8710.3320   MIDDLE LEVEL ENDORSEMENT LICENSE FOR TEACHERS OF MATHEMATICS.

Subpart 1. **Scope of practice.** A teacher of mathematics with a middle level endorsement license is authorized to teach students in grades 5 through 8 in any school organizational pattern.

Subp. 2. **Licensure requirements.** A candidate for licensure as a middle level teacher of mathematics shall:

A. hold one or more of the following classroom teaching licenses granted by the Professional Educator Licensing and Standards Board: a life license; a current nonvocational entrance, nonrenewable, or professional license; or a current entrance or continuing secondary vocational license based on a degree program in agriculture education, business education, consumer homemaking and family life education, industrial education, or marketing education;

B. show verification of completing a preparation program approved under chapter 8705 leading to licensure in middle level teaching of mathematics for grades 5 through 8 in subpart 3; and

C. demonstrate completion of the equivalent of a college minor in mathematics.

Subp. 3. **Subject matter standards.** A candidate for licensure as a middle level teacher of mathematics must complete a preparation program under subpart 2, items B and C, that includes the candidate's demonstration of the knowledge and skills in items A to D.

A. A teacher of middle level students understands the nature of early adolescence and the needs of young adolescents. The teacher must understand and apply:

(1) the research base for and best practices of middle level education;

(2) the educational principles relevant to the physical, social, emotional, moral, and cognitive development of young adolescents;

(3) the concepts of "belonging" and "family connectedness" as crucial to the development of young adolescents; and

(4) the process and necessity of collaboration with families and other adults in support of the learning of young adolescents.

B. A teacher of middle level students understands the teaching of an academic subject area that integrates understanding of the academic content with the teacher's understanding of pedagogy, students, learning, classroom management, and professional development. The teacher of middle level students in grades 5 through 8 must:

(1) develop curriculum goals and purposes based on the central concepts of the academic specialty and know how to apply instructional strategies and materials that are appropriate for middle level students and are specific to the academic content area;

(2) understand how to integrate curriculum across subject areas in developmentally appropriate ways;

(3) understand the role and alignment of district, school, and department mission and goals in program planning;

(4) understand the need for and how to connect schooling experiences with everyday life, the workplace, and further educational opportunities;

(5) know how to involve representatives of business, industry, and community organizations as active partners in creating educational opportunities;

(6) understand the role and purpose of cocurricular and extracurricular activities in the teaching and learning process; and

(7) understand the impact of reading ability on achievement in the academic specialty, recognize the varying reading comprehension and fluency levels represented by students, and possess the strategies to assist students to read the academic specialty content more effectively.

C. A teacher with a middle level endorsement for teaching mathematics in grades 5 through 8 must demonstrate knowledge of fundamental concepts of mathematics and the connections among them. The teacher must know and apply:

(1) concepts of patterns, relations, and functions:

(a) recognize, describe, and generalize patterns and build mathematical models to describe situations, solve problems, and make predictions;

(b) analyze the interaction within and among quantities and variables to model patterns of change and use appropriate representations, including tables, graphs, matrices, words, algebraic expressions, and equations;

(c) represent and solve problem situations that involve variable quantities and be able to use appropriate technology;

(d) understand patterns present in number systems and apply these patterns to further investigations;

(e) apply properties of boundedness and limits to investigate problems involving sequences and series; and

(f) apply concepts of derivatives to investigate problems involving rates of change;

(2) concepts of discrete mathematics:

(a) application of discrete models to problem situations using appropriate representations, including sequences, finite graphs and trees, matrices, and arrays;

(b) application of systematic counting techniques in problem situations to include determining the existence of a solution, the number of possible solutions, and the optimal solution;

(c) application of discrete mathematics strategies including pattern searching; organization of information; sorting; case-by-case analysis; iteration and recursion; and mathematical induction to investigate, solve, and extend problems; and

(d) exploration, development, analysis, and comparison of algorithms designed to accomplish a task or solve a problem;

(3) concepts of number sense:

(a) understand number systems; their properties; and relations, including whole numbers, integers, rational numbers, real numbers, and complex numbers;

(b) possess an intuitive sense of numbers including a sense of magnitude, mental mathematics, estimation, place value, and a sense of reasonableness of results;

(c) possess a sense for operations, application of properties of operations, and the estimation of results;

(d) be able to translate among equivalent forms of numbers to facilitate problem solving; and

(e) be able to estimate quantities and evaluate the reasonableness of estimates;

(4) concepts of shape and space:

