

Thinking Mathematically: Elementary EditionTM Online

Thinking Mathematically: Elementary Edition Online is designed for elementary school teachers to deepen their knowledge, appreciation, and understanding of K-6 mathematics. Using the NCTM Content and Process Standards as a vehicle for understanding what students need to know and be able to do in math, students will investigate strategies for developing mathematical literacy and fostering logical thinking. Students will explore methods and suggestions for increasing student engagement and interest in the subject of mathematics. All course modules model research-based strategies for teaching mathematics and engage students in discussion on the use of these strategies.

To the right are the key areas of focus for the eight-week online asynchronous course. For more information, refer to the syllabus, which provides a detailed outline of the course material as well as a bibliography of research on which the course is based.

In this course, participants will

- ▶ Research NCTM standards and connect them to state curriculum.
- ▶ Use precise terminology to foster effective communication of mathematical ideas and concepts.
- ▶ Use the five content strands (Number and Operations, Algebra, Geometry, Measurement, Data Analysis and Probability).
- ▶ Use the five process strands (Problem Solving, Reasoning and Proof, Communication, Connections, and Representation).
- ▶ Analyze strategies for developing mathematical literacy, explaining its overall importance in effective teaching, and applying strategies in the classroom.
- ▶ Formulate different ways to link curriculum, instruction, and assessment.
- ▶ Connect and integrate mathematical topics and other content areas.
- ▶ Form connections between mathematics and real life.

Thinking Mathematically: Elementary Edition™ Online

Course Description

This course is designed to deepen elementary school teachers' knowledge, appreciation, and understanding of K–6 mathematics. Participants will use the NCTM Content and Process Strands as a vehicle for understanding what students need to know and be able to do in math. They will also investigate strategies for developing mathematical literacy, fostering logical thinking, and increasing student interest in the subject of mathematics. All modules will model research-based strategies for teaching mathematics and engage participants in discussion on the use of these strategies.

Course Outcomes

Upon completion of this class, the learner is expected to be able to:

1. Identify his or her individual learning style and reflect on how that style influences classroom teaching and learning.
2. Define his or her personal history with mathematics and mathematics education.
3. Research NCTM standards and connect them to his or her state curriculum.
4. Use more precise terminology to foster effective communication of mathematical ideas and concepts.
5. Define *number sense*, describe its relationship to mathematical literacy, and provide several examples of how it is applied by both students and teachers.
6. Use the five content strands (Number and Operations, Algebra, Geometry, Measurement, Data Analysis and Probability).
7. Use the five process strands (Problem Solving, Reasoning and Proof, Communication, Connections, and Representation).
8. Analyze strategies for developing mathematical literacy, explain its overall importance in effective teaching, and apply strategies in the classroom.
9. Formulate different ways to link curriculum, instruction, and assessment.
10. Connect and integrate mathematical topics and other content areas.
11. Form connections between mathematics and real life.
12. Evaluate topical research and participate in graduate-level discussions about best practices.

Required Text

Jacobs, H. (1994). *Mathematics: A human endeavor* (3rd ed.). New York: W.H. Freeman and Company.

Participants must also order a hinged mirror from the following site:

<https://www.enasco.com/product/TB17195J>

Instructors and learners will also use instructor-generated materials, learner-generated materials, and Web-based resources to facilitate learning.

Topical Outline	List of Concepts
Exploring NCTM Principles and Standards for Elementary Math	Overview of NCTM Standards and Curriculum Focal Points; vertical alignment among grades K–6; gap analysis using NCTM content and process strands with individual state standards; writing about mathematics; Frayer Model
Developing Mathematical Literacy	Strategies for vocabulary development (for example, List–Group–Label and word sorts); resources for reading in math and ways to use them in the classroom; techniques for encouraging writing/drawing to explain mathematical thinking; good questioning techniques; question sets for the five content strands of mathematics
Reasoning and Number Sense	Number sense and its relationship to mathematical literacy; solving word problems; reasoning and its role in mathematical education; deductive reasoning; proof; logic problems; Bloom’s Taxonomy; questioning skills
Building Blocks for Algebraic Thinking - Patterns, Sequences, and Functions	Sequences (arithmetic, geometric, binary, squares, cubes, and Fibonacci); algebraic number sense; equations in their simplest form; functions (linear and nonlinear); current research on early teaching of algebra and algebraic concepts; comparing and contrasting various types of sequences
Geometry : Two- and Three-Dimensional Figures	Properties of different types of symmetry; reflectional symmetry and rotational symmetry; properties of two- and three-dimensional figures; sorting and classifying shapes and polygons
The Mathematics of Chance	Probability; expressing and teaching probability; tree diagrams; Pascal’s triangle; fractions
Statistically Speaking	Data collection and analysis; polls and surveys; reading statistics correctly; basic vocabulary of statistics (mean, median, and mode); measures of central tendency and variability; ways in which statistics can be used to “lie”
Looking Back at What You’ve Learned	Ways to use podcasting and similar media to teach mathematics; developing narrative stories to explain mathematical problems; audio math stories that use accessible, free online technology; current research on math for elementary grade levels

Course Assessments and Links to Course Outcomes

Throughout the course the learner will be assessed and evaluated on the completion of the following assessments. Learning activities include large- and small-group discussions and assessments for a total of 1176 points.

