

Title

Applying the NCTM Principles in Grades 6-8

Target Audience

This course is intended for pre-service and in-service teachers of students in grades 6-8.

Prerequisites

There are no prerequisites for this course.

Course Description

This course provides an introduction to the six principles identified in the National Council of Teachers of Mathematics' (NCTM) *Standards and Principles for School Mathematics*: Equity, Curriculum, Teaching, Learning, Assessment, and Technology. Through a combination of media such as text, video, and interactives, the learner receives key concepts and strategies for applying these principles in the classroom. As a final task, learners will use what they have learned to create a plan for applying these six principles to their teachings.

Instructor/Facilitator

See instructor/facilitator sheet

Credits

To be determined by college or university

Goals

In this course, learners will:

- Explore NCTM's *Principles for School Mathematics* through engaging personal reflection and by reviewing outside examples.
- Expand your understanding of effective classroom strategies that allow students to make sense of mathematics, whether working independently or collaboratively.
- Discover strategies for creating a learning environment that fosters the development of each student's mathematical power.
- Develop a plan of action for applying NCTM's *Principles for School Mathematics* to your own classroom via a final project in which you redesign one of your own lessons or align a segment of your curriculum to reflect the underpinnings of these principles.

Student Outcomes

Learners completing the Applying the NCTM Principles to Grades 3-5 course will be able to:

- Describe the key points associated with each of the NCTM principles.
- Describe strategies they can use to align their instruction with the principles.
- Discuss how their instruction will change in order to account for the principles.

Outline of Content and Assignments

After previewing the course’s introductory information, including the Introduction and Goals, Competency Map, and Assessment Rubric, learners will proceed to the Assignments area, where they will find six main parts, each of which focuses on one NCTM principle. Each principle, in turn, has six main sections. In "Objectives," learners encounter preliminary questions and read objectives related to the principle at hand. In "Define," learners find an overview of the key points of the principle and its definition from the *Principles and Standards for School Mathematics*. "Explore" and "Plan" give learners the opportunity to work with readings, videos, and Web sites that demonstrate how the key points of the principle can be applied in classroom settings. Next, learners proceed to the "Implementation" section, which provides specific tips and strategies for implementing the principle in the classroom. Finally, in "Reflection," learners consider what they have learned about the principle and think about how it will impact their classroom practice.

After completing all the readings and activities associated with each principle, learners move on to the Final Assignment, where they use what they have learned to create a plan of action for applying the six principles to their classrooms. Learners may choose to either redesign one of their own lessons or align a segment of their curriculum to reflect the underpinnings of these principles.

Below, you’ll find a breakdown of each principle’s objectives and activities.

Introduction and Goals

Learners will:

Read and respond

- Online materials
- An overview of the course
- Course goals
- A description of the development of NCTM’s “Principles and Standards of School Mathematics”

Participate in the online discussion

Introduce yourself on the appropriate forum in the Discussion Board. Tell your facilitator and other learners a little bit about yourself and your interest in this course. You should also include a couple of sentences describing your prior experience (if any) with the NCTM Principles.

Part 1: The Equity Principle

Learners will be able to:

- Demonstrate an understanding of significant issues related to equity by reflecting on implementation strategies of the principle in the final project.
- Develop classroom implementation strategies based on the principle that will use space and materials in ways that facilitate students' learning of mathematics.
- Create a classroom context that encourages the development of mathematical skills and procedural proficiency in line with the principle.
- Demonstrate an understanding of the value to be placed on all students' ideas, ways of thinking, and mathematical dispositions as related to the principle by discussing the role of students in the final project.

