In addition to the Arkansas Teaching Standards, the teacher of middle childhood mathematics, grades 4-8, shall demonstrate knowledge and competencies in the following areas:

1. Knowing and Understanding Meaningful Mathematics *NCTM/CAEP:Standard 1*	**<u>NCTM/CAEP Standard 1:</u>** *Demonstrate and apply understandings of major mathematics concepts, procedures, knowledge, and applications within and among mathematical domains of Number and Operations; Algebra and Functions; Statistics and Probability; Geometry, Trigonometry, and Measurement*
	1.1 Demonstrate and apply understandings of major mathematics concepts, procedures, knowledge, and applications of number, including flexibly applying procedures, using real and rational numbers in contexts, attending to units, developing solution strategies and evaluating *the correctness of conclusions.* Major mathematical concepts in *Number and Operations* include number systems (particularly rational numbers); algorithmic and recursive thinking; number and set theory; ratio, rate of change, and proportional reasoning; and structure, relationships, operations, and representations
	1.2 Demonstrate and apply understandings of major mathematics concepts, procedures, knowledge, and applications of algebra and functions, including how mathematics can be used systematically to represent patterns and relationships among numbers and other objects, analyze change, and model everyday events and problems of life and society. Major mathematical concepts in *Algebra and Functions* include algebra that connects mathematical structure to symbolic, graphical, and tabular descriptions; exploration of expressions; connecting algebra to functions; induction; and develops families of functions of discrete and continuous variables as a fundamental concept
	1.3 Demonstrate and apply understandings of major mathematics concepts, procedures, knowledge, and applications of statistics and probability including how statistical problem solving and decision making depend on understanding, explaining, and quantifying the variability in a set of data to make decisions. Understand the role of randomization and chance in determining the probability of events. Major mathematical concepts in *Statistics and Probability* include quantitative literacy; visualizing and summarizing data; statistical inference; probability; exploratory data analysis and applied problems and modeling

	1.4 Demonstrate and apply understandings of major mathematics concepts, procedures, knowledge, and applications of geometry including using visual representations for numerical functions and relations and networks, to provide a lens for solving problems in the physical world. Major mathematical concepts in *Geometry, Trigonometry, and Measurement* include measurement, transformations, scale, graph theory, geometric arguments, reasoning and proof, applied problems and modeling, development of axiomatic proof, and the Pythagorean theorem
2. Knowing and Using Mathematical Processes *NCTM/CAEP: Standard 2* *AMTE* *ISTE*	***NCTM/CAEP Standard 2:*** *Demonstrate, within or across mathematical domains, their knowledge of and ability to apply the mathematical processes of problem-solving; reason and communicate mathematically; and engage in mathematical modeling and apply technology appropriately (ISTE Standards: 7a, 7b, 7c, 6a, 6c, 5a, 5b, 5c, 4a, 4b, 4c, 3a, 3b, 3c, 3d, 1a, 1b, & 1c) within these mathematical processes* 2.1 Demonstrate a range of mathematical problem-solving strategies to make sense of and solve nonroutine problems (both contextual and non-contextual) across mathematical domains 2.2 Organize mathematical reasoning and use the language of mathematics to express their mathematical reasoning precisely, both orally and in writing, to multiple audiences 2.3 Understand the difference between the mathematical modeling process and models in mathematics, engaging in the mathematical modeling process, and demonstrate their ability to model mathematics ***AMTE*** 2.4 Understand content progressions and the ways in which students develop mathematical content over time
3. Knowing Students and Planning for Mathematical Learning *NCTM/CAEP: Standard 3* *New America*	***NCTM/CAEP Standard 3:*** *Apply knowledge of students and mathematics to plan rigorous and engaging mathematics instruction supporting students' access and learning, and mathematics instruction developed provides equitable, culturally responsive opportunities for all students to learn and apply mathematics concepts, skills, and practice* 3.1 Identify and use students' individual and group differences when planning rigorous and engaging mathematics instruction that supports students' meaningful participation and learning