Modules	Topics of Modules	Points	Correlation With Course Outcomes
Module 1:	Exploring NCTM Principles and Standards for Elementary Math	143	1, 2, 3, 4, 11
Module 2:	Developing Mathematical Literacy	158	4, 8, 9, 11
Module 3:	Reasoning and Number Sense	153	1, 2, 5, 6, 7, 11
Module 4:	Building Blocks for Algebraic Thinking - Patterns, Sequences, and Functions	178	6, 7, 10, 11
Module 5:	Geometry: Two- and Three-Dimensional Figures	159	6, 7, 10, 11
Module 6:	The Mathematics of Chance	123	6, 7, 10, 11
Module 7:	Statistically Speaking	147	1, 2, 6, 7, 10, 11
Module 8:	Looking Back at What You've Learned	115	9, 12
		Total	1176

Criteria specific to each assessment will be explained in conjunction with the instructional activities.

Instructional Methodology

The instructional methodology of this course focuses on developing, enhancing, and improving the instructional expertise and pedagogical knowledge base of practicing educators. Strategies include presentation of new content through online readings, active construction of knowledge through practice and problem solving, collaborative group work, personal reflection, structured small-group or whole-class discussion, analysis of assigned reading, and the application of course content and skills to participant's individual grade level, subject area(s), and classroom.

Grading Scale

The course facilitator will post the grading scale.

Performance Learning Systems' Late Policy

There will be a 10% deduction of points per day for all posts and submitted assignments which are late. Replies posted after the due date will earn no points. In rare cases, partially or poorly completed assignments may be resubmitted for partial credit at the discretion of the instructor. The following exceptions apply:

- If a participant is sick/hospitalized or has a death in the family, the timing of makeup work may be arranged with the course facilitator. No points will be deducted if the work is completed according to the agreement.
- If a participant is on vacation/traveling/etc., the participant must contact the course facilitator ahead of time to avoid a penalty. This type of absence may occur only once during a course. All posts should be submitted for the missed module before

- If a participant has difficulty completing everything in a week, an extension can be granted if the participant contacts the facilitator during the week (not at the last minute).

Performance Learning Systems' Participant Drop Policy

- Participants are eligible to receive a refund if they attend class for one week or less. This means participants must withdraw by the end of Module 1 to receive a refund.
- Refunds of the balance of tuition paid will be given, minus the \$50 deposit.

Performance Learning Systems' Academic Integrity Policy

Performance Learning Systems expects absolute academic honesty and integrity from every course participant. The specific Academic Integrity and Honor Code policies of our partner colleges and universities are embraced and enforced by PLS instructors. The following are considered to be serious violations:

- **Plagiarism:** the use of another's ideas, data, or words without proper acknowledgment.
- **Fabrication:** the use of invented information or the falsification of research or other findings with the intent to deceive.
- **Collusion:** improper collaboration with another in preparing assignments or projects.
- **Cheating:** an act of deception by which a student misrepresents that he or she has mastered information on an academic exercise that he or she has not mastered.
- **Academic Misconduct:** tampering with grades, or taking part in obtaining or distributing any part of student work that is not his or her own.

Violation(s) or suspected violation(s) will be investigated and pursued according to specific college/university procedures.

Identity Authentication

The college/university, Performance Learning Systems (PLS), and students share a joint responsibility to ensure that each student's contribution in an online course activity comes from that student alone. For the student, this responsibility has two parts:

1. Students are responsible for positively ensuring that every contribution to an online course created with the students' computer account is made by the student alone. Contributions covered under this policy include: written assignments; quiz and exam submissions; discussion forum postings; live participation in text-based chat sessions, phone conferences, and videoconferences. If a student allows another person to write or make any kind of submission to an online activity in the student's name, then this constitutes cheating and will be treated as a violation of academic honesty.
2. Students are responsible for ensuring the integrity of their computer account security by following the actions required of them by the PLS Acceptable Use Policy. These actions include keeping passcodes private, updating passcodes when required by Performance Learning Systems, and reporting breaches of the security policy to the IT Helpdesk.

Course Evaluation

The evaluation of learner work will be based on the defined criteria for learner assessments. The criteria for learner assessments will be outlined for students prior to instructional activities and engagement with student learning targets (outcomes). Grading is based solely on the evaluation of student learning targets and defined criteria for learner assessments.

Formative assessment of learning outcomes is conducted throughout the course, using a variety of means that include the following: completion of assessments; constructive contributions to class discussions (whole-class as well as small-group); sharing of valuable, pertinent, and/or applicable ideas and experiences; and active participation in online interactions. It is expected that each participant will contribute to the academic quality of the course.

Summative assessment includes the completion of weekly learning activities and assignments for which the participant will need to synthesize class content, apply it to his or her own practice, and complete a plan for implementing the major components of content and skill acquired during the course.

