Memorandum

To: State Board of Education

From: Risa A. Regnier, Director of Educator Licensing

Date: September 4, 2019

Re: Adoption of Updated REPA Educator Standards in Four Content Areas

Background:

The Indiana Educator Standards that underpin educator preparation programs and the CORE licensure assessments were initially adopted by the Indiana Professional Standards Board in December 2010. Beginning in 2015, the Indiana Department of Education (IDOE) and its licensure test vendor, Evaluation Systems of Pearson, undertook a process to review the Educator Standards and prioritize the revision/updating of standards on an ongoing basis, including the redevelopment of the respective licensure tests as necessary. Initially, seven content area standards were identified for updating, and that work was divided into two phases: Phase One consists of Computer Science, Middle School Mathematics, Middle School English/ Language Arts, and Middle School Science. Phase Two includes Elementary Generalist, Middle School Social Studies, and Secondary Historical Perspectives.

The process for updating the educator standards was facilitated by Pearson personnel and observed by IDOE's Director of Educator Licensing, the Director of Higher Education and Educator Preparation Programs, and the Educator Preparation Program and P12 Partnership Specialist. The process actively engaged IDOE subject matter experts (SMEs), Pearson SMEs, committees of Indiana licensed teachers and teacher educators from each content area, and included a public comment period. The standards revision process has now concluded for Phase One and the updated Educator Standards for Computer Science, Middle School Mathematics, Middle School English Language Arts, and Middle School Science are ready to be adopted. Following adoption, the IDOE will undertake a communication plan with the educator preparation programs and the public to disseminate and post the updated Educator Standards and to establish a timeline for EPPs to ensure ongoing program alignment. Redevelopment of the respective CORE tests will continue with a goal of summer 2020 for operational tests.

The following documentation is attached for reference:

1. Milestones and timeline for key development and redevelopment activities completed for the Phase One content areas.

2. Final versions of the updated Educator Standards eligible for adoption.

3. Track-change versions of the Educator Standards showing the revisions following public comment, except for the Middle School Science; there were no revisions resulting from the public comments for this field.

<u>Recommendation</u>:

The Indiana Department of Education recommends adoption of the updated Educator Standards for Computer Science, Middle School Mathematics, Middle School English Language Arts, and Middle School Science.

Indiana Content Standards
for Educators

COMPUTER SCIENCE

Computer science teachers are expected to have a broad and comprehensive understanding of the knowledge and skills needed for this educator license, and to use that knowledge to help students prepare for the challenges and opportunities of the twenty-first century. This requires the ability to identify, comprehend, analyze, synthesize, and evaluate the basic principles, fundamental concepts, and essential content defined in these standards, and to apply that knowledge to the tasks of planning and delivering effective instruction and assessment.

DRAFT

July 2019

Standard 1: Data and Information

Computer science teachers have a broad and comprehensive understanding of the collection, storage, presentation, analysis, and interpretation of data.

Standard 2: Computing Devices and Systems

Computer science teachers have a broad and comprehensive understanding of computing devices, their components, the relationship between hardware and software, and basic techniques of troubleshooting.

Standard 3: Programs and Algorithms

Computer science teachers have a broad and comprehensive understanding of computational thinking, algorithms and problem solving, and programming concepts associated with variables, program control, modularity, and program development.

Standard 4: Networking and Communication

Computer science teachers have a broad and comprehensive understanding of the characteristics of computer networks, cybersecurity, and the Internet.

Standard 5: Impact and Culture

Computer science teachers have a broad and comprehensive understanding of the influence of computing technology on culture, societal interactions, and issues associated with safety, law, and ethics.

Standard 6: Computer Science Instruction and Assessment

Computer science teachers have a broad and comprehensive understanding of content-specific curricula, instruction, and assessment in computer science.

Standard 1: Data and Information

Computer science teachers have a broad and comprehensive understanding of the collection, storage, presentation, analysis, and interpretation of data, including:

1.1   technology and appropriate multimedia resources to conduct research and to support learning across the curriculum

1.2   digital tools to locate, search, manipulate, modify, store, and present data for a given purpose

1.3   evaluation of the accuracy, relevance, appropriateness, comprehensiveness, and biases that occur in electronic information sources

1.4   representation of data in a variety of ways (e.g., binary sequences, numbers, texts, sounds, images), and different visual representations of problems, structures, and data (e.g., graphs, charts, network diagrams, flowcharts)

1.5   types of databases (e.g., relational, hierarchical), principles of database design (e.g., tables, SQL), and database administration and management

Standard 2: Computing Devices and Systems

Computer science teachers have a broad and comprehensive understanding of computing devices, their components, the relationship between hardware and software, and basic techniques of troubleshooting, including:

