All teachers know how to plan, organize, deliver, and evaluate instruction for all students that incorporates the effective use of current technology for teaching and integrating the Technology Applications Texas Essential Knowledge and Skills (TEKS) into the curriculum.**	
	7.10s use a variety of instructional strategies to ensure all students' reading comprehension of content-related texts, including helping students link the content of texts to their lives and connect related ideas across different texts; 7.11s locate, retrieve, and retain content-related information from a range of texts and technologies; 7.12s use appropriate sources, such as dictionaries, thesauruses, glossaries, and search engines to locate the meanings and pronunciations of unfamiliar content-related words; 7.13s use technology tools to perform administrative tasks such as taking attendance, maintaining grade books, and facilitating communication; 7.14s use formal and informal assessment methods to evaluate appropriately students' projects and portfolios; 7.15s collect observable and measurable data to gauge student progress and adjust instruction in Technology Applications; 7.16s conduct an ongoing self-assessment of strengths and weaknesses in the knowledge and skills of Technology Applications; 7.17s develop and implement an individual plan for professional growth in the knowledge and skills of Technology Applications; and 7.18s incorporate new strategies to improve classroom instruction in Technology Applications.

Standard VIII. **The computer science teacher has the knowledge and skills needed to teach the creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making; digital citizenship; and technology operations and concepts strands of the Technology Applications Texas Essential Knowledge and Skills (TEKS) in computer science, in addition to the content described in Technology Applications Standards I–VII.**	
Teacher Knowledge: What Teachers of Computer Science Know ***Teachers of Students in Grades 7–12*** The beginning teacher of computer science knows and understands **Creativity and Innovation** 8.1k how to use digital resources and communication to create new knowledge and share ideas; 8.2k how to develop products and generate new understandings by extending existing knowledge;	**Application: What Computer Science Teachers Can Do** ***Teachers of Students in Grades 7–12*** The beginning teacher of computer science is able to teach students to **Creativity and Innovation** 8.1s investigate and explore career opportunities within the computer science field and report findings through various media; 8.2s use online communities and digital products to extend the learning environment beyond the classroom by participating as a learner, initiator, contributor, and teacher/mentor; 8.3s participate in relevant, meaningful activities in the larger community and society to create electronic projects; 8.4s create and publish interactive stories, games, and animations; algorithms for solving problems; and Web pages by using a mark-up language along with creative and effective user interfaces; 8.5s create digital products to improve teaching and learning in the other subject areas; 8.6s compare, contrast, and select design methodologies and implementation techniques such as top-down, bottom-up, and black box; 8.7s analyze, modify, and evaluate existing code and large programs, including performing a case study on a large program that implements inheritance and black box programming; 8.8s identify and select the appropriate data type (integer, real, Boolean), abstract data type, advanced data structure, and supporting algorithms to manipulate and use the data in a program problem solution; 8.9s use visual organizers including Unified Modeling Language to read and write class specifications; 8.10s use graphs and trees to model computer science problems;

Standard VIII. **The computer science teacher has the knowledge and skills needed to teach the creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making; digital citizenship; and technology operations and concepts strands of the Technology Applications Texas Essential Knowledge and Skills (TEKS) in computer science, in addition to the content described in Technology Applications Standards I–VII.**	
	8.11s follow the systematic problem-solving process of identifying the specifications of purpose and goals, the data types and objects needed, and the subtasks to be performed; 8.12s write and use programming solutions to simulate the outcome of probabilities of events and expectations of random variables for problems such as games of chance;
Communication and Collaboration 8.3k how to format digital information for appropriate and effective communication; 8.4k how to deliver a product electronically in a variety of media; 8.5k how to work collaboratively to create a product; 8.6k how to evaluate communication in terms of both process and product;	**Communication and Collaboration** 8.13s write programs and communicate with proper programming style to enhance the readability and functionality of the code by using meaningful descriptive identifiers, internal comments, spacing, indentation, and a standardized program style; 8.14s to acquire data and display meaningful output, including simple vector and bitmap images; 8.15s publish information in a variety of ways (e.g., print, digital display, mobile application, Web pages, audio, video, and multimedia) and optimize data display by optimizing data visualization; 8.16s seek and respond to advice from peers and professionals in evaluating problem solutions, quality, and accuracy; 8.17s use the principles of software engineering to work collaboratively in software design teams to break a problem statement into specific solution requirements, create a program-development plan, code part of a solution from a program-development plan while a partner codes the remaining part, team test the solution for correctness, and develop presentations to report the solution findings; 8.18s convert spoken language statements to appropriate statements in propositional logic; 8.19s explain basic terminology of sets, functions, and relations; 8.20s define and provide examples of logical equivalence, normal forms, validity, and modus ponens/modus tollens;

Standard VIII. **The computer science teacher has the knowledge and skills needed to teach the creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making; digital citizenship; and technology operations and concepts strands of the Technology Applications Texas Essential Knowledge and Skills (TEKS) in computer science, in addition to the content described in Technology Applications Standards I–V<u>II</u>.**	
Research and Information Fluency 8.7k how to use a variety of strategies for acquiring information from electronic resources; 8.8k how to use programming languages and other techniques to process, analyze and to evaluate acquired electronic information;	**Research and Information Fluency** 8.21s use local area networks (LANs) and wide area networks (WANs), including the Internet and intranets, in research, file management, and collaboration; 8.22s use an assortment of resources together with various productivity tools to gather authentic data as a basis for individual and group programming projects; 8.23s understand programming file structure and file access and to acquire, process, write, and modify information from text files of known and unknown sizes; 8.24s construct truth tables for negation, conjunction, disjunction, implication, bi-conditional, and bit operators and to demonstrate propositional relations;
Critical Thinking, Problem Solving, and Decision Making 8.9k how to analyze problems and design algorithms; 8.10k how to use appropriate computer-based productivity tools and current programming languages to create and modify solutions to problems; 8.11k how to use technology applications to facilitate evaluation of work, including both process and product;	**Critical Thinking, Problem Solving, and Decision Making** 8.25s understand various number-base systems and use them to count, convert, and perform mathematical operations individually and between one another; 8.26s design and code a solution to a problem by identifying the program's purpose and goals, the data types and objects needed, the subtasks to be performed, and the reusable components from existing code; 8.27s understand and use variables in a program or programmed story, game, or animation, and understand the concept of scope; 8.28s manipulate data values by casting between data types and represent and manipulate text data by using concatenation and other string functions; 8.29s identify and use the following data structures to traverse, search, modify, insert, and delete data: one-dimensional array, two-dimensional array, two-dimensional ragged array, array of objects, and list object, including vector; 8.30s understand and create program solutions through the use of stacks, queues, trees, heaps, priority queues, graph theory, enumerated data types, sets (including HashSet and TreeSet), and maps (including HashMap and TreeMap);