Course Outcome Correlations With INTASC Standards for Teachers

	Course Outcomes
Standard 1: Subject Matter The teacher understands the central concepts, tools of inquiry, and structures of the discipline(s) he or she teaches and can create learning experiences that make these aspects of subject matter meaningful for students.	3, 4, 5, 6, 7, 8, 9, 10, 11, 12
Standard 2: Student Learning The teacher understands how children and youth learn and develop, and can provide learning opportunities that support their intellectual, social and personal development.	1, 2, 3
Standard 3: Diverse Learners The teacher understands how students differ in their approaches to learning and creates instructional opportunities that are adapted to diverse learners.	8, 9, 10, 11, 12
Standard 4: Instructional Strategies The teacher understands and uses a variety of instructional strategies to encourage students' development of critical thinking, problem solving, and performance skills.	8, 9, 10, 11, 12
Standard 5: Learning Environment The teacher uses an understanding of individual and group motivation and behavior to create a learning environment that encourages positive social interaction, active engagement in learning, and self-motivation.	8, 9, 10, 11, 12
Standard 6: Communication The teacher uses knowledge of effective verbal, nonverbal, and media communication techniques to foster active inquiry, collaboration, and supportive interaction in the classroom.	4
Standard 7: Planning Instruction The teacher plans and manages instruction based upon knowledge of subject matter, students, the community, and curriculum goals.	8, 9, 10, 11, 12
Standard 8: Assessment The teacher understands and uses formal and informal assessment strategies to evaluate and ensure the continuous intellectual, social and physical development of the learner.	9
Standard 9: Reflection and Professional Development The teacher is a reflective practitioner who continually evaluates the effects of her/his choices and actions on others (students, parents, and other professionals in the learning community) and who actively seeks out opportunities to grow professionally.	1, 2, 8, 9, 10, 11, 12
Standard 10: Collaboration, Ethics, and Relationships The teacher fosters relationships with school colleagues, parents, and agencies in the larger community to support students' learning and well-being.	12

The Interstate New Teacher Assessment and the Support for Consortium (INTASC) standards were developed by the Council of the Chief State School Officers and member states. Copies may be downloaded from the Council's website at <http://www.ccsso.org>.

© Council of Chief State School Officers. (1992) Model standards for beginning teacher licensing, assessment, and development: A resource for state dialogue. Washington, DC: Author. <http://www.ccsso.org/content/pdfs/corestrd.pdf>.

Course Outcome Correlations With National Board for Professional Teaching (NBPTS) Propositions and Standards

Proposition 1: Teachers are Committed to Students and Their Learning.	Course Outcomes
NBCTs are dedicated to making knowledge accessible to all students. They believe all students can learn.	9, 10, 11, 12
They treat students equitably. They recognize the individual differences that distinguish their students from one another and they take account for these differences in their practice.	9, 10
NBCTs understand how students develop and learn.	1, 2, 3, 5, 6, 7
They respect the cultural and family differences students bring to their classroom.	1, 2, 4, 5
They are concerned with their students' self-concept, their motivation and the effects of learning on peer relationships.	1, 2, 4, 5
NBCTs are also concerned with the development of character and civic responsibility.	NA
Proposition 2: Teachers Know the Subjects They Teach and How to Teach Those Subjects to Students.	
NBCTs have mastery over the subject(s) they teach. They have a deep understanding of the history, structure and real-world applications of the subject.	5, 6, 7, 8
They have skill and experience in teaching it, and they are very familiar with the skills gaps and preconceptions students may bring to the subject.	5, 6, 7, 8, 9, 10, 12
They are able to use diverse instructional strategies to teach for understanding.	9, 10, 11
Proposition 3: Teachers are Responsible for Managing and Monitoring Student Learning.	
NBCTs deliver effective instruction. They move fluently through a range of instructional techniques, keeping students motivated, engaged and focused.	8, 9, 10
They know how to engage students to ensure a disciplined learning environment, and how to organize instruction to meet instructional goals.	3, 4, 5, 6, 7
NBCTs know how to assess the progress of individual students as well as the class as a whole.	9
They use multiple methods for measuring student growth and understanding, and they can clearly explain student performance to parents.	8, 9, 10, 11
Proposition 4: Teachers Think Systematically about Their Practice and Learn from Experience.	
NBCTs model what it means to be an educated person – they read, they question, they create and they are willing to try new things.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
They are familiar with learning theories and instructional strategies and stay abreast of current issues in American education.	4, 12
They critically examine their practice on a regular basis to deepen knowledge, expand their repertoire of skills, and incorporate new findings into their practice.	1, 2

Proposition 5: Teachers are Members of Learning Communities.

NBCTs collaborate with others to improve student learning.	1, 2
They are leaders and actively know how to seek and build partnerships with community groups and businesses.	NA
They work with other professionals on instructional policy, curriculum development and staff development.	NA
They can evaluate school progress and the allocation of resources in order to meet state and local education objectives.	NA
They know how to work collaboratively with parents to engage them productively in the work of the school.	NA

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