	3.2 Identify and use students' mathematical strengths to plan rigorous and engaging mathematics instruction that supports students' meaningful participation and learning 3.3 Understand that the teachers' interactions impact individual students by influencing and reinforcing students' mathematical identities, positive or negative, and plan experiences and instruction to develop and foster positive mathematical identities **_New America_** 3.4 Draw on students' culture to shape curriculum and instruction 3.5 Bring real-world issues into the classroom
4. Teaching Meaningful Mathematics *NCTM/CAEP:* *Standard 4* *AMLE: Standard 2* *ISTE* *New America*	**_NCTM/CAEP Standard 4:_** *Implementing effective and equitable teaching practices to support rigorous mathematical learning for a full range of students. Establish rigorous mathematics learning goals, engage students in high cognitive demand learning, use mathematics specific tools and representations, elicit and use student responses, develop conceptual understanding and procedural fluency, and pose purposeful questions to facilitate student discourse* 4.1 Establish rigorous mathematics learning goals for students based on mathematics standards and practices 4.2 Select or develop and implementing high cognitive demand tasks, with multiple entry points, to engage students in mathematical learning experiences that promote reasoning and sense making 4.3 Select mathematics-specific tools, including technology (*ISTE Standards: 6b & 6c*), to support students' learning, understanding, and application of mathematics and to integrate tools into instruction 4.4 Select and use mathematical representations to engage students in examining understandings of mathematics concepts and the connections to other representations 4.5 Use multiple student responses, potential challenges and misconceptions, and highlight students' thinking as a central aspect of mathematics teaching and learning 4.6 Use conceptual understanding to build procedural fluency for students through instruction that includes explicit connections between concepts and procedures 4.7 Pose purposeful questions to facilitate discourse among students that ensures that each student learns rigorous mathematics and builds a shared understanding of mathematical ideas

	AMLE 4.8 Demonstrate the interdisciplinary nature of knowledge by helping all young adolescents make connections among subject areas 4.9 Demonstrate the ability to motivate all young adolescents and facilitate their learning through a wide variety of developmentally responsive materials and resources and establishing equitable, caring, and productive learning environments for all young adolescents ***New America*** 4.10 Model high expectations for all students
5. Assessing Impact on Student Learning *NCTM/CAEP: Standard 5*	***NCTM/CAEP Standard 5:*** *Assess and use evidence of students' learning of rigorous mathematics to improve instruction and subsequent student learning. Analyze learning gains from formal and informal assessments for individual students, the class as a whole, and subgroups of students disaggregated by demographic categories, and they use this information to inform planning and teaching* 5.1 Select, modify, or create both informal and formal assessments to elicit information on students' progress toward rigorous mathematics learning goals 5.2 Collect information on students' progress and using data from informal and formal assessments to analyze progress of individual students, the class as a whole, and subgroups of students disaggregated by demographic categories toward rigorous mathematics learning goals 5.3 Use the evidence of student learning of individual students, the class as a whole, and subgroups of students disaggregated by demographic categories to analyze the effectiveness of their instruction with respect to these groups. Propose adjustments to instruction to improve student learning for each and every student based on the analysis
6. Social and Professional Context of Mathematics Teaching and Learning *NCTM/CAEP: Standard 6* *AMLE: Standards 3 & 5* *AMTE: Standard C.3* *New America* *ISTE*	***NCTM/CAEP Standard 6:*** *Aspire to become reflective mathematics educators who collaborate with colleagues and other stakeholders to grow professionally, to support student learning, and to create more equitable mathematics learning environments* 6.1 Seek to create more equitable learning environments about teaching and learning mathematics, and associated classroom practices that produce equitable or inequitable mathematical learning for students

	6.2 Reflect on their impact on students' mathematical identities and developing professional learning goals that promote students' positive mathematical identities 6.3 Communicate with families in linguistically and culturally responsive ways to share and discuss strategies for ensuring the mathematical success of their children *6.4 Collaborate with colleagues to grow professionally, support student learning of mathematics, and to create authentic learning experiences that leverage technology (ISTE Standard: 4a)* **_AMLE_** 6.5 Perform successfully in middle level programs and practices such as interdisciplinary teaming, advisory programs, flexible block schedules, professional learning communities (PLCs), and common teacher planning time 6.6 Understand, reflect on, and are successful in unique roles as middle level professionals 6.7 Serve as an advocate for young adolescents and for developmentally responsive schooling practices and are informed advocates for effective middle level educational practices and policies 6.8 Use professional leadership responsibilities to create equitable opportunities for all young adolescents in order to maximize their students' learning **_AMTE_** 6.9 Support emerging mathematical practices of middle level learners **_New America_** 6.10 Promote respect for students differences 6.11 Collaborate with families and the local community
7. Middle Level Field Experiences and Clinical Practices *NCTM/CAEP: Standard 7*	**NCTM/CAEP Standard 7:** *Effective teachers of middle level mathematics engage in a planned sequence of field experiences and clinical practice under the supervision of experienced and highly qualified mathematics teachers. Develop a broad experiential base of knowledge, skills, effective approaches to mathematics teaching and learning, and professional behaviors in settings that involve a diverse range and varied groupings of students. Candidates experience a full-time student teaching/internship in middle level mathematics supervised by university or college faculty with middle*