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	8.31s use arithmetic operators to create mathematical expressions, including addition, subtraction, multiplication, real division, integer division, and modulus division; 8.32s demonstrate proficiency in the use of short-circuit evaluation and in the use of Boolean algebra, including De Morgan laws; 8.33s develop sequential algorithms to solve nonbranching and noniterative problems; 8.34s develop decision-making algorithms through the use of conditional (selection control) statements that use if-then-else statements; switch statements (case statements/multiway branches), including break, label, and continue; and nested conditional statements; 8.35s develop iterative algorithms that use for loops, while loops, do-while loops, and nested loops; 8.36s develop program solutions that use assignment, relational operators, logical operators, bitwise operators, ternary operator, and iterators; 8.37s create program solutions to problems by using available mathematics libraries, including absolute value, round, power, square, and square root; 8.38s develop program solutions that generate and use random numbers; 8.39s construct, evaluate, and compare searching algorithms, including linear and binary searches; 8.40s identify, describe, construct, evaluate, and compare sorting algorithms that perform sorting operations on data structures, including quadratic algorithms for selection, bubble, and insertion sorts; linearithmic algorithms for heap, quick, and merge sorts; and other efficient algorithms, including shell sort; 8.41s explore common algorithms, including finding the greatest common divisor, finding the biggest number out of three, finding primes, making a change, finding the average, performing matrix addition and multiplication, fractals, Towers of Hanoi, and magic squares;

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	8.42s develop algorithms to solve various problems, including factoring, summing a series, finding the roots of a quadratic equation, and generating Fibonacci numbers; 8.43s identify, trace, and appropriately use recursion in programming solutions, including algebraic computations; 8.44s understand and create program solutions through the use of hashing; 8.45s select the most appropriate algorithm for a defined problem; 8.46s compare and contrast the efficiency of search and sort algorithms, including linear, linearithmic, quadratic, and recursive strategies, by using informal runtime comparisons, exact calculation of statement execution counts, and theoretical efficiency values using big-O notation, including worst-case, best-case, and average-case time/space analysis; 8.47s understand object-oriented design concepts and the relationships among defined classes (including composition and inheritance), abstract classes, interfaces, nested classes (inner classes and outer classes), and anonymous classes; 8.48s design classes that include class declarations, local and global variable declarations, constant declarations, method declarations, parameter declarations, and interface declarations; 8.49s create subroutines that do and do not return typed values with and without the use of arguments and parameters, and identify the data-binding process between arguments and parameters; 8.50s instantiate objects of classes, and use reference variables for objects; 8.51s extend, modify, and improve existing code by using inheritance; use object reference scope identifiers, including null, this, and super; and create adaptive behaviors, including overloading and using polymorphism; 8.52s design and implement multiclass programs that use abstract classes and interfaces;

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	8.53s compare objects by using reference values and a comparison routine, duplicate objects by using deep and/or shallow copy, and examine and mutate the properties of an object using accessors and modifiers; 8.54s provide object functionality to primitive data types; 8.55s write program assumptions in the form of assertions, write a Boolean expression to test a program assertion, and construct assertions to make explicit program invariants; 8.56s create program solutions that exhibit robust behavior by understanding and avoiding runtime errors and handling anticipated errors, including division by zero and type mismatch; 8.57s identify problems and debug errors (including compile, syntax, runtime, and logic errors) by using error messages, reference materials, language documentation, and effective strategies; 8.58s test program solutions by entering valid and invalid test data; investigating boundary conditions; testing classes, methods, and libraries in isolation; and performing stepwise refinement; 8.59s analyze and modify existing code to improve the underlying algorithm; 8.60s perform pattern recognition by using regular expressions; 8.61s design and implement procedures to track trends, set timelines, and review/evaluate programming progress for continual improvement in process and product; 8.62s use appropriate models of sets, functions, and relations to analyze practical examples; 8.63s compare tautology, contradiction, and contingency as related to propositional equivalences; 8.64s compare and contrast examples and use of counterexamples, contrapositions, and contradictions; 8.65s describe the appropriate use and limitations of predicate logic, and apply formal methods of symbolic propositional and predicate logic;

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	8.66s use formal logic proofs and logical reasoning to solve problems; 8.67s outline the basic structure of proofs and compare the types of problems best satisfied by direct, indirect, contradiction, induction, existence, and constructive proofs; 8.68s relate mathematical induction to recursion and recursively defined structures and compare and contrast weak, strong, and structural 8.69s compare and contrast dependent and independent events; 8.70s use recurrence equations and counting techniques to analyze and solve algorithms and other practical problems; 8.71s apply probability tools to solve problems; 8.72s define, compare, and contrast simple graphs, multigraphs, and directed and undirected graphs through the use of definitions, properties, and examples, including special cases;
Digital Citizenship 8.12k understands safety, legal, cultural, and societal issues related to the use of technology and information;	**Digital Citizenship** 8.73s discuss intellectual property, privacy, sharing of information, copyright laws, software licensing agreements, and digital rights management and model ethical acquisition and the use of digital information, including using established methods to cite sources; 8.74s demonstrate proper etiquette and responsible use of electronic information, software, and online systems; 8.75s investigate measures such as passwords or virus detection/protection for protecting computer systems and databases from unauthorized use and tampering; 8.76s investigate how technology has changed and the social and ethical ramifications of its use (including the use of social media and social networking sites) and determine the reliability of information available through electronic media;

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	8.77s investigate how the concepts of discrete mathematics are related to relevant problems and significant questions;
Technology Operations and Concepts	**Technology Operations and Concepts**
8.13k the appropriate use of networking and hardware components, software programs, online systems, and their connections; and	8.78s compare, contrast, and use a variety of operating systems, software applications, hardware platforms, and networks;
8.14k the levels of programming languages and properties of a variety of current programming languages.	8.79s demonstrate knowledge of major hardware components, including primary and secondary memory, the central processing unit (CPU), input/output devices, and peripherals; 8.80s demonstrate knowledge of major networking components, including hosts, servers, switches, and routers; 8.81s demonstrate knowledge of computer communication systems (including single-user, peer-to-peer, workgroup, client-server, and networked) and create a small workgroup network; 8.82s demonstrate knowledge of computer-addressing systems (including Internet protocol [IP] address and media access control [MAC] address) and create and apply a basic network addressing scheme; 8.83s differentiate among properties of current programming languages, discuss the use of the languages in other fields of study, and demonstrate knowledge of specific programming terminology and concepts; 8.84s differentiate among the levels of programming languages (including machine, assembly, high-level compiled, scripted, and interpreted languages; compare and contrast high-level languages) and compare and contrast strongly typed and un-typed languages; 8.85s create discovery programs in a low-level language, high-level language, and scripting language; 8.86s demonstrate coding proficiency in contemporary programming languages, including an object-oriented language; 8.87s perform operations associated with sets, functions, and relations, including computing permutations and combinations of a set;

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	8.88s apply basic counting principles, including cardinality and the pigeonhole principle; 8.89s apply appropriate precedence when using logical operators and use appropriate strategies, including De Morgan laws, to identify propositional equivalences; 8.90s identify and appropriately use predicates, existential and universal quantifiers, and valid arguments; 8.91s identify possible applications of proofs, including evaluating algorithmic complexity; 8.92s state and appropriately use the product and sum rules; 8.93s solve a variety of basic recurrence equations; 8.94s apply the binomial theorem to independent events; and 8.95s demonstrate traversal methods for trees and graphs and relate trees and graphs to data structures, algorithms, and counting.