2.1   input and output devices

2.2   major computer system components and their properties

2.3   operating systems and the relationship between hardware and software

2.4   characteristics of computers and computing in daily life (e.g., voice mail, downloading video and audio files, Internet of things, wireless Internet, microcontrollers, mobile computing devices)

2.5   technology resources (e.g., data collection probes, mobile devices, videos, educational software, virtual and augmented reality, Web tools) for problem solving and to facilitate and support the learning process

2.6   productivity tools (e.g., word processing, spreadsheet, presentation software, Web and application-based productive tools) to facilitate learning and to support individual and collaborative writing, communication, and publishing activities

2.7   informatics and developing trends in computing (e.g., cyber-physical systems [CPS], network function virtualization [NFV], machine learning and artificial intelligence, smart homes, robotics, cloud computing)

2.8   troubleshooting strategies to identify and solve routine hardware and software problems that occur during everyday computer use

Standard 3: Programs and Algorithms

Computer science teachers have a broad and comprehensive understanding of computational thinking, algorithms and problem solving, and programming concepts associated with variables, program control, modularity, and program development, including:

3.1   the use of technology resources to solve problems and communicate thoughts, ideas, or stories in a step-by-step manner

3.2   interdisciplinary applications of computational thinking and the use of content-specific models and simulations to support learning and research

3.3   algorithmic problem solving to design solutions to problems (e.g., problem statement and exploration, examination of sample instances, design, implementing a solution, testing, evaluation)

3.4   characteristics and uses of common algorithms (e.g., searching, sorting)

3.5   implementing problem solutions using concepts of procedural and object-oriented programming languages

3.6   properties and uses of data types (i.e., integer, float, Boolean, string, and array) and variables

3.7   the use of conditionals (e.g., if statements, if else statements) to control program flow

3.8   characteristics and applications of loops (i.e., while statements, for statements)

3.9   the use of functions and methods to enhance program logic and support code reuse

3.10 hierarchy and abstraction in computing, including high-level languages, translation, instruction set, and logic circuits

3.11 debugging techniques to test, verify, and refine programs

Standard 4: Networking and Communication

Computer science teachers have a broad and comprehensive understanding of the characteristics of computer networks, cybersecurity, and the Internet, including:

4.1   major types of computer networks and network components

4.2   use of online resources (e.g., e-mail, online discussions, collaborative Web environments) to participate in collaborative problem-solving activities for the purpose of developing solutions or products

4.3   designing, developing, publishing, and presenting products (e.g., videos, podcasts, Web sites, mobile apps) in a collaborative manner that uses technology resources to demonstrate and communicate curriculum concepts

4.4   principles of Web site design and Web development tools (e.g., HTML, CSS)

4.5   issues related to cybersecurity (e.g., methods for protecting personal information, encryption)

4.6   the basic structure and characteristics of the Internet

Standard 5: Impact and Culture

Computer science teachers have a broad and comprehensive understanding of the influence of computing technology on culture, societal interactions, and issues associated with safety, law, and ethics, including:

5.1   the positive and negative impacts of technology (e.g., social networking, cyberbullying, mobile computing and communication, Web technologies, cybersecurity, virtualization) on personal life and society

5.2   digital citizenship and the responsible use of technology and information

5.3   legal and ethical issues related to computers and networks (e.g., equity of access, security, privacy, copyright, intellectual property)

5.4   the influence of technology on careers and global development

5.5   the distribution of technological resources in a global economy and issues of equity and access

Standard 6: Computer Science Instruction and Assessment

Computer science teachers have a broad and comprehensive understanding of content-specific curricula, instruction, and assessment in computer science, including:

6.1   state and national learning standards related to computer science

6.2   instructional strategies related to computer science that meet the needs of diverse student populations

6.3   strategies for actively engaging students in using technology to support their own learning and for developing students' problem-solving skills

6.4   instructional strategies for teaching concepts and skills related to the programming processes

6.5   strategies for facilitating individual and collaborative projects and investigations involving technology and virtual environments

6.6   strategies for effectively assessing students' understanding and mastery of skills and concepts related to computer science

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2.6 productivity tools (e.g., word processing, spreadsheet, presentation software, Web and application-based productive tools) to facilitate learning and to support individual and collaborative writing, communication, and publishing activities

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Rules for Educator Preparation and Accountability (REPA) Standards Development: Key Milestones and Timeline

Overview of Original Development	Dates
1. Indiana enacts the REPA licensure rules to emphasize content knowledge at both the elementary and secondary levels.	Spring 2010
2. Indiana Department of Education (IDOE) selects Evaluation Systems group of Pearson to develop the REPA Educator Standards grounded in scientifically-based research and aligned with Indiana Academic standards and national standards.	Fall 2010
3. The Professional Standards Board approves REPA Educator Standards in 46 content areas, 2 administrative areas, and 5 school setting developmental levels.	Winter 2010
4. Evaluation Systems conducts the alignment study between the REPA Educator Standards and the Indiana P-12 Standards and national standards and assigns redevelopment priority for each field, divided into two phases.	2015