Read

- "Moving Into the Mainstream"
- "Multicultural and Gender Equity in the Mathematics Classroom: The Gift of Diversity"
- "The Effect of Personalized Word Problems"
- "Feisty Females: Using Children's Literature With Strong Female Characters"
- Lesson Plan - Swamp Angel
- Spreadsheet - Swamp Angel

Explore Web resources

- Definition of the Equity Principle
- Environmental Checklist
- Math Forum
- Knowledge Loom
- Eisenhower National Clearinghouse
- edHelper.com
- Cooperative Learning workshop
- Grades 3-5 section

Watch videos

- "What Groups of Students?"
- "Accommodating Differences Without Lowering Expectations"

Classroom Implementation Activities (optional)

- **Observe Your Class:** Have a teacher observe your class, or videotape your class so you can watch the tape later. How do you use questioning strategies to provide equitable opportunities for students to communicate?
- **Use Cooperative Learning Techniques to Promote Equity:** Try out a new teaching technique such as cooperative learning. Visit Thirteen/WNET New York's Concept to Classroom Cooperative Learning workshop to find out more. What criteria will you use for determining the cooperative learning groups?
- **Understand Your Students:** Outside the classroom, have a conversation with at least two students with whom you haven't had out-of-class discussions previously. Try to learn something about their lives outside of school. Or you might ask all of your students the following questions: "What's one thing you would like a total stranger to know about you?" and "What hobby do you enjoy that others don't know you enjoy?" Record what you have learned about your students and consider the ways (if any) this information might influence your instruction. Attempt to use your new knowledge in a future lesson.
- **Explore Online Resources:** Go to the Grades 3-5 section of the NCTM Illuminations Web site, which is dedicated to illuminating the Principles and Standards for School Mathematics. Find an activity that you can use in your classroom to promote the key points of the Equity Principle. Use this activity in your teaching.

Participate in online discussion

- Discuss with colleagues your position on accommodating student differences without lowering expectations. What are your own techniques? Present a real-life or hypothetical example that supports your position on the issue and encourages discussion.
- Talk about the following question with your colleagues: As a result of your learning experience with the Equity Principle, what things do you feel need immediate attention in your classroom or school to ensure that the learning experiences of students are equitable?
- (Optional) If you have completed one of the implementation activities, share what happened on the discussion board's "Implementation" forum.

Part 2: The Curriculum Principle

Learners will be able to:

- Demonstrate an understanding of the significant issues related to coherent and effective mathematics curriculum by reflecting on the implementation strategies of the principle in the final project.
- Develop classroom implementation strategies that will use space and materials in ways that facilitate students' learning of mathematics in line with the principle.
- Create a classroom context that encourages the development of mathematical skill and proficiency as related to the principle.

Read

- "Mathematics Curricula Based on Rigorous National Standards"

Explore Web resources

- Definition of the Curriculum Principle

Watch videos

- "Teacher Control"
- "Big C, Little C"
- "Introduction to the Kite Problem"
- "Curriculum Principle Discussion" (Part 1)
- "Curriculum Principle Discussion" (Part 2)
- "Curriculum Principle Discussion" (Part 3)
- "Curriculum Principle Discussion" (Part 4)
- "Curriculum Principle Discussion" (Part 5)

Classroom Implementation Activities (optional)

- **Aligning Local Curriculum with State Standards:** Learners review state or district mathematics standards, then answer the following questions: What do the standards say your students should know? What are the big ideas that need to be emphasized? Are these well aligned with your text(s)? In what ways do you work with teachers at your grade level, and the grades before and after, to ensure that students are learning the state-recommended concepts and skills?
- **Interview Former Students:** Learners talk with some former students to learn what big ideas they took away from your class. Then, learners reflect on the following questions: How do students' responses compare with what you hoped they had learned? What do their responses tell you about what was emphasized in your class?
- **Coherent Curriculum:** Choose a lesson that you will soon teach. How does this lesson fit into the unit? How does this unit fit into the entire year? What would be considered prerequisite knowledge? What will this concept lead into?

- For lesson-plan ideas, explore the following resources:
 - The National Library of Virtual Manipulatives provides a collection of free virtual manipulatives.
 - NCTM Illuminations for PreK-2 offers a wide variety of activities. The NCTM Web site is a good source of publications and information.
- Colleague Discussion (Articulation): Talk with teachers in your school, district, or state who teach the grade/course following or prior to yours. Compare the topics you cover and the level of sophistication of those topics. Reflect on the extent to which concepts and skills are taken to a more advanced level, if at all. What amount of your curriculum would be considered "new" to your students?