***Standard IX*. The digital forensics teacher has the knowledge and skills needed to teach the creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making; digital citizenship; and technology operations and concepts strands of the Technology Applications Texas Essential Knowledge and Skills (TEKS) in digital forensics, in addition to the content described in Technology Applications Standards I–VII.**	
Teacher Knowledge: What Teachers of Digital Forensics Know	**Application: What Teachers of Digital Forensics Can Do**
Teachers of Students in Grades 7–12	***Teachers of Students in Grades 7–12***
The beginning teacher of digital forensics knows and understands	The beginning teacher of digital forensics is able to teach students to
Creativity and Innovation	**Creativity and Innovation**
9.1k how to develop products and generate new understanding by extending existing knowledge;	9.1s describe the need for digital forensics, staffing requirements, and team interactions;
9.2k how to interpret policies, procedures, and regulations for the workplace environment, including employer and employee responsibilities;	9.2s define staff roles and responsibilities by creating policies;
	9.3s establish guidelines, procedures, and recommendations for the use of digital forensics tools;
	9.4s reconstruct computer security incidents by examining simulations and case studies of crime;
Communication and Collaboration	**Communication and Collaboration**
9.3k how to communicate and collaborate with peers to contribute to his or her own learning and the learning of others;	9.5s justify and describe the behaviors of and the impact of selecting a given system;
	9.6s use effective teamwork practices;
	9.7s seek and respond to advice from peers and professionals;
	9.8s describe considerations required for incident response;
Research and Information Fluency	**Research and Information Fluency**
9.4k how to locate, analyze, process and organize data;	9.9s classify possible sources of data;
9.5k how to use information and communication technologies to synthesize, summarize, compare, and contrast information from multiple sources;	9.10s gather, investigate, and report data collected;
	9.11s maintain data integrity while collecting files by copying files from media;
	9.12s analyze data files by locating files, extracting data, and using a digital forensics toolkit;
	9.13s investigate and examine operating system data;

***Standard IX*. The digital forensics teacher has the knowledge and skills needed to teach the creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making; digital citizenship; and technology operations and concepts strands of the Technology Applications Texas Essential Knowledge and Skills (TEKS) in digital forensics, in addition to the content described in Technology Applications Standards I–VII.**	
	9.14s use traffic data sources, including firewalls and routers, packet sniffers and protocol analyzers, intrusion detection systems, remote access, security event management software, and network forensic analysis tools; 9.15s collect, examine, and analyze data from multiple sources; 9.16s provide examples of how multiple data sources can be used during digital forensics, including investigating worm infections, malware, phishing incidents, viruses, trojans, rootkits, and e-mail threats;
Critical Thinking, Problem Solving, and Decision Making 9.6k use digital technologies to discern the quality and value of information collected and recognize bias and intent of the associated sources;	**Critical Thinking, Problem Solving, and Decision Making** 9.17s resolve information conflicts and validate information through data acquisition, research, and comparison; 9.18s examine and analyze network traffic data, including identifying events of interest, examining data sources, and identifying attacks;
Digital Citizenship 9.7k understands safety, legal, cultural, and societal issues related to the use of technology and information; and	**Digital Citizenship** 9.19s acquire digital information and use appropriate methods for citing the source; 9.20s identify and discuss intellectual property laws, issues, and use; 9.21s identify and describe the kinds of crimes investigated by digital forensics specialists; 9.22s compare and contrast legal, illegal, ethical, and unethical information gathering methods and identify possible gray areas; 9.23s identify and explain ways in which developing laws and guidelines affect digital forensics practices; 9.24s identify and describe businesses and government agencies that use digital forensics;

***Standard IX*. The digital forensics teacher has the knowledge and skills needed to teach the creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making; digital citizenship; and technology operations and concepts strands of the Technology Applications Texas Essential Knowledge and Skills (TEKS) in digital forensics, in addition to the content described in Technology Applications Standards I–VII.**	
Technology Operations and Concepts 9.8k understands technology concepts, systems, and operations as they apply to computer science.	**Technology Operations and Concepts** 9.25s demonstrate knowledge and appropriately use operating systems, software applications, and communication and networking components; 9.26s differentiate between and appropriately use various input, processing, output, and primary and secondary storage devices, including online storage; 9.27s make decisions regarding the selection, acquisition, and use of software, including its quality, appropriateness, effectiveness, and efficiency; 9.28s demonstrate knowledge of networks, including the Internet, intranets, and extranets; 9.29s differentiate between nonvolatile and volatile data; 9.30s explain technical procedures related to collecting operating system data; 9.31s describe the significance to digital forensics of the transmission control protocol/Internet protocol (TCP/IP) model, including application, transport, IP, and hardware layers; 9.32s describe the function and use of application components, including configurations settings, authentications, logs, application data, supporting files, and application architecture; and 9.33s describe the functions and use of application types, including e-mail, Web usage, interactive communications, file sharing, document usage, security applications, and data-concealment tools.

Standard X. **The digital art/animation teacher has the knowledge and skills needed to teach the creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making; digital citizenship; and technology operations and concepts strands of the Technology Applications Texas Essential Knowledge and Skills (TEKS) in digital art/animation, in addition to the content described in Technology Applications Standards I–VII.**	
Knowledge: What Teachers of Digital Art/Animation Know ***Teachers of Students in Grades 7–12*** The beginning teacher of digital graphics/animation knows and understands **Creativity and Innovation** 10.1k how to use technology to demonstrate creative thinking, constructs knowledge, and develops innovative products and processes using technology; 10.2k how to evaluate the use of graphic design elements;	**Application: What Teachers of Digital Art/Animation Can Do** ***Teachers of Students in Grades 7–12*** The beginning teacher of digital graphics/animation is able to teach students to **Creativity and Innovation** 10.1s evaluate, edit, and create scripts for animations; 10.2s identify color-mixing theories and apply these theories to create new colors and schemes in the digital format; 10.3s apply texture, transparency, skinning, tweening, and contour along a 3-D object surface; 10.4s compare, contrast, and integrate basic sound-editing principles, including the addition of effects and the manipulation of wave forms; 10.5s compare and contrast the rules of visual composition such as the rule of thirds and the golden section/rectangle with respect to harmony and balance as well as discord and drama; 10.6s assess the fundamental concepts of 3-D modeling and design, such as composition, perspective, angles, lighting, repetition, proximity, white space, balance, and contrast; 10.7s examine 3-D model objects to interpret the point of interest, the prominence of the subject, and visual parallels between the structures of natural and human-made environments; 10.8s evaluate the fundamental concepts of a graphic design, including composition and lighting; 10.9s analyze graphic designs to decide the point of interest and the attributes that determine prominence and support of the subject; 10.10s distinguish among the categories of typefaces while recognizing and resolving conflicts that occur through combined usage;