Rules for Educator Preparation and Accountability (REPA) Standards Development: Key Milestones and Timeline

REPA Educator Standards Redevelopment Tasks	Dates	
	Phase 1: • Computer Science • MS English Language Arts • MS Mathematics • MS Science	**Phase 2:** • Elementary Ed Generalist • MS Social Studies • Social Studies – Hist. Perspectives
1. Evaluation Systems drafts updates to the REPA Educator Standards based on the alignment study.	October 2017	October – November 2018
2. IDOE subject-matter experts (SMEs) in each field review draft REPA Educator Standards in preparation for review by committees of Indiana educators.	November 2017	December 2018
3. IDOE approves the initial draft REPA Educator Standards for committee review.	December 2017	December 2018
4. Fairness and content advisory committees of Indiana educators review and suggest revisions to the draft REPA Educator Standards.	October 2018	March 2019
5. The IDOE SMEs in each field review suggested revisions to the draft REPA Educator Standards based on committee feedback in preparation for public comment.	December 2018 - February 2019	June – July 2019
6. Draft REPA Educator Standards are available on the IDOE website for a public comment period.	February 28 - April 10, 2019	September 2019
7. IDOE shares public comments and IDOE SME feedback to the public comments with Evaluation Systems.	April 2019	October 2019
8. Evaluation Systems incorporates feedback from the public comment period into the draft REPA Educator Standards and shares the updated versions with IDOE.	May-June 2019	October – November 2019
9. Evaluation Systems incorporates the IDOE SMEs final revisions in the draft REPA Educator Standards (if applicable) and shares clean versions with the IDOE.	August 2019	November 2019
10. IDOE approves final revisions to the draft REPA Educator Standards.	August 2019	November 2019
11. **The Indiana State Board of Education (SBOE) adopts the final versions of the REPA Educator Standards.**	**September 4, 2019**	*December 2019*

Indiana Content Standards
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MIDDLE SCHOOL ENGLISH LANGUAGE ARTS

These standards can be used by educator preparation programs to design licensure programs for middle school English language arts teachers. An educator preparation program can use these standards to develop English language arts content preparation for elementary candidates to meet the REPA 3 requirement for a content area and for middle school English language arts licensure. Any candidate recommended for licensure for middle school English language arts needs to have mastery of all standards indicated in this document.

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July 2019

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Standard 2: Reading Literature and Nonfiction Texts

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Standard 3: Writing and Research

Middle school English language arts teachers have a broad and comprehensive understanding of the forms, purposes, and conventions of writing; the writing process; strategies for writing in various modes; and the research process.

Standard 4: Listening, Communicating, and Presenting

Middle school English language arts teachers have a broad and comprehensive understanding of strategies for listening, communicating, and presenting.

Standard 5: English Language Arts Instruction and Assessment

Middle school English language arts teachers have a broad and comprehensive understanding of content-specific instruction and assessment in English language arts.

Standard 1: Language Development and Foundations of Reading

Middle school English language arts teachers have a broad and comprehensive understanding of language acquisition and development, vocabulary development, and reading comprehension, including:

1.1 theories of language acquisition, development, and processes, including cognitive and social processes that affect language development during the early adolescent years

1.2 diverse linguistic patterns, prescriptive and descriptive grammars, academic and non-academic English, and their appropriate usage

1.3 historical, social, cultural, regional, and technological influences that have helped shape the English language

1.4 factors that influence vocabulary development and reading comprehension

1.5 word roots and affixes; denotative, connotative, and figurative meanings of words; and word-identification skills

1.6 general academic and domain-specific vocabulary

1.7 ways in which early adolescents read texts and make meaning through interaction with various types of texts and media, including the ways in which personal, cultural, and historical context can influence early adolescents' interpretation of texts and media

1.8 comprehension strategies to use before, during, and after reading

Standard 2: Reading Literature and Nonfiction Texts

Middle school English language arts teachers have a broad and comprehensive understanding of a wide range of literature and nonfiction texts from a variety of genres, time periods, and cultures and of strategies for comprehending, interpreting, evaluating, and appreciating literature and nonfiction texts, including:

2.1   use of literary and rhetorical elements, devices, and techniques in literature and nonfiction texts

2.2   denotative, connotative, figurative, and technical meanings of words as they are used in works of literature and nonfiction texts and the impact of specific word choices on texts' meaning and tone

2.3   stylistic and thematic characteristics of literary works and genres, including literature written for young adults

2.4   historical, social, cultural, and political contexts for and influences on literature