Participate in the online discussion board

- With "The Kite Problem" in mind, turn to your own curriculum. Identify a rich activity or lesson plan that you have done or that you do with your students. What gives this problem/lesson its richness? How does this problem/lesson address the challenges set forth by the Curriculum Principle? Share this problem and your reflections on it with your colleagues. You may also want to note some of your reflections—and your colleagues' insights—in your online journal; these notes will be invaluable when you tackle your final project.
- With your colleagues, discuss your key concepts and see how they compare. Support your selections with what you have learned about the Curriculum Principle.
- (Optional) If you have completed one of the implementation activities, share what happened on the discussion board's "Implementation" forum.

Part 3: The Teaching Principle

Learners will be able to:

- Demonstrate an understanding of the significant ideas and problems related to the principle by reflecting on implementation strategies in the final project.
- Develop classroom implementation strategies that will use space and materials in ways that facilitate students' learning of mathematics in line with the principle.
- Create a classroom context that encourages the development of mathematical skill and proficiency in line with the principle.
- Demonstrate an understanding of the value to be placed on all students' ideas, ways of thinking, and mathematical dispositions as related to the principle by discussing the role of students in the final project.

Read

- "You Make the Call"
- "Improving Mathematics Teaching and Learning"
- "Guidelines for an Instructional Lesson Plan"
- "101 Things You Can Do the First Day of Class"
- "Developing Mathematical Thinking with Effective Questions"
- "Classroom Management Style"

Explore Web resources

- Principles and Standards for School Mathematics
- Room Arrangement
- Classroom Model 1
- Classroom Model 2
- NCTM ListServ—Math Forum
- General Questioning 1

- General Questioning 2
- General Questioning 3

Watch the videos

- "Introduction to the Teaching Principle"
- "You Make the Call" (Part 3)
- "Discussing Good Teaching"
- "Discussing Student Perspectives"
- "Instructional Decisions"
- "Sharing with Colleagues"
- "What Are You Teaching My Child?"
- "Visions for Teaching"

Classroom Implementation Activities (optional)

- **Setting the Tone:** The Teaching and Learning Center at the University of Nebraska-Lincoln has created a list of [101 Things You Can Do the First Three Weeks of Class](#). While the ideas were originally intended for college classes, many of the ideas are applicable to grade school classrooms. Explore the article for ideas about what you can do as an individual to better align your classroom with the Teaching Principle.
- **Discussion with Other Educators:** You can visit discussion boards on the Internet to collaborate with other educators and learn more about effective teaching strategies. One useful site is the [NCTM Listserv](#) at the Math Forum. You should also share with colleagues information related to Internet resources that offer students a chance to interact with innovative educational technology tools such as virtual manipulatives or applets. Such tools are available at the [NCTM Illuminations Web site](#).
- **Colleague Observation:** Have other teachers observe you teaching, but don't tell them anything about the lesson before they observe. Afterwards, have them tell you what they thought the goal of the lesson was. Have them offer constructive comments about your performance. In their responses, look for key comments that are directly related to the underpinnings of the Teaching Principle. When you have completed this experiment, go to your [TeacherLine Journal](#) and answer the question: How does the other teacher's perception of the goal and your performance match your perceptions?
- **Videotape a Lesson:** Videotape a lesson you teach. View the lesson that evening. Then, view the video again a few days later (perhaps with colleagues). What did you do well? What could you have done better?
- **List of Goals:** For a course that you are currently teaching, create a list of mathematical goals. Enter these goals in your [TeacherLine Journal](#) and answer this question: By the end of the school year, what "big ideas" about mathematics would you like to convey to your students?
- **Classroom Arrangement:** Rearrange the seating in your classroom to better facilitate a lesson. Note that rearranging the room may cause some disruption, especially the first time you try it. An effective strategy is to familiarize students with two or three different classroom arrangements early in the year. For instance, if you use cooperative learning and whole-class discussions as two frequent instructional modes, familiarize your students with desks arranged in small groups and in a large circle. Then, for each day's lesson, use the most effective arrangement.

