Standards of the P-6 Mathematics Specialist Endorsement

I. Mathematical Content Knowledge and Knowledge of Curriculum

Candidates have deep understanding of mathematical content and knowledge of mathematical curricula appropriate to grade levels P – 8. As a result, candidates:

1.1. Understand numbers and operations both broadly enough and deeply enough to teach arithmetic for understanding and to develop strategies for building conceptual understanding of number.	a. Discriminate between and provide examples of procedural and conceptual knowledge. b. Utilize an extensive repertoire of interpretations of arithmetic operations using whole numbers, integers, fractions, rational numbers, and decimals. c. Use place value to represent whole numbers and finite decimals through various representations. d. Apply standard algorithms and mental math for calculations and interpret non-standard methods commonly created by students. e. Provide examples of various representations of integers and rational numbers and explore their relationships. f. Coach inservice teachers to build deep understanding of number and operations through different approaches.
1.2. Use arithmetic to build algebraic concepts, appropriately apply algebraic reasoning and use algebraic notation and language correctly.	a. Use a variety of representations, including algebraic notation, to represent, generalize, and justify arithmetic claims. b. Use and critique different forms of mathematical and deductive arguments. c. Develop and use mathematical models to represent and solve real-world problems. d. Move from concrete experiences to important generalizations foundational to understanding major mathematical concepts. e. Recognize and explain properties of real numbers such as commutative property, associative property, distributive property, identities, and inverses, and how these properties affect the arithmetic of real numbers. f. Represent and analyze patterns and functions using words, tables, graphs, and algebraic notation. g. Coach inservice teachers in developing algebraic reasoning through knowledge of numbers and operations.
1.3. Are able to develop visualization and reasoning skills through use of technology and manipulatives.	a. Draw, decompose, and re-construct two- and three-dimensional shapes. b. Classify two- and three-dimensional shapes according to their properties and develop definitions of classes of shapes. c. Apply transformations and use symmetry to analyze mathematical situations. d. Communicate inductive and deductive geometric arguments, using correct technical vocabulary. e. Coach in service teachers in connections between geometric and algebraic concepts through use of technology.
1.4. Demonstrate expertise in selecting appropriate units and tools for the attribute being measured.	a. Compare units and convert measurements from one unit to another. b. Devise area formulas for basic shapes and estimate areas of irregular shapes. c. Recognize the behavior of measure (length, area, and volume) under uniform dilations. d. Coach inservice teachers in identifying and selecting the appropriate unit and tool for measuring various shapes.

1.5. Demonstrate procedural and conceptual understanding of data analysis and probability through statistical experiments.	a. Pose questions, design investigations, and gather appropriate data to address the questions. b. Represent data using concrete objects, tables, and pictures and graphs. c. Describe a set of data, including its shape, spread, and center, using different forms of representations. d. Propose and justify conclusions and predictions that are based on data and design studies to further investigate the conclusions and predictions. e. Measure the likelihood of events occurring, and apply the idea of randomness to small and large samples. f. Coach inservice teachers in using methods for gathering, analyzing, and interpreting data in raw form, tables, and graphs.
1.6. Apply the five process criteria throughout work in any of the content strands	a. Build mathematical knowledge through problem solving, solve problems that arise in mathematics and other contexts, apply and adapt a variety of strategies to solve problems, and monitor and reflect on the process. b. Recognize reasoning and proof as fundamental aspects of mathematics; make and investigate mathematical conjectures, develop and evaluate mathematical arguments and proofs, and select and apply various types of reasoning. c. Organize mathematical thinking through communication, communicate mathematical thinking using the language of mathematics, and analyze and evaluate the mathematical and thinking strategies of others. d. Recognize and apply connections within mathematics and to contexts outside of mathematics; understand how mathematical ideas interconnect and build upon one another to produce a coherent whole. e. Create and use representations to organize, record and communicate mathematical ideas and to model and interpret physical, social, and mathematical phenomena. Select, apply, and translate between mathematical representations to solve problems.
1.7. Are able to evaluate mathematics curricula based upon the NCTM Principles and Standards and upon the Ohio Academic Content Standards (OAS) and use technology as an integrated part of the curriculum.	a. Evaluate mathematics curriculum alignment with the OAS. b. Trace threads of mathematical concepts throughout the grade levels in the OAS and then use the results to evaluate a curriculum across grade levels. c. Select and use the appropriate technology for learning mathematics and for solving problems.