2.5   structural elements of literary texts

2.6   development of central ideas and themes in works of literature

2.7   development of character, plot, and setting in works of literature

2.8   characteristics of various types of nonfiction texts, including organizational features, formats, styles, and structures

2.9   authors' perspectives and purposes in nonfiction texts

2.10   development of central ideas in nonfiction texts

2.11   reliability, objectivity, and credibility of sources used in nonfiction texts

2.12   relevance, importance, and sufficiency of evidence, examples, and reasons that are provided as support in nonfiction texts

2.13   elements of multimedia texts, the ways in which these elements convey meanings and messages, and the motives (e.g., social, commercial, political) behind these meanings and messages

2.14   persuasive and propaganda techniques used in visual and verbal messages by electronic, print, and mass media

Standard 3: Writing and Research

Middle school English language arts teachers have a broad and comprehensive understanding of the forms, purposes, and conventions of writing; the writing process; strategies for writing in various modes; and the research process, including:

3.1   forms of writing to use for various purposes, tasks, and audiences, including, but not limited to, argumentative, informative, and narrative writing

3.2   methods of discovering, developing, and shaping ideas for writing

3.3   methods of drafting, revising, editing, and proofreading written texts

3.4   methods of developing effective introductions and conclusions to written texts

3.5   methods of developing sentences, paragraphs, and complete texts that are clear, concise, and coherent

3.6   methods of establishing a clear position or making a significant claim in argumentative writing

3.7   use of appropriate and effective examples, reasons, and evidence in informative, argumentative, and narrative writing

3.8   use of narrative structure and techniques to develop experiences, events, and characters

3.9   use of appropriate style, tone, and diction in informative and argumentative writing

3.10   conventions of standard English grammar, word usage, capitalization, punctuation, and spelling

3.11   methods of finding, selecting, and refining research topics and of formulating research questions

3.12   methods of locating relevant sources, assessing the reliability of sources, and synthesizing information from multiple sources

3.13   methods of paraphrasing, summarizing, and quoting source information and of citing and acknowledging sources in a written text

3.14   use of contemporary technologies to interact and collaborate with others to generate, produce, edit, revise, and publish writing and to present information and ideas efficiently

Standard 4: Listening, Communicating, and Presenting

Middle school English language arts teachers have a broad and comprehensive understanding of strategies for listening, communicating, and presenting, including:

4.1   strategies for listening actively and interpreting information that is presented orally

4.2   critical-listening skills for delineating an argument and for identifying, analyzing, and evaluating reasoning and evidence

4.3   types of speech delivery and presentations

4.4   strategies for adjusting the use of spoken language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes

4.5   individual, social, and cultural factors that influence interpersonal communication

4.6   large- and small-group dynamics and factors that influence group communication

4.7   strategies for engaging effectively in a range of collaborative discussions, including managing conflicts, solving problems, and making decisions in groups

4.8   use of contemporary technologies and digital media to compose multimodal discourse and to organize, develop, and produce multimedia presentations

4.9   digital citizenship and ethical, responsible, and safe practices in social and personal media communications

Standard 5: English Language Arts Instruction and Assessment

Middle school English language arts teachers have a broad and comprehensive understanding of content-specific instruction and assessment in English language arts, including:

5.1 state and national teacher standards for English language arts

5.2 Indiana academic standards for students

5.3 strategies for differentiating instruction in English language arts to meet the needs of diverse learners

5.4 strategies for integrating English language arts instruction with contemporary technologies and/or digital media

5.5 strategies for developing students' reading proficiency

5.6 strategies for developing students' media literacy

5.7 strategies for developing students' writing proficiency

5.8 strategies for developing students' proficiency in listening, communicating, presenting, and participating in collaborative discussions

5.9 strategies for creating learner-centered environments in English language arts classrooms

5.10 strategies for planning and implementing English language arts instruction that promotes students' critical engagement with complex issues related to maintaining a diverse, inclusive, equitable society while being responsive to students' backgrounds and individual identities

5.11 knowledge of how theories and research about social justice, diversity, equity, student identities, and schools as institutions can inform instruction and enhance students' opportunities to learn in English language arts

5.12 classroom-based, informal assessments and assessment tools used for English language arts

5.13 general types of formal assessments used for English language arts and specific types of formal assessments used for English language arts in Indiana

5.14 knowledge of how to use analysis of assessment data to inform instructional decisions

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2.3 ~~formal,~~ stylistic~~,~~ and thematic characteristics of ~~major~~ literary works~~,~~ and genres~~, , movements, periods, and authors of American, British, and world literature,~~ including literature written for young adults

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3.12   methods of locating relevant sources, assessing the reliability of sources, and synthesizing information from multiple sources

3.13   methods of paraphrasing, summarizing, and quoting source information and of citing and acknowledging sources in a written text

