

Indiana Content Standards for Educators

Elementary STEM License

June 2020



Elementary STEM 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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Elementary STEM teachers have a broad and comprehensive understanding of fundamental concepts and processes of the science and engineering disciplines and demonstrate the ability to provide content-specific instruction in science.

Standard 2: Mathematics

Elementary STEM teachers have fundamental computation skills and a broad and comprehensive understanding of fundamental concepts and processes of mathematics and demonstrate the ability to provide content-specific instruction in mathematics.

Standard 3: Computer Science

Elementary STEM teachers have a broad and comprehensive understanding of computer science concepts and practices and demonstrate the ability to provide content-specific instruction in computer science.

Standard 4: The Nature and Processes of STEM

Elementary STEM teachers can distinguish the unique nature of each discipline within STEM (scientific inquiry, technology, engineering design, mathematics), identify how crosscutting concepts unify the study of each domain through their common application across fields, and understand the interrelationships between the process standards of each.

Standard 5: Integrated STEM Pedagogy

Elementary STEM teachers have a broad and comprehensive understanding of content-specific instruction and assessment in science, technology, engineering, computer science, math, and integrated inquiry-based learning that includes appropriate connections between and within content areas and processes. Elementary STEM teachers foster positive dispositions and understand how multiple identities shape students as learners, presenting learning opportunities that connect to students' lived experiences.

Standard 6: Scientifically Based Instruction in Content-Based Reading and Language Arts Instruction

Elementary STEM teachers have a broad and comprehensive understanding of foundations of content-based reading development and effective reading instruction grounded in scientifically based reading research (SBRR), as well as a broad and comprehensive understanding of the major components of reading development and content area writing and communication.

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The Indiana Educator Standards for Elementary STEM Teachers describe the knowledge and skills that teachers need to help students achieve the learning outcomes defined by the Indiana Academic Standards for Mathematics and Science. Links to relevant portions of the Indiana Academic Standards can be found below.

Mathematics: [Core Standards](#)

Science and Computer Science: [Science and Computer Science K-6](#)

Standard 1: Sciences

Elementary STEM teachers have a broad and comprehensive understanding of fundamental concepts and processes of science and demonstrate the ability to provide content-specific instruction in science. Elementary STEM teachers:

- 1.1** Know and understand the fundamental concepts and application of the nature of science, scientific inquiry, and the engineering design process.
- 1.2** Understand and apply the unifying concepts of science, engineering, and technology; the social, cultural, and ethical aspects of science; and the interactions between science, computer science, technology, and society.
- 1.3** Understand and apply the fundamental concepts and processes of physical science, including atomic and molecular structure; the structures, properties, and states of matter; knowledge of physical and chemical properties and changes; principles of force and motion; collision; concepts of weight, volume, and mass; thermodynamics; energetics; properties and characteristics of waves (e.g., sound, light); and concepts of electricity and magnetism.
- 1.4** Understand and apply the fundamental concepts and processes of life science, including cells; photosynthesis and respiration; characteristics, classification, and life cycles of organisms; genetics and inheritance of characteristics; evolution over time; the relationships of organisms to each other and to their environment; and major characteristics of and factors affecting ecosystems and biomes.
- 1.5** Understand and apply the fundamental concepts and processes of Earth and space science, including characteristics of and relationships between celestial bodies, the sun-moon-Earth system, properties of rocks and minerals, factors that change Earth over time, features and patterns of weather and climate, the characteristics and interactions of Earth systems, the use of natural resources, and the impact of humans on the environment.
- 1.6** Understand and apply the fundamental concepts and processes of engineering and technology, including properties and uses of natural and human-made materials; the use of computer science and technology to meet human needs and solve problems; and the design, testing, and evaluation of practical solutions to real-world situations (e.g., building a structure to achieve a goal, optimizing a system, using simple mechanical devices).

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- 1.7** Understand and apply the principles and procedures for using tools, materials, and technology in scientific investigations; considering multiple perspectives and sources of information in scientific inquiry; using critical-thinking, computational thinking, and mathematical skills to evaluate scientific information; and organizing, analyzing, and communicating results of scientific investigations.
- 1.8** Understand and apply the procedures and guidelines for establishing and maintaining a safe science learning environment that provides opportunities for multisensory exploration and ensures the humane and ethical treatment of living organisms and the safe handling and disposal of chemicals.
- 1.9** Understand and utilize the state academic standards and state and national teacher standards for instruction and assessment.
- 1.10** Utilize methods for planning and delivering evidence-based science instruction that fosters students' understanding and mastery of concepts and skills related to science and the development of critical- and creative-thinking, reasoning, problem-solving, and performance skills.
- 1.11** Develop strategies and skills for effectively assessing students' understanding and mastery of essential science concepts and skills, using ongoing assessment to monitor progress and inform instruction, and applying Response to Instruction (RtI) procedures.