	level or secondary mathematics teaching experience or equivalent knowledge base 7.1 Participate in a diverse range of field experiences and clinical practice in middle level settings with highly qualified math teachers

8. Course-Specific Competencies
Praxis II (5169): Sections I & II
K-5 AMS
6-8 AMS
AMLE: Standard 2
AMTE: Standard C.1
	Praxis II (5169), K-5 AMS, 6-8 AMS, AMLE, AMTE, & CCSS-M
	    I. Arithmetic and Algebra
	8.1 <u>Numbers, Number Systems, and Operations</u>
	    a. Apply and extend previous understandings of numbers to the system of rational numbers
	    b. Understand the place value system
	    c. Apply place value understanding for multi-digit whole numbers
	    d. Perform operations with multi-digit whole numbers and with decimals to hundredths
	    e. Understand place value and properties of operations to perform multi-digit arithmetic
	    f. Extend understanding of fraction equivalence and ordering
	    g. Build fractions from unit fractions by applying and extending previous understanding of operations of whole numbers
	    h. Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit
	    i. Understand operations and properties of the real number system
	    j. Understand the relationships among fractions, decimals, and percents
	    k. Use ratio reasoning to solve problems
	    l. Use proportional relationships to solve real-world problems
	    m. Use basic concepts of number theory (e.g., divisibility, prime factorization, multiples) to solve problems
	    n. Know a variety of strategies to determine the reasonableness of results
	    o. Understand and explain methods of calculating products and quotients of fractions, by using area models, tape diagrams, and double number lines, and by reading relationships of quantities from equations

  p. Using properties of operations to explain operations with rational numbers (including negative integers)

  q. Use the standard U.S. division algorithm to explain why decimal expansions of fractions eventually repeat and showing how decimals that eventually repeat can be expressed as fractions

  r. Explain why irrational numbers are needed and how the number system expands from rational to real numbers

8.2 Algebra

  a. Generate and analyze patterns

  b. Gain familiarity with factors and multiples

  c. Know how to evaluate and manipulate algebraic expressions, equations, and formulas

  d. Recognize and represent linear relationships algebraically

  e. Know how to solve linear equations and inequalities

  f. Apply and extend previous understandings of multiplication and division to divide fractions by fractions

  g. Know how to represent and solve nonlinear equations and inequalities

  h. Know how to represent and solve systems of equations and inequalities

  i. Know how to recognize and represent simple sequences or patterns (e.g., arithmetic, geometric)

8.3 Functions and Their Graphs

  a. Know how to identify, define, and evaluate functions

  b. Know how to determine and interpret the domain and the range of functions numerically, graphically, and algebraically

  c. Understand basic characteristics of linear functions (e.g., slope, intercepts)

  d. Understand the relationships among functions, tables, and graphs

  e. Know how to analyze and represent functions that model given information

II. Geometry and Data

8.4 Geometry and Measurement

a. Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit
b. Understand the concepts of angles and how to measure angles
c. Know how to solve problems involving perimeter, area, surface area and volume
d. Understand the concepts of similarity and congruence
e. Understand the properties of lines (e.g., parallel, perpendicular, intersecting) and angles
f. Draw and identify lines and angles, and classifying shapes by properties of their lines and angles
g. Understanding the properties of triangles
h. Understand the properties of quadrilaterals (e.g., rectangle, rhombus, trapezoid) and other polygons
i. Understand the properties of circles
j. Know how to interpret geometric relationships in the xy-plane (e.g., transformations, distance, midpoint)
k. Understand systems of measurements (e.g., metric, customary)
l. Understand congruence and similarity using physical models, transparencies, or geometry software
m. Understand how geometric constructions are made
n. Understand the basic concepts of trigonometry (e.g., right angle trigonometry)
o. Understand concepts of a line and rotational symmetry
p. Convert like measurement units within a given measurement system
q. Understand, apply, and discuss a proof of the Pythagorean Theorem
r. Solve real world and mathematical problems involving volume of cylinders, cones, and spheres
s. Examine dilations, translations, rotations, and reflections and combinations of these