3.14   use of contemporary technologies to interact and collaborate with others to generate, produce, edit, revise, and publish writing and to present information and ideas efficiently

Standard 4: Listening, Communicating, and Presenting

Middle school English language arts teachers have a broad and comprehensive understanding of strategies for listening, communicating, and presenting, including:

4.1   strategies for listening actively and interpreting information that is presented orally

4.2   critical-listening skills for delineating an argument and for identifying, analyzing, and evaluating reasoning and evidence

4.3   types of speech delivery and presentations

4.4   strategies for adjusting the use of spoken language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes

4.5   individual, social, and cultural factors that influence interpersonal communication

4.6   large- and small-group dynamics and factors that influence group communication

4.7   strategies for engaging effectively in a range of collaborative discussions, including managing conflicts, solving problems, and making decisions in groups

4.8   use of contemporary technologies and digital media to compose multimodal discourse and to organize, develop, and produce multimedia presentations

4.9   digital citizenship and ethical, responsible, and safe practices in social and personal media communications

Standard 5: English Language Arts Instruction and Assessment

Middle school English language arts teachers have a broad and comprehensive understanding of content-specific instruction and assessment in English language arts, including:

5.1   state and national teacher standards for English language arts

5.2   Indiana academic standards for students

5.3   strategies for differentiating instruction in English language arts to meet the needs of diverse learners

5.4   strategies for integrating English language arts instruction with contemporary technologies and/or digital media

5.5   strategies for developing students' reading proficiency

5.6   strategies for developing students' media literacy

5.7   strategies for developing students' writing proficiency

5.8   strategies for developing students' proficiency in listening, communicating, presenting, and participating in collaborative discussions

5.9   strategies for creating learner-centered environments in English language arts classrooms

5.10   strategies for planning and implementing English language arts instruction that promotes students' critical engagement with complex issues related to maintaining a diverse, inclusive, equitable society while being responsive to students' backgrounds and individual identities

5.11   knowledge of how theories and research about social justice, diversity, equity, student identities, and schools as institutions can inform instruction and enhance students' opportunities to learn in English language arts

5.12   classroom-based, informal assessments and assessment tools used for English language arts

5.13   general types of formal assessments used for English language arts and specific types of formal assessments used for English language arts in Indiana

5.14   knowledge of how to use of analysis of assessment data to inform instructional decisions

Indiana Content Standards for Educators

MIDDLE SCHOOL SCIENCE

These standards can be used by educator preparation programs to design licensure programs for middle school science teachers. An educator preparation program can use these standards to develop science content preparation for elementary candidates to meet the REPA 3 requirement for a content area and for middle school science licensure. Any candidate recommended for licensure for middle school science needs to have mastery of all standards indicated in this document.

Middle school science teachers are expected to have a broad and comprehensive understanding of the knowledge and skills needed for this educator license, and to use that knowledge to help students prepare for the challenges and opportunities of the twenty-first century. This requires the ability to identify, comprehend, analyze, synthesize, and evaluate the basic principles, fundamental concepts, and essential content defined in these standards, and to apply that knowledge to the tasks of planning and delivering effective instruction and assessment.

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Standard 1: The Nature and Processes of Science

Middle school science teachers have a broad and comprehensive understanding of the nature of science and the processes of scientific inquiry.

Standard 2: Central Concepts and Connections in Science

Middle school science teachers have a comprehensive understanding of the core ideas and principles that connect different scientific disciplines and of the relationships between science, engineering, technology, and society.

Standard 3: The Nature and Processes of Engineering and Engineering Design

Middle school science teachers have a broad and comprehensive understanding of the core ideas and principles behind engineering practices and design.

Standard 4: Physical Science

Middle school science teachers have a broad and comprehensive understanding of physical science.

Standard 5: Earth and Space Science

Middle school science teachers have a broad and comprehensive understanding of Earth and space science, the use and management of geologic resources, and the effects of human activities on the environment.

Standard 6: Life Science

Middle school science teachers have a broad and comprehensive understanding of the life sciences.

Standard 7: Middle School Science Instruction and Assessment

Middle school science teachers have a broad and comprehensive understanding of content-specific instruction and assessment in science.