Standard 2: Mathematics

Elementary STEM teachers have fundamental computation skills and a broad and comprehensive understanding of fundamental concepts and processes of mathematics and demonstrate the ability to provide content-specific instruction in mathematics. Elementary STEM teachers:

- 2.1** Understand and utilize number sense, number representations, number systems, and number theory.
- 2.2** Understand and apply the properties of mathematical operations and patterns, strategies for estimating and computing solutions, and methods and resources for modeling mathematical operations.
- 2.3** Understand and apply the concepts of functions; algebraic expressions, equations, and inequalities; and quantitative relationships between dependent and independent variables.
- 2.4** Understand and apply measurement systems and units; concepts related to geometric measurement; and tools, techniques, and formulas used to solve measurement problems.
- 2.5** Understand and apply attributes of geometric figures and the relationships between them; similarity, symmetry, formulas, and other geometric concepts used to solve geometry problems; and coordinate systems.

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- 2.6** Understand and apply principles related to statistical variability and data distribution, methods for representing and analyzing data and making predictions, and methods for determining probabilities.
- 2.7** Understand and apply ratios, proportional thinking, and other methods for representing and solving mathematical and real-world problems and for evaluating solutions.
- 2.8** Understand and apply processes and skills related to reasoning and proof (i.e., representing mathematical information, using mathematical language to communicate relationships and concepts, adaptive reasoning, strategic competence, procedural fluency, and productive disposition).
- 2.9** Demonstrate the ability to select, administer, interpret, and communicate the results of assessments in major components of mathematics for various instructional purposes and for planning, progress monitoring, and measuring outcomes.
- 2.10** Understand and utilize the state academic standards and state and national teacher standards for instruction and assessment.
- 2.11** Utilize methods for planning and delivering evidence-based mathematics instruction that foster students' understanding and mastery of concepts and skills related to mathematics and the development of critical- and creative-thinking, reasoning, problem-solving, and performance skills.
- 2.12** Develop and utilize strategies and skills for effectively assessing students' understanding and mastery of essential mathematics concepts and skills, using ongoing assessment to monitor progress and inform instruction, and applying Response to Instruction (RtI) procedures.

Standard 3: Computer Science

Elementary STEM teachers have a broad and comprehensive understanding of computer science concepts and practices and demonstrate the ability to provide content-specific instruction in computer science. Elementary STEM teachers:

- 3.1** Understand the collection, storage, presentation, analysis, and interpretation of data.
- 3.2** Understand and utilize computing devices, their components, the relationship between hardware and software, and basic techniques of troubleshooting.
- 3.3** Develop and apply computational thinking, algorithms and problem solving, and programming concepts associated with event triggers, variables, program control, modularity, and the program development cycle.
- 3.4** Know and understand fundamental concepts related to computer networks and cybersecurity and the operation and characteristics of the internet.

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- 3.5** Understand the positive and negative influences of computing and technology on culture, society, and issues related to safety, law, and ethics.
- 3.6** Understand the practices of fostering an inclusive computing culture, collaborating around computing, recognizing and defining computational problems, developing and using abstractions, creating computational artifacts, testing and refining computational artifacts, and communicating about computing.
- 3.7** Understand and utilize content-specific curricula, pedagogy, and assessment.
- 3.8** Understand and utilize the K-12 Computer Science Framework and relevant state and national standards.

Standard 4: Nature and Processes of STEM

Elementary STEM teachers can distinguish the unique *nature* of each discipline within STEM (scientific inquiry, technology, engineering design, mathematics), identify how *crosscutting concepts* unify the study of each domain through their common application across fields, and understand the interrelationships between the *process standards* of each. Elementary STEM teachers:

- 4.1** Make sense of problems and persevere in solving them, attending to precision.
- 4.2** Reason abstractly and quantitatively and create explanations by constructing viable arguments and critiquing the reasoning of others.
- 4.3** Look for and make use of mathematical structure and look for and express regularity in repeated reasoning.
- 4.4** Pose scientific questions. Construct and perform experimental and observational investigations to pursue answers.
- 4.5** Construct models (conceptual, physical, mathematical, and computational) useful for representation, simulation, and testing.
- 4.6** Define engineering problems. Design, test, and revise solutions using engineering design processes.
- 4.7** Use evidence to construct explanations and support claims through argumentation.
- 4.8** Obtain and evaluate information from a variety of reference sources (research, experiments, observation, and testing), and communicate that information in multiple ways, including orally, visually, and in writing.
- 4.9** Use appropriate tools (physical, mathematical, computational) strategically for measurement, data collection, representation and analysis of data, and problem solving.