8.5 Probability, Statistics, and Discrete Mathematics
a. Know how to interpret, represent, and analyze data
b. Know how to represent data in various forms

    c. Know and understand how to develop, use, and evaluate probability models

    d. Understand concepts associated with measures of central tendency and dispersion (spread)

    e. Know how to model and solve problems using simple diagrams, flowcharts, or algorithms

    f. Develop an understanding of statistical variability

    g. Summarize and describe distributions

    h. Analyze proportional relationships and using them to solve real-world and mathematical problems

    i. Investigate patterns of association in bivariate data

    j. Understand how to interpret and analyze data presented in various forms

    k. Understand how to represent data in various forms

    l. Understand statistical concepts and evaluate inferences associated with statistics (e.g., spread)

    m. Understand how to model and solve problems using diagrams and algorithms

    n. Understand how to model and solve problems using statistics and probability in real-world situations

    o. Compare two data distributions and making informal inferences between two populations

    p. Exploring patterns of association in bivariate data based on two-way tables (bivariate categorical data) and scatter plots (bivariate quantitative data)

8.6 Modeling

    a. Understand how a variety of strategies determine the reasonableness of results

    b. Understand how to model and solve problems in real-world situations

    c. Understand how to engage middle level learners in meaningful and interdisciplinary contexts, including the use of mathematical modeling

8.7 Ratios and Proportional Reasoning

    a. Reason about how quantities vary together in a proportional relationship, using tables, double number lines, and tape diagrams as supports

    b. Distinguish proportional relationships from other relationships, such as additive relationships and inversely proportional relationships

    c. Use unit rates to solve problems and to formulate equations for proportional relationships

	d. Identify that unit rates make connections prior learning by connecting ratios to fractions e. View the concept of proportional relationships as an intellectual precursor and key example of a linear relationship
9. Young Adolescent Development *AMLE: Standards 1& 3* *AMTE: Standard C*	***AMLE*** 9.1 Demonstrate comprehensive knowledge of young adolescent development 9.2 Demonstrate an understanding of the implications of diversity on the development of young adolescents 9.3 Demonstrate knowledge of young adolescent development when planning and implementing middle level curriculum and when selecting and using instructional strategies 9.4 Apply knowledge of young adolescent development when making decisions about their respective roles in creating and maintaining developmentally responsive learning environments 9.5 Utilize knowledge of the effective components of middle level programs and schools to foster equitable educational practices and to enhance learning for all students ***AMTE*** 9.6 Utilize strategies to support a range of early-adolescent learners and engage other educational professionals within their settings to support student learning 9.7 Understand how to engage middle level learners in meaningful and interdisciplinary contexts, including the use of mathematical modeling 9.8 Understand the developmental needs of early adolescents and use their knowledge to create and implement culturally relevant mathematical experiences for their students 9.9 Show awareness of structures that support and inhibit opportunities for learning in schools and systems

10. Computing Concepts
AR CSS K-8
ISTE
	AR CSS K-8 & ISTE
	10.1 Understand computational thinking and problem solving by
	   • Analyze problem solving strategies
	   • Analyze connections between mathematics and computer science
	   • Solve problems cooperatively and collaboratively (*ISTE Standards: 4a, 4b, 4c, and 4d*)
	10.2 Demonstrate an understanding of data and information by

	• Analyze various ways in which data is represented
	• Collect, arrange, and represent data
	• Interpret and analyze data and information
	10.3 Demonstrate understanding of algorithms and computer programs by
	     • Create and evaluate, and modify algorithms
	     • Create computer programs to solve problems
	10.4 Demonstrate an understanding of data and information
	     • Analyze the utilization of computers
	     • Utilize appropriate digital tools for various applications
	     • Analyze various components and functions of computers
	10.5 Demonstrating an understanding of community, global, and ethical impacts by analyzing appropriate uses of technology (*ISTE Standards: 3a, 3b, 3c, & 3d*)