Standard 1: The Nature and Processes of Science

Middle school science teachers have a broad and comprehensive understanding of the nature of science and the processes of scientific inquiry, including:

1.1   characteristics, assumptions, and goals of science

1.2   tentative nature of scientific knowledge, which is subject to change as new evidence, new tools, or new ways of thinking become available

1.3   principles and procedures for designing and conducting controlled scientific investigations and the formulation of testable hypotheses

1.4   common tools and materials used in scientific investigations

1.5   scientific data collection, limiting variables, organization, analysis, interpretation, and communication, including the use of technology

1.6   role and applications of mathematics in science

1.7   characteristics and uses of various sources of scientific information and the evaluation of scientific information, claims, and arguments

1.8   role of peer review and critical evaluation of the results of scientific investigations, models, and explanations

Standard 2: Central Concepts and Connections in Science

Middle school science teachers have a comprehensive understanding of the core ideas and principles that connect different scientific disciplines and of the relationships between science, technology, engineering, math, and society, including:

2.1   concepts and processes that unify the scientific, technological, engineering and math fields

2.2   core ideas and principles that connect the various disciplines of science

2.3   interrelationships between science, technology, engineering, and math

2.4   social, cultural, and ethical aspects of science, technology, engineering, and math

2.5   historical development of important ideas in science from different periods and cultures

Standard 3: The Nature and Processes of Engineering and Engineering Design

Middle school science teachers have a broad and comprehensive understanding of the core ideas and principles behind engineering practices and design, including:

3.1   basic characteristics, principles, and goals of the engineering design process

3.2   basic engineering process and its application to real-world situations

3.3   use of basic criteria and constraints within the engineering design process

3.4   development of a prototype

3.5   principles and processes of iterative testing and model usage

3.6   design solution evaluation, including modifications needed to the design

Standard 4: Physical Science

Middle school science teachers have a broad and comprehensive understanding of physical science, including:

4.1   characteristics and arrangement of subatomic particles and historical and contemporary models of the atom

4.2   periodic trends and organization of the periodic table and effect of these trends on the chemical and physical properties of matter

4.3   properties of the different states of matter, kinetic molecular theory, the gas laws, and the concepts of heat and temperature, including heat transfer

4.4   characteristics and comparisons of elements, molecules, compounds, solutions, and mixtures

4.5   principles of chemical bonding and types and characteristics of chemical bonds

4.6   types and characteristics of chemical reactions, factors that affect reaction rates and equilibrium, and distinguishing between physical and chemical changes

4.7   basic understanding of the law of conservation of mass, the principles of stoichiometry, the mole concept, and their application in balancing chemical equations

4.8   basic understanding of acids and bases and their characteristic properties

4.9   Newton's laws of motion and universal gravitation and their application, including using the vector nature of force and motion

4.10   basic principles of work, energy, and power and the characteristics and uses of simple machines

4.11   forms of energy, the transformation of energy from one form to another, and the relationship of potential and kinetic energy

4.12   amplitude, wavelength, frequency, and period of mechanical waves and the characteristics and applications of energy transfer by mechanical waves

4.13   basic understanding of the properties of sound waves and their propagation in different media

4.14   basic understanding of the electromagnetic spectrum, nature of light, patterns of electromagnetic wave movement through different media, and the properties and uses of lenses and mirrors

4.15   basic understanding of static and flowing electricity, conservation of charge, electric current, potential difference, resistance, and parallel and series circuits

4.16   basic understanding of the properties of permanent magnets and the principles and applications of electromagnetic induction

Standard 5: Earth and Space Science

Middle school science teachers have a broad and comprehensive understanding of Earth and space science, the use and management of geologic resources, and the effects of human activities on the environment, including:

5.1   origin, structure, and components of the universe

5.2   characteristics and models of the solar system and planets, movement of celestial bodies, and the effects of the sun and moon on Earth systems

5.3   origin, evolution, structure, and composition of Earth

5.4   geologic time scale, evidence for the major events in the history and origin of Earth, and the principles and applications of radiometric dating and stratigraphy

5.5   processes of weathering, erosion, and deposition and the origin of major landforms, including those specific to Indiana

5.6   processes involved in the rock cycle and the characteristics, identification, and composition of rocks and minerals

5.7   theory of and supporting evidence for plate tectonics

5.8   hydrosphere, atmosphere, biosphere, and geosphere interactions

5.9   physical and chemical properties of water, the hydrological cycle, and the characteristics and processes of freshwater systems, oceans, and glaciers

5.10   structure and processes of the atmosphere and the causes and characteristics of different types of weather, including meteorological technology and maps

5.11   basic characteristics of Earth's different climate regions, the global climate system, and changes in climate that have occurred over the course of geologic time and human history

5.12   causes and consequences of natural hazards

5.13   impact of human activities on Earth systems and ecosystems and strategies for reducing these human impacts, including the development and impact of common synthetic materials

5.14   benefits and risks associated with the extraction and management of geologic resources and renewable and nonrenewable energy resources, including those specific to Indiana

5.15   basic concepts and usage of geologic and energy resources and the basic process of production and transmission of electric power

Standard 6: Life Science

Middle school science teachers have a broad and comprehensive understanding of the life sciences, including:

6.1   characteristics of all life and the basic principles of taxonomy

6.2   characteristics of single-celled organisms and the similarities and differences between prokaryotes and eukaryotes

6.3   similarities and differences of viruses and bacteria, including the effects on humans