Standard X. **The digital art/animation teacher has the knowledge and skills needed to teach the creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making; digital citizenship; and technology operations and concepts strands of the Technology Applications Texas Essential Knowledge and Skills (TEKS) in digital art/animation, in addition to the content described in Technology Applications Standards I–VII.**	
	10.11s use perspective, including spot and directional light, backgrounds, ambience, shades and shadows, and hue and saturation; 10.12s use perspective, including backgrounds, light, shades/shadows, and scale to capture a focal point and create depth; 10.13s use the basic principles of proportion, balance, variety, emphasis, harmony, symmetry, and unity in type, color, size, line thickness, shape, and space; 10.14s edit files using appropriate digital editing tools and established design principles including consistency, repetition, alignment, proximity, ratio of text to white space, image file size, resolution, color use, font size, type, and style; 10.15s identify pictorial qualities in a design, such as shape and form, space and depth, and pattern and texture, to create visual unity and desired effects in designs;
Communication and Collaboration 10.3k how to use research skills and electronic communication to create new knowledge; 10.4k how to use technology applications to facilitate evaluation of work, including both process and product; 10.5k how to deliver a product electronically in a variety of media;	**Communication and Collaboration** 10.16s use technology to participate in self-directed, meaningful activities in the larger community and society; 10.17s use and understand the vocabulary related to digital art, audio, and animation software; 10.18s participate with electronic communities as a learner, initiator, contributor, and teacher/mentor; 10.19s create technology specifications for problem-solving tasks and rubrics to evaluate digital graphics/animation products and product quality against established criteria; 10.20s design and implement procedures to track trends, set timelines, and review/evaluate problem-solving progress; 10.21s determine and employ technology specifications to evaluate digital graphics/animation projects for design, content delivery, purpose, and audience;

Standard X. **The digital art/animation teacher has the knowledge and skills needed to teach the creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making; digital citizenship; and technology operations and concepts strands of the Technology Applications Texas Essential Knowledge and Skills (TEKS) in digital art/animation, in addition to the content described in Technology Applications Standards I–VII.**	
	10.22s seek and respond to advice from colleagues and other professionals in delineating technological tasks related to solving problems in digital graphics/animation; 10.23s publish information in a variety of formats;
Research and Information Fluency 10.6k how to acquire electronic information in a variety of formats;	**Research and Information Fluency** 10.24s distinguish among and correctly use process color (RGB, CMYK, and Pantone), spot color, and black/white; 10.25s research the history of and career choices in digital art and animation; 10.26s use the Internet to retrieve information in electronic formats, including text, audio, video, and graphics, citing the source; 10.27s demonstrate the appropriate use of digital imaging, video integration, and audio in files; 10.28s import audio, video, and multimedia files from a variety of sources; 10.29s create planning designs such as rough sketches, storyboards, and brainstorming;
Critical Thinking, Problem Solving, and Decision Making 10.7k how to use critical-thinking skills as well as appropriate digital tools and resources to plan and conduct research, manage projects, solve problems, and make informed decisions;	**Critical Thinking, Problem Solving, and Decision Making** 10.30s distinguish among and use the components of animation and 3-D animation software programs, including the animation control panel and cast, score, and stage; 10.31s distinguish between and use the animation techniques of path and cell animation and utilize basic animation tools such as onion-skinning and tweening; 10.32s use foreground, middle distance, and background images to create three-dimensional effects; 10.33s distinguish between and use different 3-D modeling techniques such as box modeling, transformation, and polygon primitives that use extrusion and rotation;

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	10.34s apply a variety of color schemes to digital designs, including monochromatic, analogous, complementary, primary/secondary triads, cool/warm colors, and split complements; 10.35s use the basic concepts of color and design theory, such as working in a bitmapped and vector mode to create backgrounds, characters, and other cast members as needed for an animation and 3-D animation; 10.36s use appropriate scripting languages to create an animation; 10.37s use a variety of lighting techniques, including shadows and shading, to create an effect; 10.38s define the design attributes and requirements of products created for a variety of purposes, including posters, billboards, business cards, banners, calendars, stationery, book jackets, folders, booklets, pamphlets, brochures, magazines, and e-publications; 10.39s define the design attributes and requirements of a 3-D animation project;
Digital Citizenship 10.8k the human, cultural, and societal issues related to technology, and practices legal and ethical behavior; and	**Digital Citizenship** 10.40s discuss copyright laws, licenses, issues, and fair use including creative commons and public domain and use of digital information such as attributing ideas and citing sources using established methods; 10.41s define plagiarism and model respect of intellectual property; 10.42s demonstrate proper digital etiquette and knowledge of responsible use policies when using technology; 10.43s evaluate the validity and reliability of sources;
Technology Operations and Concepts 10.9k the appropriate use of hardware components, software programs, online systems and applications, and their connections.	**Technology Operations and Concepts** 10.44s demonstrate knowledge and appropriate use of operating systems, software applications, online systems, and communication and networking components;

***Standard X*. The digital art/animation teacher has the knowledge and skills needed to teach the creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making; digital citizenship; and technology operations and concepts strands of the Technology Applications Texas Essential Knowledge and Skills (TEKS) in digital art/animation, in addition to the content described in Technology Applications Standards I–VII.**	
	10.45s make decisions regarding the selection, acquisition, and use of graphics and animation software, taking into consideration its quality, appropriateness, effectiveness, and efficiency; 10.46s delineate and make necessary adjustments regarding compatibility issues, including but not limited to digital file formats and cross-platform connectivity; and 10.47s read, use, and develop technical documentation related to digital art/animation.

Standard XI. **The robotics teacher has the knowledge and skills needed to teach the creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making; digital citizenship; and technology operations and concepts strands of the Technology Applications Texas Essential Knowledge and Skills (TEKS) in robotics, in addition to the content described in Technology Applications Standards I–VII.**	
Teacher Knowledge: What Teachers of Robotics Know	**Application: What Teachers of Robotics Can Do**
Teachers of Students in Grades 7–12	***Teachers of Students in Grades 7–12***
The beginning teacher of robotics knows and understands	The beginning teacher of robotics is able to teach students to
Mathematical Process Standards	**Mathematical Process Standards**
11.1k how to acquire and demonstrate mathematical understanding;	11.1s employ mathematics to problems arising in everyday life, society, and the workplace; 11.2s use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution; 11.3s select appropriate tools (including real objects, manipulatives, paper and pencil, and technology) and appropriate techniques (including mental math, estimation, and number sense) to solve problems; 11.4s use multiple representations (such as symbols, diagrams, graphs, and language) to convey mathematical ideas, reasoning, and their implications; 11.5s design and use representations to organize, record, and communicate mathematical ideas; 11.6s examine mathematical relationships to connect and communicate mathematical ideas; 11.7s exhibit, describe, and justify mathematical ideas and arguments through the use of precise mathematical language in written or oral communication;
Creativity and Innovation	**Creativity and Innovation**
11.2k how to develop products and generate new understanding by extending existing knowledge;	11.8s create and present a prototype that uses a variety of media; 11.9s utilize the design process to construct and refine the design of a robot; 11.10s construct robots of simple, moderate, and advanced complexity; 11.11s enhance a robot design to meet a specified need;