11. Disciplinary Literacy
 	
ARDLS
	ARDLS
	
	Reading Standards for Literacy in Science and Technical Subjects, Grades 6-8
	11.1 Reading scientific and technical texts closely to determine what the text says explicitly and to make logical inferences from it, while determining central ideas or themes and analyzing development by:
	     • Cite specific textual evidence to support analysis of science and technical texts
	     • Determine the central ideas or conclusions of a text
	     • Provide an accurate summary of the text distinct from prior knowledge or opinions
	     • Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks
	11.2 Interpret words and phrases as they are used in scientific and technical texts, while analyzing the structure of such texts by:
	     • Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context
	     • Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic

- Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text

11.3 Integrate knowledge and ideas by:

- Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table)
- Distinguish among facts, reasoned judgement based on research findings, and speculation in a text
- Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic

11.4 Complete a text complexity analysis using all three complexity measures: quantitative, qualitative, and reader and task

Writing Standards for Literacy in Science and Technical Subjects, Grades 6-8

11.5 Write arguments focused on discipline-specific content by:

- Introduce claim(s) about a topic or issue, acknowledging, and distinguishing the claim(s) from alternate or opposing claims, and organizing the reasons and evidence logically
- Support claim(s) with logical reasoning and relevant, accurate data, and evidence that demonstrate an understanding of the topic or text, using credible sources
- Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence
- Establish and maintain a formal style
- Provide a concluding statement or section that follows from and supports the argument presented

11.6 Write informative/explanatory texts, including scientific procedures/experiments or technical processes by:

- Introduce a topic clearly, preview what is to follow; organize ideas, concepts, and information into broader categories as appropriate to achieving purpose; including formatting, graphics, and multimedia when useful to aiding comprehension
- Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples
- Use appropriate and varied transitions to create cohesion and clarifying the relationships among ideas and concepts

- Use precise language and domain-specific vocabulary to inform about or explain the topic
- Establish and maintain a formal style and objective tone
- Provide a concluding statement or section that follows from and supports the information or explanation presented

11.7 Produce and distribute writing by:
- Producing a clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience
- Developing and strengthening writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed
- Using technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently

11.8 Use research to build and present knowledge by:
- Conduct short research projects to answer a question (including a self-generated question), drawing on several sources, and generating additional related, focused questions that allow for multiple avenues of exploration
- Gather relevant information from multiple print and digital sources while using search terms effectively, assessing the credibility and the accuracy of each source, quoting, or paraphrasing the data and conclusions of others while avoiding plagiarism, and following a standard format for citation
- Draw evidence from informational texts to support analysis, reflection, and research

11.9 Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences

12. Mathematical Practices *NCTM-MP*	**<u>NCTM-MP:</u>** *The Standards for Mathematical Practices describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. These practices rest on important "processes and proficiencies" with longstanding importance in mathematics education.* 12.1 Make sense of problems and persevere in solving them 12.2 Reason abstractly and quantitatively 12.3 Construct viable arguments and the critique the reasoning of others

	12.4 Model with mathematics 12.5 Use appropriate tools strategically 12.6 Attend to precision 12.7 Look for and make use of structure 12.8 Look for and express regularity in repeated reasoning
13. Mathematics Teaching Practices *NCTM-PA*	***NCTM-PA:*** *The Effective Mathematics Teaching Practices provide a framework for the teaching and learning of mathematics that fosters student engagement in the Standards for Mathematical Practice at all levels. These Mathematics Teaching Practices represent a core set of high-leverage practices and essential teaching skills necessary to promote deep learning of mathematics.* 13.1: Establish mathematics goals to focus learning 13.2: Implement tasks that promote reasoning and problem solving 13.3: Use and connect mathematical representations 13.4: Facilitate meaningful mathematical discourse 13.5: Pose purposeful questions 13.6: Build procedural fluency from conceptual understanding 13.7: Support productive struggle in learning mathematics 13.8: Elicit and use evidence of student thinking