- Student Ratings: After teaching a lesson this week, have students (anonymously) answer the following questions:
 - What was the main objective of this lesson?
 - What did I (the teacher) teach you today?
 - On a scale of 1 (not at all) to 5 (very well), how well did you understand it?
 - Select the number that best describes how you feel about today's lesson.
 - 1 – I really understood today's lesson
 - 2 – I understood some of today's lesson.
 - 3 – I did not understand today's lesson.
 - What did you learn today that you did not already know?
 - Did you get enough help from me today?
 - What could I (the teacher) have done to help you or your classmates learn better?
- Talk Less, Listen More: For a lesson that you'll be teaching this week, attempt to "talk less and listen more." Construct the lesson so that students are working alone or in groups, and assign a task for yourself -- fill out an assessment chart while circulating, record student's questions, etc. Use this assignment for yourself as a means to let the students think about the problem and to keep you from explaining something they can discover on their own.
- Lesson Planning: Plan a lesson that integrates the key points of the Teaching Principle and the Process Standards (i.e., problem solving, communication, connections, and higher-order thinking skills). Also, plan to teach a lesson using an alternative mode of instruction, such as inquiry-based learning. Consider having students work cooperatively/collaboratively in small groups.

Participate in the online discussion

- Do you go through a standard process when you make decisions about the instructional strategies/activities that will be used to teach and support the development of mathematical concepts? If yes, describe your decision-making process, addressing the elements to be considered. If no, then answer the following: Do you see the need to make these informed instructional decisions, and can you identify some steps you will use to do this?
- Talk about the following global questions about teaching. As a teacher, in what areas do you need to grow and increase your knowledge? What kinds of professional development experiences have been, or would be, most effective in helping you become a better teacher?
- (Optional) If you have completed one of the implementation activities, share what happened on the discussion board's "Implementation" forum.

Part 4: The Learning Principle

Learners will be able to:

- Demonstrate an understanding of significant ideas and problems related to the principle by reflecting on implementation strategies of the principle in the final project.
- Develop classroom implementation strategies that will use space and materials in ways that facilitate students' learning of mathematics in line with the principle.
- Create a classroom context that encourages the development of mathematical skill and proficiency in line with the principle.
- Demonstrate an understanding of the value to be placed on all students' ideas, ways of thinking, and mathematical dispositions by discussing the role of students for the final project.

Interact

- Tower of Hanoi

Read

- "Call Data Charts"
- "Redefining Success in Mathematics Teaching and Learning"
- "What's the Rule?"

Explore Web resources

- Principles and Standards for School Mathematics
- Thirteen's Concept to Classroom

Watch videos

- "Checking for Understanding"
- "You Make the Call—Student Reports"
- "Teacher as Facilitator"
- "Learner-Centered Teaching"
- "Mystery Liquids" (Parts 1 & 2)
- "Prior Knowledge"

Classroom Implementation Activities (optional)

- Inquiry-Based Learning & Alternate Modes of Instruction: Use inquiry-based learning to teach at least one lesson. What problem will you pose to students? By the end of the period, what concept should they discover? If they haven't discovered the concept by the end of the period, how will it be conveyed? You may also consider using collaborative groups, real-world and relevant-problem scenarios, small- or large-group discussions, or the creation of a project.
- Student Self-Assessment: For some of the tasks that you use in class this week, have the students create a set of criteria for assessing their solutions. Then, have each student assess his or her work. Given a complete solution, have students identify their mistakes.
- Shadow a Student: Chose a student from one of your classes and (with their permission) shadow them for an entire day—attend classes, eat lunch, go to soccer practice. What is it like? What are the most memorable moments throughout the day? How do the experiences a student has throughout the day impact how he or she interacts in your class?
- Prior Knowledge: Examine a lesson that you will be teaching soon. Go to your TeacherLine Journal and record your answers to the following questions:
 - To learn this concept effectively, what prior knowledge will students need?
 - Which of these skills have your students not yet mastered?
- Questions for Students: Have students in your class generate a list of ways they can take control of their own learning. What items on their list did you find that you hadn't expected? Then, based on their ideas, create a list of what you can do to help them take control of their learning. You may wish to ask students the following questions:
 - What do you expect from your teacher?
 - What can your parents/caregivers do to help you be successful?
 - What can you do to be successful?