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Standard 5: Integrated STEM Pedagogy

Elementary STEM teachers have a broad and comprehensive understanding of content-specific instruction and assessment in science, technology, engineering, computer science, math, and integrated inquiry-based learning *that includes appropriate connections between and within content areas and processes*. Elementary STEM teachers foster positive dispositions and understand how multiple identities shape students as learners, presenting learning opportunities that connect to students' lived experiences.

Elementary STEM teachers:

- 5.1** Engage students in learning experiences that develop scientific, mathematical, and computational proficiency as characterized by the integration and balance of conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, productive disposition, and evidence-based argumentation.
- 5.2** Organize and deliver instruction that is developmentally appropriate and responsive to individual learners, acknowledging cultural and linguistic differences.
- 5.3** Draw on student's strengths to create inclusive, social learning contexts that engage all learners in discussions, explorations, and investigations among all members of the learning community in order to motivate and extend learning opportunities, connecting to lived experiences.
- 5.4** Cultivate positive identities and promote positive dispositions towards science, technology, engineering, computer science, and mathematics learning; demonstrate and encourage equitable and ethical treatment of students; expect that all students will achieve success.
- 5.5** Understand the roles of power, privilege, and oppression in the history of science, technology, engineering, computer science, and mathematics education and be equipped to question existing and proposed educational systems that produce inequitable learning experiences and outcomes for students.

Standard 6: Scientifically Based Instruction in Content-Based Reading and Language Arts Instruction

Elementary STEM teachers have a broad and comprehensive understanding of foundations of content-based reading development and effective reading instruction grounded in scientifically based reading research (SBRR), as well as a broad and comprehensive understanding of the major components of reading development and content area writing and communication, including the ability to:

- 6.1** Know and understand the major theoretical, conceptual, and evidence-based components of reading development, including concepts of print, phonemic awareness, phonics, fluency, vocabulary, and text

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comprehension.

- 6.2** Know and understand the foundations of language acquisition and literacy development, including cognitive, linguistic, cultural, social, and motivational factors that affect language acquisition and literacy development.
- 6.3** Know and understand the essential components of effective reading instruction, including explicit explanation, teacher modeling, guided practice, and independent practice, and the ability to plan and implement reading instruction that incorporates these components.
- 6.4** Understand and apply the key dimensions of effective differentiated reading instruction in the elementary setting, including modifying digital and print materials and the pacing and/or complexity of instruction; and the ability to plan and implement differentiated instruction to match students' evidence-based strengths and needs in reading.
- 6.5** Select and use high-quality literary, multimedia, and informational texts to provide a coherent, integrated, and motivating literacy program.
- 6.6** Know and apply evidence-based approaches to integrate the components of literacy and interdisciplinary learning and to support writing appropriate to task.
- 6.7** Know and apply instructional practices, approaches, and methods for eliciting students' engagement in and motivation for reading.
- 6.8** Use evidence-based practices effectively to create a literacy-rich classroom environment that fosters and supports the literacy development of all students, reflects and values cultural diversity, promotes respect for all readers, promotes the involvement of families and members of the community at large in students' literacy development, and engages all students as agents in their own literacy development.
- 6.9** Know and apply key concepts and SBRR in the development of vocabulary and academic language, including the correlation between vocabulary knowledge and academic achievement; the essential role of wide and varied reading in the development of vocabulary knowledge; different levels of vocabulary knowledge; different tiers of vocabulary words; and the importance of early, robust, and explicit language and content experiences to promote young children's development of vocabulary and academic language.
- 6.10** Know and apply key concepts and SBRR in comprehension and analysis of informational, persuasive, and literary texts, including levels of reading comprehension as applied to these texts; comprehension strategies; critical and close reading; text-based and non-text-based factors that affect reading comprehension; genres, text structures, characteristics, and graphic, textual, and organizational features of informational and persuasive texts; and genres, key elements, and

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characteristics of literary texts.

- 6.11** Develop in students the ability to comprehend, interpret, and analyze nonfiction texts from a variety of genres that represent a range of diverse perspectives.
- 6.12** Know and understand the major developmental stages of emergent writing and factors that affect the development of writing skills. Understand the major forms and functions of writing, and apply to various purposes, tasks, and audiences (e.g., informative, persuasive, argumentative, narrative).
- 6.13** Understand and apply the steps in the writing process (e.g., drafting, revising, editing, proofreading, and publishing) and methods of completing each step, including use of contemporary technologies to interact and collaborate with others to generate, revise, edit, produce, and publish writing.
- 6.14** Apply the methods of inquiry and research, including methods of finding, selecting, and refining research topics; and methods of locating, evaluating, and citing sources.
- 6.15** Develop in students the skills and strategies for active, critical listening and for engaging in a range of collaborative conversations.
- 6.16** Know and apply strategies for the presentation of information and ideas.
- 6.17** Know and apply the characteristics and components of media literacy, including the analysis and interpretation of media and use of media to present information and ideas.

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