Standard XI. **The robotics teacher has the knowledge and skills needed to teach the creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making; digital citizenship; and technology operations and concepts strands of the Technology Applications Texas Essential Knowledge and Skills (TEKS) in robotics, in addition to the content described in Technology Applications Standards I–VII.**	
	11.12s demonstrate an understanding of and create artificial intelligence in a robot; 11.13s design behavior-based control algorithms;
Communication and Collaboration 11.3k how to communicate and collaborate with peers to contribute to his or her own learning and to the learning of others;	**Communication and Collaboration** 11.14s demonstrate an understanding of and implement design teams to solve problems; 11.15s function as a team leader and a team member; 11.16s design a solution to a problem and share a solution through various media; 11.17s document prototypes, adjustments, and corrections in the design process; 11.18s verify and present a final design, the testing results and the solution;
Research and Information Fluency 11.4k how to analyze, process, and organize data;	**Research and Information Fluency** 11.19s examine and evaluate a robot design; 11.20s implement position tracking to complete assigned robot tasks; 11.21s develop solution systems and implement systems analysis; 11.22s adjust a robot to respond to a change in specifications; 11.23s implement a system to identify and track all components of a robot;
Critical Thinking, Problem Solving, and Decision Making 11.5k how to use appropriate strategies to analyze problems and design algorithms; 11.6k how to demonstrate understanding and appropriate use of a variety of programming structures;	**Critical Thinking, Problem Solving, and Decision Making** 11.24s develop algorithms to control a robot, including applying instructions, collecting sensor data, and performing simple tasks; 11.25s design maneuvering algorithms to physically move the location of the robot and algorithms that provide interaction with the robot;

Standard XI. **The robotics teacher has the knowledge and skills needed to teach the creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making; digital citizenship; and technology operations and concepts strands of the Technology Applications Texas Essential Knowledge and Skills (TEKS) in robotics, in addition to the content described in Technology Applications Standards I–VII.**	
	11.26s demonstrate an understanding of and use output commands, variables, and sequence programming structure; 11.27s demonstrate an understanding of and use jumps, loops, and selection programming structures; 11.28s demonstrate an understanding of and use subroutines, accessors, and modifiers; 11.29s utilize decision-making strategies when developing solutions;
Digital Citizenship 11.7k safety, legal, cultural, and societal issues related to the use of technology and information; and	**Digital Citizenship** 11.30s explain intellectual property, privacy, sharing of information, copyright laws, and software licensing agreements; 11.31s demonstrate proper digital etiquette, responsible use of software, and knowledge of responsible use policies; 11.32s explore the effects robots have on our culture and society;
Technology Operations and Concepts 11.8k how to demonstrate technology concepts, systems, and operations as they apply to robotics.	**Technology Operations and Concepts** 11.33s use tools and laboratory equipment safely to construct and repair robots; 11.34s use software applications to simulate robotic behavior, present design concepts, and test solution strategies; 11.35s demonstrate the use of computers to manipulate a robot; 11.36s demonstrate knowledge of process-control design factors; 11.37s demonstrate knowledge of different types of sensors used in robotics; 11.38s demonstrate knowledge and use of effectors; 11.39s implement multiple sensors in a robot, interpret sensor feedback, and calculate threshold values; 11.40s apply measurement and geometry to calculate robot navigation;

Standard XI. **The robotics teacher has the knowledge and skills needed to teach the creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making; digital citizenship; and technology operations and concepts strands of the Technology Applications Texas Essential Knowledge and Skills (TEKS) in robotics, in addition to the content described in Technology Applications Standards I–VII.**	
	11.41s use shaft encoding to implement movement control; 11.42s implement path planning that uses geometry and multiple sensor feedback; 11.43s program a robot to perform simple tasks, including following lines, moving objects, and avoiding obstacles; 11.44s demonstrate and implement a robotic task solution that uses robotic arm construction; 11.45s demonstrate knowledge of feedback control loops to provide information; 11.46s demonstrate knowledge of torque and power factors used in the operation of a robot servo; and 11.47s troubleshoot and maintain robotic systems and subsystems.

Standard XII. **The digital communications teacher has the knowledge and skills needed to teach the creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making; digital citizenship; and technology operations and concepts strands of the Technology Applications Texas Essential Knowledge and Skills (TEKS) in digital communications, in addition to the content described in Technology Applications Standards I–VII.**	
Teacher Knowledge: What Teachers of Digital Communications Know	**Application: What Teachers of Digital Communications Can Do**
Teachers of Students in Grades 7–12	***Teachers of Students in Grades 7–12***
The beginning teacher of digital communications knows and understands	The beginning teacher of digital communications is able to teach students to
Creativity and Innovation	**Creativity and Innovation**
12.1k how to apply academic knowledge and skills in audio and video projects; 12.2k how to utilize information technology applications; 12.3k how to apply design systems;	12.1s employ English language arts knowledge and skills by demonstrating the use of appropriate technical concepts, vocabulary, and correct grammar and punctuation to write and edit publications, storyboards, and scripts; 12.2s demonstrate the effective use and importance of verbal, nonverbal, and written communication skills when presenting ideas and solutions to diverse audiences; 12.3s integrate knowledge of mathematics by determining the correct resolution and aspect ratio for keeping a file; 12.4s use personal information management, e-mail, Internet, publishing, presentation, and spreadsheet, or database applications for audio or video production projects; 12.5s use video concepts (including video conferencing, broadcasting, and social network environments) to manage communication apprehension, build self-confidence, and gain command of information; 12.6s demonstrate an understanding of the impact digital publications have on current and emerging media environments; 12.7s investigate and summarize the history and evolution of mass communications, including print and digital publishing and audio and video production;
Communication and Collaboration	**Communication and Collaboration**
12.4k how to actively apply interpersonal and communication skills to a variety of situations;	12.8s adapt language for audience, purpose, situation, and intent; 12.9s demonstrate innovative uses of a wide range of current and emerging technologies, including oral and