II. Knowing Students as Learners of Mathematics

Candidates have knowledge of child development, child psychology, and influences on student learning such as, cultural diversity, limited English proficiency, gender, and physical challenges. As a result, candidates:

2.1 Demonstrate and apply current theories in the learning of mathematics.	a. Identify and describe mathematics-specific principles of learning theory. b. Develop lessons which reflect application of current learning theory and knowledge of how students learn specific mathematical concepts. c. Design instructional plans that enable students to construct valid and useful understanding of mathematics. d. Identify, explain, and create appropriate assessment strategies based on mathematics learning theory. e. Model the application of mathematics learning theory.
2.2 Know and are able to incorporate and model developmentally appropriate practice for all students	a. Describe various types of human development, such as, intellectual, social, and emotional. b. Articulate the levels of development of P-6 children in terms of theories of human development. c. Select developmentally appropriate learning experiences.

	d. Provide instructional options to meet developmental needs. e. Support classroom teachers in using a wide range of suitable instructional practices.
2.3 Know and are able to apply and model a variety of intervention strategies for meeting diverse student needs.	a. Relate student characteristics to instructional decision-making. b. Articulate how differences in student characteristics can affect mathematics learning. c. Employ critical analysis and synthesis to identify, evaluate, and modify practice to meet the needs of a diverse student population. d. Adapt instruction and assessment to meet the individual needs of students. e. Support classroom teachers in using a wide range of instructional practices to meet diverse student needs.
2.4 Respect all students and support student differences.	a. Provide evidence of self-efficacy for meeting the needs of diverse learners. b. Model practice that supports respect for student differences.

III. Instructional strategies and the use of materials and technology

Candidates have knowledge of developmentally appropriate instructional practices, approaches, methods, materials, technology, and reflective skills to support mathematics instruction. As a result, candidates:

3.1 Use a wide range of instructional practices that promote mathematics for learners at differing stages of development.	a. Acquaint teachers with successful and innovative strategies, including translating research findings into practice. b. Assist other teachers in developing significant mathematical tasks and leading classroom discourse that promote mathematical thinking. c. Support classroom teachers in developing a climate of inquiry, incorporating the process standards (problem solving, reasoning and proof, communication, connections, and representation) in their classrooms. d. Assist other teachers in implementing early intervention strategies with low-performing students, including differentiation of time and teaching strategies. e. Coach teachers in a variety of instructional grouping options and methods to promote a positive learning environment. f. Assist other teachers by modeling effective instructional strategies
3.2 Evaluate curriculum materials; plan and use appropriate materials, including technology-based, for effective mathematics instruction for learners at various stages of development.	a. Assist the building or district by recommending and aiding in the selection of instructional materials. b. Oversee the implementation of instructional materials and evaluate their effectiveness. c. Recommend appropriate technology to support mathematics instruction. d. Coach teachers in effectively implementing the use of a wide variety of technology in their classrooms (from "low tech" options to computer software).
3.3 Encourage reflection on, and the discussion of what is effective, what is not effective, and how to make improvements.	a. Use a variety of professional development models (e.g., peer coaching, lesson study, and action research). b. Assist other teachers to make instructional decisions based on student data. c. Analyze results of statewide and other standardized testing to make professional development decisions for teachers in the district. d. Conduct and analyze longitudinal assessment studies to determine program effectiveness and recommend changes for improvement.

IV. Assessment, Diagnosis, and Evaluation

Candidates use a variety of tools and practices to plan, implement, and revise classroom instruction to best meet the needs of all students. As a result, candidates can:

4.1 Critique and use a wide range of assessment tools and practices including individual and group,	a. Determine the appropriateness of various assessment instruments. b. Use diagnostic, formative, and summative methods to determine students' understanding of mathematics.

formal and informal, diagnostic, formative, and summative.	c. Use formative and summative assessment methods to monitor their own teaching effectiveness. d. Use formative assessment methods to monitor student learning and adjust instructional strategies and assessment practices. e. Use and interpret a wide range of assessment tools and practices. f. Coach inservice teachers to administer and interpret assessments appropriate for selected purposes.
4.2 Use assessment information to design, implement, and revise effective instruction for all students.	a. Integrate assessment into instruction to promote learning of all students. b. Skillfully incorporate emergent opportunities for assessing student progress into daily instruction. c. Use assessment tools to monitor and adjust teaching. d. Design appropriate assessment strategies that address state standards. e. Coach inservice teachers to apply student assessment results to make inferences and draw conclusions about future instructional plans and goals. f. Coach inservice teachers to use assessment results to inform intervention practices for current students. g. Articulate evidence-based research supporting different perspectives regarding assessment and instruction.
4.3 Communicate results of assessment to specific individuals and groups (students, parents, caregivers, colleagues, administrators, policymakers, community members, etc.).	a. Coach inservice teachers to communicate in a variety of formats (including but not limited to: newsletter, internet, flyers, email, letters, etc.) to specific individuals and groups (students, parents, caregivers, colleagues, administrators, policymakers, community members, etc.). b. Communicate results of assessments in context. c. Provide appropriate (valid) interpretations of testing results.
4.4 Use statewide assessment tools and results to inform instruction and revise curriculum.	a. Use summative and diagnostic assessments to determine student achievement. b. Use summative and diagnostic assessments to evaluate curriculum and programs. c. Use summative and diagnostic assessments to inform instruction. d. Coach inservice teachers to use statewide assessment tools and results to inform instruction and revise curriculum and programs.
4.5 Identify the strengths and weaknesses of different assessment methods.	a. Use knowledge of mathematics to make decisions about the appropriateness of assessment tools. b. Compare and contrast a wide range of assessment tools, practices and their applications. c. Recommend a wide range of assessment tools and practices as appropriate. d. Coach inservice teachers to administer and interpret assessments appropriate for selected purposes. e. Articulate evidence-based research supporting different perspectives regarding assessment and instruction.
4.6 Develop student self-monitoring skills to use in their mathematics learning.	a. Teach students to develop skills in reflection to improve their mathematics abilities (including but not limited to: entries in a journal, revision of work, discussions with other students, notes to the teacher, etc.) b. Provide opportunities for students to take responsibility for their own learning. c. Coach inservice teachers to develop student self-monitoring skills to use in their mathematics learning.