Participate in online discussion

- Share an experience you have had with inquiry-based learning, either as a part of your personal learning experience or with your students.
- Describe a lesson that you will teach this week. Based on what you have learned about the Learning Principle, describe how you will teach this lesson to ensure that students actively construct new knowledge from experience and prior knowledge. Share this lesson with your colleagues on the discussion board. Solicit comments and suggestive ideas.

- If you have completed one of the implementation activities, share what happened on the discussion board's "Implementation" forum.

Part 5: The Assessment Principle

Learners will be able to:

- Demonstrate an understanding of the significant ideas and problems related to the principle by reflecting on implementation strategies in the final project.
- Develop classroom implementation strategies that will use space and materials in ways that facilitate students' learning of mathematics in line with the principle.
- Create a classroom context that encourages the development of mathematical skill and proficiency in line with the principle.
- Demonstrate an understanding of the value to be placed on all students' ideas, ways of thinking and mathematical dispositions as related to the principle by discussing the role of students in the final project.

Read

- "Making Cranberry Punch"
- "Assessment Jumble Board"
- "State Achievement Tests Can Be a Positive Force in Your Classroom"
- "Does the Task Truly Measure What was Intended?"
- "NAEP Problems"
- "Modifications-NAEP Problems"

Explore Web resources

- Principles and Standards for School Mathematics
- Assessment, Evaluation and Curriculum Redesign
- Classroom Assessment Techniques
- Various Types of Assessment
- A Framework for Creating a Rubric

Watch the videos

- Assessing Student Work
- Formative Assessment

Classroom Implementation Activities (optional)

- Use Alternative Assessment: Identify at least one form of alternative assessment that you can use in your classroom. Visit your TeacherLine Journal and record your response to the following: How will this type of assessment help you gain information regarding student understanding? (Learn about open-ended assessments at Thirteen's Assessment, Evaluation, and Curriculum Redesign workshop.)
- Construct a Rubric: For an activity that you will incorporate in your instructional program, construct a rubric to analyze student work. For the same activity, have students construct a rubric.
- Modify Problems: Modify some of the problems you plan to use this week in class. Make several of them open-ended. Read up on open-ended assessments at Thirteen's Assessment, Evaluation, and Curriculum Redesign workshop.
- Talk with Former Students: Talk with former students to discover what they learned in your class. Compare their responses to the learning goals you set for your students in your curriculum.

Participate in the online discussion

- State a learning outcome/objective and describe what you believe would be a fair assessment of a student’s understanding. Discuss this with your colleagues. You may want to take notes on the ideas shared because they may be useful as you plan your final project
- Choose two alternative assessment strategies. How will these types of assessment help you gain information regarding student understanding? How will you implement them? Discuss these questions with your colleagues on the discussion board.
- (Optional) If you have completed one of the implementation activities, share what happened on the discussion board’s “Implementation” forum.

Part 6: The Technology Principle

Learners will be able to:

- Demonstrate an understanding of significant ideas and problems related to the principle by reflecting on implementation strategies of the principle in the final project.
- Develop classroom implementation strategies that will use space and materials in ways that facilitate students' learning of mathematics in line with the principle.
- Learn to create a classroom context that encourages the development of mathematical skill and proficiency in line with the principle.
- Demonstrate an understanding of the value to be placed on all students' ideas, ways of thinking, and mathematical dispositions by discussing the role of students in the final project.

Interact

- Up, Up, and Away

Read

- “Up, Up, and Away”
- “The Nines Game”
- “Deciding When to Use Calculators”

Explore Web resources

- Definition of the Technology Principle
- International Society for Technology in Education
- PBS TeacherSource
- NCTM Illuminations Marco Polo
- NCTM E-examples
- Explore Math

Watch the videos

- “Data Collection”
- “Analyzing Data with Spreadsheets”
- “Technology Enhances Mathematics”
- “Technology Takes Time”

Classroom Implementation Activities (optional)

- Learn New Technology: For teachers to use technology effectively, they have to know how it operates and what it can do. Create a personal professional development plan that will allow you to participate in a workshop or activity that will offer training in technology. Local math conferences have workshops for graphing calculators; intermediate units offer various

trainings; computer centers can teach you about Excel, Word, and other computer applications; and online courses can teach you just about anything! Talk to your school and district administrators about funds that may be available that will allow you to seek this kind of training.