(a) shapes and the ways in which shape and space can be derived and described in terms of dimension, direction, orientation, perspective, and relationships among these properties;

(b) spatial sense and the ways in which shapes can be visualized, combined, subdivided, and changed to illustrate concepts, properties, and relationships;

(c) spatial reasoning and the use of geometric models to represent, visualize, and solve problems;

(d) motion and the ways in which rotation, reflection, and translation of shapes can illustrate concepts, properties, and relationships;

(e) formal and informal argument, including the processes of making assumptions; formulating, testing, and reformulating conjectures; justifying arguments based on geometric figures; and evaluating the arguments of others;

(f) plane, solid, and coordinate geometry systems, including relations between coordinate and synthetic geometry and generalizing geometric principles from a two-dimensional system to a three-dimensional system;

(g) attributes of shapes and objects that can be measured, including length, area, volume, capacity, size of angles, weight, and mass;

(h) the structure of systems of measurement, including the development and use of measurement systems and the relationships among different systems; and

(i) measuring, estimating, and using measurements to describe and compare geometric phenomena;

(5) concepts of data investigations:

(a) data and its power as a way to explore questions and issues;

(b) investigation through data, including formulating a problem; devising a plan to collect data; and systematically collecting, recording, and organizing data;

(c) data representation to describe data distributions, central tendency, and variance through appropriate use of graphs, tables, and summary statistics; and

(d) analysis and interpretation of data, including summarizing data; and making or evaluating arguments, predictions, recommendations, or decisions based on an analysis of the data; and

(6) concepts of randomness and uncertainty:

(a) inference and the role of randomness and sampling in statistical claims about populations;

(b) probability as a way to describe chance or risk in simple and compound events;

(c) predicting outcomes based on exploration of probability through data collection, experiments, and simulations; and

(d) predicting outcomes based on theoretical probabilities and comparing mathematical expectations with experimental results.

D. A teacher with a middle level endorsement for teaching mathematics in grades 5 through 8 must understand the content and methods for teaching reading, including:

(1) knowledge of reading processes and instruction, including:

(a) orthographic knowledge and morphological relationships within words;

(b) the relation between word recognition and vocabulary knowledge, fluency, and comprehension in understanding text and content materials;

(c) the importance of direct and indirect vocabulary instruction that leads to enhanced general and domain-specific word knowledge;

(d) the relationships between and among comprehension processes related to print processing abilities, motivation, reader's interest, background knowledge, cognitive abilities, knowledge of academic discourse, and print and digital text; and

(e) the development of academic language and its impact on learning and school success;

(2) ability to use a wide range of instructional practices, approaches, methods, and curriculum materials to support reading instruction, including:

(a) the appropriate applications of a variety of instructional frameworks that are effective in meeting the needs of readers of varying proficiency levels and linguistic backgrounds in secondary settings;

(b) the ability to scaffold instruction for students who experience comprehension difficulties;

(c) selection and implementation of a wide variety of before, during, and after reading comprehension strategies that develop reading and metacognitive abilities;

(d) the ability to develop and implement effective vocabulary strategies that help students understand words including domain-specific content words;

(e) the ability to plan instruction and select strategies that help students read and understand math texts and spur interest in more complex reading materials, including:

i. the density of ideas;

ii. concepts that build within a chapter or across chapters;

iii. use of equations to model life situations; asking students to create or restate, in words or sentences, the relations between symbols; and the situation being modeled;

iv. text with diagrams and graphs; and

v. use of different representations to aid in understanding the underlying mathematical concept, matching each representation to the learning styles of different individuals; and

(f) model strategies for representing mathematical ideas in a variety of modes (literal, symbolic, graphic, digital), which includes asking students to restate symbolic representations (numerals, equations, and graphs), in words or sentences.

Subp. 3a. **Student teaching and field experiences.** A candidate for licensure to teach mathematics in grades 5 through 8 must apply the standards of effective practice in teaching students in this academic subject by completing a minimum of a four-week student teaching experience in a middle level placement in which the candidate is supervised by a cooperating teacher, and evaluated at least twice by qualified faculty supervisors in collaboration with the cooperating teachers. Candidates for licensure who hold a license at the elementary level must complete the student teaching experience with students in grade 7 or 8. Candidates for licensure who hold a license at the secondary level must complete the student teaching experience with students in grade 5 or 6.

Subp. 4. [Repealed, 47 SR 986]

Subp. 5. [Repealed, L 2015 c 21 art 1 s 110]

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