Standard XII. **The digital communications teacher has the knowledge and skills needed to teach the creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making; digital citizenship; and technology operations and concepts strands of the Technology Applications Texas Essential Knowledge and Skills (TEKS) in digital communications, in addition to the content described in Technology Applications Standards I–VII.**	
	written information, online learning, mobile devices, digital content, and Web 2.0 tools such as podcasting, wikis, and blogs; 12.10s use effective communication strategies such as active listening, leadership, and parliamentary procedure to collaborate with a variety of colleagues and experts to interpret and communicate information, data and observations in formal and informal settings; 12.11s demonstrate marketing and public relations skills such as timelines, research, product development, marketing material, and effective communication; 12.12s work in a team to develop collaborative and conflict-management skills; 12.13s understand rolls and participate appropriately in audio, video, and digital publishing teams by making clear requests, giving accurate directions, and asking purposeful questions;
Research and Information Fluency 12.5k how to engage in the preproduction process;	**Research and Information Fluency** 12.14s identify critical elements in the preproduction stage, including design procedures, timeline development, technology specifications, scripting techniques, and budgeting procedures; 12.15s make decisions regarding the selection, acquisition, and use of information gathered, taking into consideration its quality, appropriateness, effectiveness, and level of interest to society; 12.16s use current industry standards to plan and examine document, script, and storyboard development processes for a successful production; 12.17s construct real-world informational materials that inform, persuade, or recommend reform of selected issues, utilizing information graphics and design principals to facilitate understanding; 12.18s understand preproduction concepts such as identifying equipment, crew, and cast requirements; auditions; and casting processes; production;

Standard XII. **The digital communications teacher has the knowledge and skills needed to teach the creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making; digital citizenship; and technology operations and concepts strands of the Technology Applications Texas Essential Knowledge and Skills (TEKS) in digital communications, in addition to the content described in Technology Applications Standards I–VII.**	
Critical Thinking, Problem Solving, and Decision Making 12.6k use critical-thinking skills to conduct research, manage products, solve problems, and make informed decisions;	**Critical Thinking, Problem Solving, and Decision Making** 12.19s identify and define authentic problems and significant questions for investigation through audio, video, and digital publications; 12.20s develop independent problem-solving skills by utilizing technical documentation, including appropriate help options, to complete tasks; 12.21s design and implement procedures to track trends, set timelines, and review and evaluate progress for project completion; 12.22s design a portfolio to document work experiences and samples; 12.23s explore a variety of video genres such as narratives, animations, and documentaries, with emphasis on potential employment and entrepreneurship possibilities; 12.24s explore a variety of digital publishing options, including print and electronic documents, with emphasis on potential employment and entrepreneurship possibilities;
Digital Citizenship 12.7k examine ethical and legal behavior to demonstrate leadership as a digital citizen; 12.8k the human, cultural, and societal issues related to technology, and practices safe, legal, and ethical behavior;	**Digital Citizenship** 12.25s demonstrate ethical conduct and provide proper credit for ideas received from peers; 12.26s research and apply copyright laws, licenses, issues, and fair use (including creative commons and public domain) and use of digital information such as attributing ideas and citing sources using established methods; 12.27s model respect for intellectual property when manipulating, morphing, and editing graphics, video, text, and sound; 12.28s investigate the ethical impact that digital publishing and audio and video production have on society; 12.29s apply personal and workplace safety rules and regulations while following all emergency procedures;

Standard XII. **The digital communications teacher has the knowledge and skills needed to teach the creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making; digital citizenship; and technology operations and concepts strands of the Technology Applications Texas Essential Knowledge and Skills (TEKS) in digital communications, in addition to the content described in Technology Applications Standards I–VII.**	
Technology Operations and Concepts 12.9k how to develop an understanding of the current practice, future trends, and procedural protocols in the use of audio/video production and digital publications; 12.10k how to apply the postproduction process; and 12.11k how to use professional communication strategies.	**Technology Operations and Concepts** 12.30 determine the most appropriate file type based on universally recognized file formats for audio, video, and digital publications, such as WAV, MP3, OGG, MP4, AVI, MOV, PDF, PNG, JPG, IBA, and EPUB; 12.31s choose appropriate compression schemes for documents, images, audio, and video files, with consideration for audience and final platform; 12.32s demonstrate the use of audio and video for a multiscreen environment, including smartphones, computer tablets, televisions, projection equipment, computers, and emerging technologies; 12.33s exhibit various videography techniques (including lighting, composition, audio, resolution, voice-over editing, and delivery) in completion of a final product; 12.34s demonstrate the skills needed to create special lighting, animation, and voice-over effects with appropriate resources; 12.35s format digital information for effective communication for a defined audience; 12.36s select the appropriate evaluation tools and delivery methods for digital publications as well as audio and video files; 12.37s apply knowledge of postproduction strategies for audio, video, and digital publishing; and 12.38s deliver the product in a variety of media forms.

Standard XIII. **The Web design teacher has the knowledge and skills needed to teach the creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making; digital citizenship; and technology operations and concepts strands of the Technology Applications Texas Essential Knowledge and Skills (TEKS) in Web design, in addition to the content described in Technology Applications Standards I–VII.**	
Teacher Knowledge: What Teachers of Web Design Know	**Application: What Teachers of Web Design Can Do**
Teachers of Students in Grades 7–12	***Teachers of Students in Grades 7–12***
The beginning teacher of Web design knows and understands	The beginning teacher of Web design is able to teach students to
Creativity and Innovation	**Creativity and Innovation**
13.1k how to demonstrate creative thinking, construct knowledge, and develop innovative products and processes that use technology;	13.1s participate with electronic communities as a learner, initiator, contributor, and teacher/mentor; 13.2s use specific tools such as Web editors and Web-authoring programs to create a Web site; 13.3s assess the usability of an original Web site as it relates to a target audience; 13.4s generate new technologies based on current technical trends; 13.5s examine the use of virtualization in the classroom; 13.6s demonstrate knowledge of appropriate use of operating systems, software applications, and communication and networking components; 13.7s make decisions regarding the selection, acquisition, and use of software related to Web mastering, Web gaming, and Web communications, taking into consideration its quality, appropriateness, effectiveness, and efficiency;
Communication and Collaboration	**Communication and Collaboration**
13.2k how to use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning experience of others;	13.8s examine and apply the proper and acceptable use of digital/virtual communications technologies; 13.9s identify and implement the acquisition, sharing, and use of files, taking into consideration primary ownership and copyright; 13.10s implement decisions regarding the selection, acquisition and sharing of uniform resource locators (URLs) used in research; 13.11s use critical-thinking strategies to solve problems;

Standard XIII. **The Web design teacher has the knowledge and skills needed to teach the creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making; digital citizenship; and technology operations and concepts strands of the Technology Applications Texas Essential Knowledge and Skills (TEKS) in Web design, in addition to the content described in Technology Applications Standards I–VII.**	
	13.12s compare, evaluate, and implement the use of wired versus wireless access; 13.13s work collaboratively to create functioning Web-based programs and gaming products;
Research and Information Fluency 13.3k how to apply digital tools to gather, evaluate, and use information;	**Research and Information Fluency** 13.14s demonstrate skill in testing the accuracy of acquired information; 13.15s obtain and use appropriate vocabulary terms; 13.16s model ethical and legal acquisition of digital information and cite sources appropriately, following guidelines in the student code of conduct (including those pertaining to plagiarism and copyright laws; 13.17s ascertain and discuss the impact of emerging technologies; 13.18s comprehend the impact of Internet history and structure on current use; 13.19s obtain, assess, and use various Web standards such as those of the World Wide Web Consortium (W3C), Ecma International, and the Internet Corporation for Assigned Names and Numbers (ICANN) to make informed decisions and implement standards in original work; 13.20s understand, analyze, and determine the appropriate use of dynamic, static, and interactive Web sites; 13.21s understand, evaluate, and determine the appropriate use of open/closed source file formats and software; 13.22s recognize the use and application of a virtual private network (VPN); 13.23s distinguish among the protocols, including hypertext transfer protocol (HTTP), file transfer protocol (FTP), transmission control protocol/Internet protocol (TCP/IP); 13.24s demonstrate proficiency in the use of a variety of electronic input devices such as keyboard, scanner, voice/sound recorders, mouse, touch screen, and