- Learn From Other Teachers: Talk with at least three teachers in your building about available technology and how they use it. What can they teach you about using the technology in your classroom?
- Computer Interactives: Conduct a lesson in your classroom using an applet (an interactive computer-based activity) from a Web site. Have students work on the Internet during class, or demonstrate a concept for them using the Internet. As you have seen, good computer-based activities are available from the NCTM E-Examples and NCTM Illuminations Web sites. Another good resource is the Explore Math Web site.

Participate in the online discussion

- Discuss with your colleagues the value or level of importance you place on the use of technology in the instructional program, particularly calculators. Be sure to include how your view relates to that of the authors.
- Does the availability or lack of appropriate technologies become an equity issue for you and your students? Why or why not? Make sure to consider the following technologies: calculators and computers; videos; software including curriculum planning programs; and Internet resources.
- (Optional) If you have completed one of the implementation activities, share what happened on the discussion board's "Implementation" forum.

Final Assignment

Learners will complete the final assignment as described below:

Your final project will provide you with an opportunity to develop a plan for applying the NCTM's Principles to your instructional program, and to assess the impact they have on the teaching and learning processes that take place in your classroom.

There are two options for the final project. Please read both options carefully, and then choose **one** option. Before you begin, be sure that you:

- Consider the notes that you have taken in your TeacherLine Journal.
- Review the strategies presented in the "Implement" section of each principle, including any strategies that you have tried or would like to try with your own students.
- Review the criteria described in the Rubric, which you can find in the "Course Info" Assessment section.
- Prepare to address all six principles in a balanced manner. This means that your final project should show that you understand and have accounted for the key points of each principle.

A: Lesson Design

Select a lesson from your current textbook and develop a full lesson plan that incorporates elements from the six NCTM principles. (NOTE: Your lesson plan should include the following elements: unit title; grade level; overall question; learning standards addressed; set-up; learning and teaching strategies; assessment task; closure; and reflection.) Consult TeacherLine's Guidelines for an Online Lesson Plan as you design your lesson. For more information about shaping the content of a lesson plan, visit Thirteen's online Cooperative and Collaborative Learning workshop.

1. Write your reflection that discusses how your planning addressed the vision of the six NCTM principles.
2. Submit both the lesson plan and your reflections to your facilitator for assessment.

B: Curriculum Alignment

1. Select a key curriculum topic or concept that applies across a range of grade levels, such as geometry or fractions.
2. Review your local and state curriculum guides/frameworks.
3. Meet with teachers at the grade levels you don't teach (e.g., if you are a 9th grade teacher, meet with a 10th grade and an 11th grade teacher). Ask what activities they do that support the teaching of the topic you selected. In your discussion, find out what skills and concepts they identify as most important, how they teach those topics in general, and how they make accommodations for students who are struggling or who already know the material.
4. Write a paper that explains how educators teach these topics across the grade levels and how the activities shared do or do not adhere to the six principles.
5. Reflect on how the findings from this research paper will impact your teaching. Pay particular attention to how it will help you work the six principles into your teaching. Conclude your paper with an action plan, in which you determine a schedule for making changes in your practice. In your plan, you will assess the changes you want to make, determine the practices you need to adopt to make these changes, and set goals for yourself.
6. Submit your paper and your reflection piece to your facilitator for assessment.

Schedule

This course is scheduled to take approximately 30 hours to complete readings, activities, video, assignments, reflections and a final project.

Requirements

Learners are expected to:

- Complete all assignments
- Maintain an online journal
- Participate in the Discussion Board as required in course assignments (at least three posts per session)
- Ask for assistance when they need it

Evaluation

Pass/fail upon satisfactory completion of assignments and discussion board participation.

Materials (hardware, software, plug-ins)

Technical Requirements

- Word processor
- Internet service provider
- E-mail

Academic Dishonesty Policy

To be inserted by university institution only