6.4   processes of photosynthesis, cellular respiration, energy use and transfer in organisms, and maintenance of homeostasis

6.5   basic structure and function of cell organelles and plant and animal cells

6.6   characteristics and functions of common specialized cells in plants and animals

6.7   structure and function of primary components of the organ systems in humans, plants, animals, and fungi

6.8   processes of cell division, heredity, and reproduction

6.9   structure of DNA and RNA and the processes of replication, transcription, translation, and protein synthesis

6.10   basic principles of genetics, patterns of inheritance, and their application to genetics problems, including the basic principles and applications of genetic engineering

6.11   the scientific theory of evolutionary, its supporting evidence, and the process of natural selection

6.12   relationships between organisms at the species level and among trophic levels, including the impact of changes in biodiversity on these relationships

6.13   interactions between living and nonliving components of ecosystems and the basic interactions between organisms and ecosystems

Standard 7: Middle School Science Instruction and Assessment

Middle school science teachers have a broad and comprehensive understanding of content-specific instruction and assessment in science, including:

7.1   state and national learning standards for middle school science and in preparing students for high school science

7.2   instructional strategies and resources for promoting students' development of conceptual understanding, inquiry skills, and scientific habits of mind

7.3   strategies and skills for planning and designing science instruction that meet the needs of diverse and exceptional learners

7.4   instructional strategies and communication methods that encourage active inquiry, supportive interaction, literacy, mathematics, creative thinking, and collaboration in the science classroom

7.5   strategies and resources for promoting students' reading, writing, literacy, mathematics, and communication skills in a scientific context

7.6   instructional strategies that encourage the application of scientific and engineering concepts to real-world scenarios

7.7   strategies and skills for selecting, adapting, and using technological and other resources to enhance teaching and learning in science

7.8   strategies, skills, and methods for effectively assessing student understanding and mastery of essential science concepts and skills

7.9   safe execution of laboratory exercises, including following procedures, resources, and guidelines for maintaining a safe science learning environment and proper storage and disposal of chemicals and materials

7.10   implementation of content and grade level appropriate classroom management and procedures

Indiana Content Standards for Educators

MIDDLE SCHOOL MATHEMATICS

These standards can be used by educator preparation programs to design licensure programs for middle school mathematics teachers. An educator preparation program can use these standards to develop middle school mathematics content preparation for elementary candidates to meet the REPA 3 requirement for a content area and for middle school mathematics licensure. Any candidate recommended for licensure for middle school mathematics needs to have mastery of all standards indicated in this document.

Middle school mathematics teachers are expected to have a broad and comprehensive understanding of the knowledge and skills needed for this educator license, and to use that knowledge to help students prepare for the challenges and opportunities of the twenty-first century. This requires the ability to identify, comprehend, analyze, synthesize, and evaluate the basic principles, fundamental concepts, and essential content defined in these standards, and to apply that knowledge to the tasks of planning and delivering effective instruction and assessment.

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July 2019

Standard 1: Number Sense and Computation

Middle school mathematics teachers have a broad and comprehensive understanding of number operations and algebraic thinking, ratios and proportional relationships, and the number system.

Standard 2: Algebra and Functions

Middle school mathematics teachers have a broad and comprehensive understanding of the extension of arithmetic to one- and two-variable expressions, equations, and inequalities; the relationship between dependent and independent variables; the characteristics, evaluation, and comparison of functions; and the modeling and solving of problems with algebraic expressions, equations, inequalities, and linear and nonlinear functions.

Standard 3: Measurement and Geometry

Middle school mathematics teachers have a broad and comprehensive understanding of the principles and procedures of measurement, the properties of two- and three-dimensional figures, and applications of coordinate and transformational geometry.

Standard 4: Statistics and Probability

Middle school mathematics teachers have a broad and comprehensive understanding of the collection and presentation of data, the summary and descriptions of statistical variability, and the fundamental principles of probability.

Standard 5: Calculus

Middle school mathematics teachers have a broad and comprehensive understanding of the fundamental principles and conceptual foundations of differential and integral calculus.

Standard 6: Middle School Mathematics Instruction and Assessment

Middle school mathematics teachers have a broad and comprehensive understanding of content-specific curricula, instruction, and assessment in mathematics education.