V. Research for the Teaching and Learning of Mathematics

Candidates view evidence-based research as a necessary and integral part of professional development and as an individual responsibility to guide practice and advance understanding of the teaching and learning of mathematics. As a result, candidates:

5.1 Demonstrate an understanding of research as it applies to the teaching and learning of	a. Use appropriate search behaviors to identify and critique research resources in mathematics education. b. Identify and articulate specific research methodologies used to inform

mathematics.	mathematics education. c. Read, critique, and synthesize mathematics education research. d. Articulate research findings and use these findings to guide practice.
5.2 Engage in research to acquire an understanding of the teaching and learning of mathematics to inform and guide practice.	a. Identify and articulate issues or topics for research. b. Read, critique, and synthesize articles in professional journals and publications. c. Design, conduct, analyze, and report research using appropriate educational research methods. d. Identify and articulate implications for informing and advancing practice.
5.3 Collaborate with other professionals for the purpose of advancing knowledge of the teaching and learning of mathematics.	a. Engage in collaborative research. b. Participate in professional conferences and grant writing activities. c. Contribute to the dissemination of mathematics education research to educational communities (other professionals, paraprofessionals, parents, and community members). d. Work collaboratively with institutions of higher learning.
5.4 Develop an understanding of research as it applies to professional development and adult learners.	a. Use appropriate search behaviors to identify and critique research resources related to professional development and adult learners. b. Read, critique, and synthesize research related to professional development and adult learners. c. Articulate research findings and use these findings to design professional development activities.

VI. Professional Development

Candidates have a knowledge base of facilitation skills, the change process, and the standards of quality professional development. As a result, candidates:

6.1 Work with colleagues to observe, analyze, reflect, and provide feedback on each other's practice.	a. Actively engage in collaboration and dialogue with other teachers and mathematics specialists to obtain recommendations and advise on teaching practices and ideas on assessment, instruction, and all areas of mathematics practice. b. Positively and constructively provide analysis and reflection of teaching practices. c. Read related research studies and use reflection to actively engage in dialogue with other professionals in observation, evaluation, and feedback activities. d. Coach colleagues toward exemplary practice in mathematics assessment and instruction. e. Model and/or team teach lessons to give peer teachers opportunities to observe appropriate learning environments.
6.2 Pursue the development of professional knowledge and positive dispositions related to mathematics as well as to the teaching of mathematics.	a. Indicate knowledge of and membership in some professional organizations related to mathematics and mathematics leadership. b. Conduct professional study groups for paraprofessionals and teachers. c. Engage in continuous, life-long learning in the area of mathematics as indicated by a cohesive plan for professional development.
6.3 Participate in, initiate, implement and evaluate professional development programs.	a. Exhibit leadership skills in professional development. b. Perform needs assessments with the staff to determine long and short term goals for mathematics professional development. c. Plan, implement and evaluate professional development efforts at the grade, school, and/or district level. d. Identify and describe the evidence-based research regarding mathematics instruction. e. Articulate the characteristics of sound professional development programs.
6.4 Use a wide range of interpersonal skills to work	a. Initiate, promote, and sustain professional learning communities. b. Model effective verbal and non-verbal communication strategies while

successfully with teachers, administrators, families, and others to bring about positive change in the teaching and learning of mathematics.	facilitating professional development sessions or modeling classroom instruction. c. Establish positive rapport with all stakeholders. d. Encourage positive school culture that adapts to reform in mathematics education.
6.5 Display positive dispositions to mathematics and the teaching of mathematics.	a. Articulate the theories and research related to the connections between teacher dispositions and student achievement. b. Demonstrate and model a personal commitment to life-long learning in the areas of mathematics and mathematics education. c. Demonstrate the value of mathematics as a way of thinking and its application in other disciplines and in society. d. Promote teachers' confidence, flexibility, perseverance, curiosity, and inventiveness in doing mathematics by engaging teachers in appropriate tasks and professional discourse about mathematics and mathematics teaching.