Standard XIII. **The Web design teacher has the knowledge and skills needed to teach the creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making; digital citizenship; and technology operations and concepts strands of the Technology Applications Texas Essential Knowledge and Skills (TEKS) in Web design, in addition to the content described in Technology Applications Standards I–VII.**	
	digital video by incorporating such components while publishing Web pages; 13.25s demonstrate proper digital etiquette and knowledge of acceptable use policies when using networks, especially resources on the Internet and intranets; 13.26s demonstrate proficiency in, appropriate use of and navigation of local area networks (LANs), wide area networks (WANs), the Internet, and intranets for research and for sharing resources; 13.27s construct appropriate search strategies in the acquisition of information from the Internet, including keyword searches and searches with Boolean operators; 13.28s acquire information in electronic formats, including text, audio, video, and graphics; 13.29s discuss, analyze, compare, and contrast game types such as action, action adventure, adventure, construction and management simulation, life simulation, massively multiplayer online role-playing (MMORPG), music, party, puzzle, role-playing, sports, strategy, trivia, and vehicle simulation;
Critical Thinking, Problem Solving, and Decision Making 13.4k how to use critical-thinking skills and appropriate digital tools and resources to plan and conduct research, manage projects, solve problems, and make informed decisions;	**Critical Thinking, Problem Solving, and Decision Making** 13.30s demonstrate the transfer and adaptation of knowledge through the creation of original work; 13.31s assess and implement security measures to protect original work such as firewalls and hypertext transfer protocol secure (HTTPS); 13.32s substantiate current licensing issues for software being used for the creation of original work; 13.33s design technology specifications for tasks and evaluation rubrics to evaluate problem-solving processes; 13.34s optimize Web information for faster download on multiple devices such as dial-up and high-speed Internet and mobile devices; 13.35s seek and respond to advice from colleagues and other professionals in the review of Web sites;

Standard XIII. **The Web design teacher has the knowledge and skills needed to teach the creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making; digital citizenship; and technology operations and concepts strands of the Technology Applications Texas Essential Knowledge and Skills (TEKS) in Web design, in addition to the content described in Technology Applications Standards I–VII.**	
	13.36s read, use, and develop technical documentation; 13.37s analyze, examine, assess, and decide on a Web host, domain name, and issues related to acquisition and retention; 13.38s assess the functionality of a Web site (e.g., with respect to color scheme, grammar, technological constraints, age appropriateness, cross-platform usability, and user-relevant criteria) as it relates to an intended audience; 13.39s classify software file formats and their characteristics and appropriate use; 13.40s explore and choose electronic security methods for a Web server to protect from unauthorized access and negative intentions; 13.41s synthesize and draw conclusions from new information with data gathered from electronic and telecommunications resources; 13.42s design and create decision trees for a game's artificial intelligence engine;
Digital Citizenship 13.5k the human, cultural, and societal issues related to technology, and practices legal and ethical behavior; and	**Digital Citizenship** 13.43s engage in online activities that follow appropriate behavioral, communication, and privacy guidelines, including ethics, personal security, verbiage determined by the intended audience, and ethical use of files and file sharing; 13.44s understand the negative impact of the inappropriate use of technology, including online bullying and harassment; 13.45s employ online security guidelines, including identity protection, limited personal information sharing, and password protection of a secure Web site; 13.46s understand and respond to local, state, national, and global issues to ensure appropriate cross-browser and cross-platform usability; 13.47s examine the impact of Internet technologies on society through research, interviews, and personal observation;

Standard XIII. **The Web design teacher has the knowledge and skills needed to teach the creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making; digital citizenship; and technology operations and concepts strands of the Technology Applications Texas Essential Knowledge and Skills (TEKS) in Web design, in addition to the content described in Technology Applications Standards I–VII.**	
	13.48s participate in relevant, meaningful activities in the larger community and society to create online projects; 13.49s assess games and game ratings in terms of their impact on societal interactions; 13.50s analyze original Web-game artwork and digital portfolios created by peers and others to form precise conclusions about formal qualities, historical and cultural contexts, intents, and meanings;
Technology Operations and Concepts 13.6k how to demonstrate a sound understanding of technology concepts, systems, and operations.	**Technology Operations and Concepts** 13.51s demonstrate knowledge of hardware, including scanners, cameras, printers, video cameras, digital voice recorders, and external hard drives; 13.52s summarize the technical needs for and functionality and use of servers; 13.53s plan and design Web pages that are accessible to diverse audiences; 13.54s examine bandwidth issues as related to audience, server, connectivity, and cost; 13.55s establish a folder/directory hierarchy for storage of a Web page and its related and linked files; 13.56s identify basic design principles when creating a Web site, including white space, color theory, background color, shape, line, proximity, unity, balance (ratio of text to white space), alignment, typography, font size, type, style, image file size, repetition, contrast, consistency, and aesthetics; 13.57s demonstrate knowledge of the six core domains (e.g., gov, net, com, mil, org, and edu) and be familiar with new domain implementation; 13.58s apply escape codes, hypertext markup language (HTML), cascading style sheets (CSS), PHP: Hypertext Preprocessor (PHP), and JavaScript through hard coding, Web editors, and Web authoring programs utilizing interactive databases and server-side processing; 13.59s apply JavaScript and Java applet insertion;

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	13.60s design, create, and evaluate a fully functional online game that includes artificial intelligence and mathematical functions; 13.61s create, evaluate, and use video, including editing, compression, exporting, appropriateness, and delivery; and 13.62s demonstrate the ability to conduct secure communications from a Web server to a client.