Middle School Mathematics
Educator Standards

Standard 1: Number Sense and Computation

Middle school mathematics teachers have a broad and comprehensive understanding of number operations and algebraic thinking, ratios and proportional relationships, and the number system, including:

1.1   structure and properties of real and complex numbers and their subsets

1.2   order, absolute value, and equivalence of different representations of numbers

1.3   number sense, estimation, and place value

1.4   numerical expressions and order of operations

1.5   fundamental concepts of number theory, including divisibility, greatest common factors, least common multiples, and prime and composite numbers

1.6   computational fluency with rational numbers and standard and non-standard algorithms

1.7   conceptual understanding and quantitative reasoning with ratio, rate, proportion, percent, and units

1.8   problem solving using models and different representations of numbers

1.9   applications of and methods of modeling with vector and matrix operations

1.10   historical development of numbers and number systems

Standard 2: Algebra and Functions

Middle school mathematics teachers have a broad and comprehensive understanding of the extension of arithmetic to one- and two-variable expressions, equations, and inequalities; the relationship between dependent and independent variables; the characteristics, evaluation, and comparison of functions; and the modeling and solving of problems with algebraic expressions, equations, inequalities, and linear and nonlinear functions, including:

2.1   algebraic notation, language, and expressions

2.2   application of arithmetic properties to algebraic linear and nonlinear expressions, equations, and inequalities

2.3   application of order of operations to algebraic expressions

2.4   methods of solving one- and two-variable linear and nonlinear equations and inequalities

2.5   connections between proportional relationships, lines, and linear equations

2.6   identification, extension, and algebraic representation of a variety of patterns

2.7   characteristics of relations, functions, and domains

2.8   functional relationships between quantities, graphs, and linear equations and inequalities

2.9   methods of modeling and solving mathematical and real-life problems using numeric and algebraic expressions, linear equations, systems, and inequalities and their representations

2.10   methods of modeling linear, absolute value, quadratic, polynomial, exponential, logarithmic, rational, and trigonometric functions

2.11   behaviors of nonlinear functions and relationships between their various representations

2.12   manipulation of functions, including transformations, translations, and compositions

2.13   individuals and cultures that contributed to the historical development of algebra

Standard 3: Measurement and Geometry

Middle school mathematics teachers have a broad and comprehensive understanding of the principles and procedures of measurement, the properties of two- and three-dimensional figures, and applications of coordinate and transformational geometry, including:

3.1   unit conversion and comparison

3.2   points, lines, planes, and angle measures in Euclidean geometry

3.3   applications and derivations of length, perimeter, circumference, area, surface area, and volume formulas of geometric figures

3.4   indirect measurement, including proportional reasoning, the Pythagorean theorem, and trigonometric ratios in right triangles

3.5   derivation of the area formulas for triangles and parallelograms

3.6   application of periodic phenomena and trigonometric identities

3.7   properties of figures in two and three dimensions

3.8   concepts and applications of similarity and congruence

3.9   representation and analysis of geometric figures in the coordinate plane

3.10   concepts and applications of dilations, translations, rotations, reflections, and symmetry

3.11   methods of modeling and solving problems using geometric concepts, including the application of axiomatic reasoning to Euclidean geometry

Standard 4: Statistics and Probability

Middle school mathematics teachers have a broad and comprehensive understanding of the collection and presentation of data, the summary and descriptions of statistical variability, and the fundamental principles of probability, including:

4.1   representation, summarization, and interpretation of data, including the description of center, spread, shape, and outliers, for one or two variables

4.2   inference, evaluation of claims based on data, and the data collection process

4.3   statistical variability, sampling techniques, bias, and randomization

4.4   simple, compound, and conditional probabilities

4.5   simulations of real-world situations that use concepts from probability

4.6   methods of modeling and solving problems involving simple discrete and continuous probability distributions

4.7   application of combinations and permutations for describing outcomes of probability events

Standard 5: Calculus

Middle school mathematics teachers have a broad and comprehensive understanding of the fundamental principles and conceptual foundations of differential and integral calculus.

5.1   infinitesimal quantities, limits, and continuity

5.2   concepts, techniques, and applications of the derivative

5.3   fundamental theorem of calculus

5.4   concepts and applications of the integral

5.5   applications of function, geometry, and trigonometry concepts to solve problems involving calculus

Standard 6: Middle School Mathematics Instruction and Assessment

Middle school mathematics teachers have a broad and comprehensive understanding of content-specific curricula, instruction, and assessment in mathematics education, including:

6.1   state and national content standards for middle school mathematics

6.2   process standards for mathematics

6.3   instructional strategies and resources for promoting student understanding of concepts and skills related to mathematics, including the use of multiple representations

6.4   instructional strategies and resources for developing and supporting students' literacy skills in the context of mathematics

6.5   evaluation and development of curricula and curricular materials, including textbooks and digital content, that support standards-based mathematics instruction and assessment

6.6   strategies and skills for planning and differentiating mathematics instruction to meet the needs of all learners

6.7   methods of communication that promote student learning and foster active inquiry, interaction, and collaboration in the mathematics classroom

6.8   strategies and skills for selecting, adapting, and using technology to enhance the teaching and learning of mathematics

6.9   strategies and skills for effectively assessing student understanding and mastery of essential mathematics concepts and skills