Standard XIV. **The game/application development teacher has the knowledge and skills needed to teach the creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making; digital citizenship; and technology operations and concepts strands of the Technology Applications Texas Essential Knowledge and Skills (TEKS) in game/application development, in addition to the content described in Technology Applications Standards I–VII.**	
Teacher Knowledge: What Teachers of Game/Application Development Know ***Teachers of Students in Grades 7–12*** The beginning teacher of game/application development knows and understands	**Application: What Teachers of Game/Application Development Can Do** ***Teachers of Students in Grades 7–12*** The beginning teacher of game/application development is able to teach students to
Creativity and Innovation	**Creativity and Innovation**
14.1k the basic game design elements, including conceptual ideas, storyline, visualization, storyboard, game effects, sound elements, game play, game controls, and player tutorial; 14.2k the fundamentals of game art, including the look and feel, graphics coordinate system, basics of color, and color palettes; 14.3k how to create mobile applications and components that are best for the intended target audience;	14.1s create a design concept document and a storyboard; 14.2s use bitmap graphics images, including designing, creating, reading, and manipulating images; 14.3s design backgrounds, including solid, image, and tiled backgrounds; 14.4s create images that use geometric shapes by writing programs; 14.5s use sprites to create games by evaluating the role of sprites, creating sprites, and managing sprites; 14.6s exhibit an understanding of image rendering; 14.7s find, create, and edit game audio sound effects and music; 14.8s implement game sound mechanics, including playing, pausing, and looping; 14.9s create effective user interfaces appropriate for a specified mobile device that is best suited for an identified purpose; 14.10s design mobile applications that combine native and hybrid components;
Communication and Collaboration	**Communication and Collaboration**
14.4k design and implement procedures to set timelines for, track the progress of, set criteria for, and evaluate a game or mobile product; 14.5k how to communicate and collaborate with peers to contribute to his or her own learning and the learning of others;	14.11s seek and respond to input from peers and professionals in evaluating a game project; 14.12s demonstrate knowledge and appropriate use of operating systems, program development tools, and networking resources;

Standard XIV. **The game/application development teacher has the knowledge and skills needed to teach the creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making; digital citizenship; and technology operations and concepts strands of the Technology Applications Texas Essential Knowledge and Skills (TEKS) in game/application development, in addition to the content described in Technology Applications Standards I–VII.**	
	14.13s use network resources to obtain, arrange, maintain, and evaluate information; 14.14s collaborate to research the business of games, including the roles of the developer, the publisher, marketing, and retail sales; 14.15s demonstrate an understanding of and evaluate online technology, including online interaction and massive multiplayer games; 14.16s use teamwork in problem solving; 14.17s explain the development workflow of mobile applications; 14.18s document and share problem solutions through various media;
Research and Information Fluency 14.6k how to evaluate, analyze, and document game styles and playability; 14.7k how to analyze, identify, and describe the requirements of a mobile application;	**Research and Information Fluency** 14.19s participate in board games to research and collect game-play data; 14.20s explore the dramatic elements in games, including kinds of fun, player types, and nonlinear storytelling; 14.21s collect and analyze available data to identify mobile application project requirements; 14.22s analyze, identify, and describe input, output, and processing requirements; 14.23s analyze, identify, and define hardware and software specifications;
Critical Thinking, Problem Solving, and Decision Making 14.8k how to demonstrate an understanding of the game design process, including generating ideas, brainstorming, and paper prototyping; 14.9k the characteristics of and differences in current programming languages and paradigms;	**Critical Thinking, Problem Solving, and Decision Making** 14.24s write programs that use variables of different data types; 14.25s assess and write game rules and instructions; 14.26s demonstrate an understanding of the user experience; 14.27s develop game software and test a finished game product;

***Standard XIV*. The game/application development teacher has the knowledge and skills needed to teach the creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making; digital citizenship; and technology operations and concepts strands of the Technology Applications Texas Essential Knowledge and Skills (TEKS) in game/application development, in addition to the content described in Technology Applications Standards I–VII.**	
	14.28s write computer game code, resolve game defects, and revise existing game code; 14.29s compare and contrast available mobile technologies, including platforms and their operating systems; 14.30s establish the most appropriate solution for the development of a given mobile application, including browser-based, native, and hybrid approaches; 14.31s compare and contrast available programming languages and how their use might be applied to specific technologies and platforms; 14.32s identify and justify the selection of an appropriate programming language, including available resources and required interfaces; 14.33s compare and contrast available networks and their implications for mobile application development; 14.34s compare and contrast design strategies related to mobile network and device security;
Digital Citizenship 14.10k how to explore and understand safety, legal, cultural, and societal issues related to the use of technology and information;	**Digital Citizenship** 14.35s investigate intellectual property, privacy, sharing of information, copyright laws, and software licensing agreements; 14.36s model ethical acquisition and use of digital information, including using established methods to cite sources; 14.37s demonstrate proper etiquette and knowledge of acceptable use of electronic information and products while in an individual classroom, lab, or on the Internet or an intranet; 14.38s model respect for intellectual property when manipulating, morphing, and editing graphics, video, text, and sound; 14.39s understand and explain the negative impact of the inappropriate use of technology, including online bullying and harassment, hacking, intentional virus setting, invasion of privacy, and piracy;

Standard XIV. **The game/application development teacher has the knowledge and skills needed to teach the creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making; digital citizenship; and technology operations and concepts strands of the Technology Applications Texas Essential Knowledge and Skills (TEKS) in game/application development, in addition to the content described in Technology Applications Standards I–VII.**	
	14.40s assess the cultural aspects of game design fundamentals, including the rationales for games and types of games; 14.41s explain the potential risks and benefits associated with the use of a mobile application; 14.42s identify current and emerging technologies related to mobile applications; 14.43s evaluate technologies and assess their applicability to current mobile applications;
Technology Operations and Concepts 14.11k technology concepts, systems, and operations as they apply to game programming; and 14.12k technology concepts, systems and operations as they apply to game design and mobile application development.	**Technology Operations and Concepts** 14.44s identify basic game components, including the game engine, game play subsystems, data structures, models, and interfaces; 14.45s apply conditional statements in the creation of a program; 14.46s implement object-oriented game programming; 14.47s demonstrate an understanding of game programming essentials, including event-driven programming, the use of messages for communicating, and device management; 14.48s demonstrate an understanding of the role of game events, the animation loop, and game timing; 14.49s implement basic game screen design and layout, including visual controls, user interfaces, menus, and options; 14.50s use game control design to understand, access, and control input devices; 14.51s implement game animation, including the principles of animation and frame-based animation; 14.52s demonstrate an understanding of and implement collision detection, including bounding boxes and sprite collisions; 14.53s implement a tile-based game, including loading tile maps, drawing tile maps, rendering a tile map, and layering sprites;

***Standard XIV*. The game/application development teacher has the knowledge and skills needed to teach the creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making; digital citizenship; and technology operations and concepts strands of the Technology Applications Texas Essential Knowledge and Skills (TEKS) in game/application development, in addition to the content described in Technology Applications Standards I–VII.**	
	14.54s explain artificial intelligence and how it relates to game design and development; 14.55s design, program, and implement intelligent agents for various games; 14.56s demonstrate an understanding of game balance and tuning; 14.57s demonstrate an understanding of player progression, including leveling, linear progression, and maintaining high score data; 14.58s demonstrate an understanding of the difference between desktop and mobile applications; 14.59s demonstrate an understanding of hardware and software structures and requirements in the design of mobile applications; 14.60s demonstrate an understanding of how low bandwidth and the mobility of a device affect the design of mobile applications; 14.61s categorize applications that are best suited for mobile devices; 14.62s demonstrate an understanding of the use of libraries when designing mobile applications; 14.63s use a simulation tool to imitate a mobile device's functionality; and 14.64s use mobile devices to test mobile applications.