

Rutgers, The State University of New Jersey

05:300:341:01 Modern High School Mathematics

Fall 2015

Wednesdays 4:30-7:30

ED-030

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Phone Number : 908-720-2434	Location: 10 Seminary Place, 2 nd floor
Office Hours: Wednesdays 3:00-4:00 p.m. or by appointment	Prerequisites or other limitations: <i>Admission to the Teacher Education Program</i>
Mode of Instruction: <input type="checkbox"/> Lecture <input checked="" type="checkbox"/> Seminar <input type="checkbox"/> Hybrid <input type="checkbox"/> Online <input type="checkbox"/> Other	Permission required: <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes Directions about where to get permission numbers: from the instructor

Rutgers University welcomes students with disabilities into all of the University's educational programs. In order to receive consideration for reasonable accommodations, a student with a disability must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentations: <https://ods.rutgers.edu/students/documentation-guidelines>. If the documentation supports your request for reasonable accommodations, your campus's disability services office will provide you with a Letter of Accommodations. Please share this letter with your instructors and discuss the accommodations with them as early in your courses as possible. To begin this process, please complete the Registration form on the ODS web site at: <https://ods.rutgers.edu/students/registration-form>.

Course Description

Learning goals:

The primary goal of this course is for you to develop a deep understanding and appreciation of the mathematical concepts underlying high school mathematics, including numbers and operations, algebra, geometry, statistics and probability, functions, and their applications. By the end of the course, you should be able to understand and explain why the procedures learned in high school mathematics work, describe different ways of representing important concepts, and explain the relationships among different mathematical concepts.

Secondary goals of the course include recognizing the importance of students and teachers having a conceptual understanding of mathematic, thinking deeply about what it means to understand a

mathematical concept, discussing what teaching strategies can help students understand concepts and what type of teaching might be counterproductive to this goal, recognizing when your understanding of a concept is not as strong as you'd like it to be, and gaining general familiarity with important ideas related to high school mathematics education (such as the NCTM's Principles and Standards and the Common Core State Standards).

New Jersey Professional Standards for Teachers (2014)¹:

Standard One: Learner Development. The teacher understands how learners grow and develop, recognizing that patterns of learning and development vary individually within and across the cognitive, linguistic, social, emotional, and physical areas, and designs and implements developmentally appropriate and challenging learning experiences.

ii. Essential Knowledge:

- (1) The teacher understands how learning occurs--how learners construct knowledge, acquire skills, and develop disciplined thinking processes--and knows how to use instructional strategies that promote student learning;
- (2) The teacher understands that each learner's cognitive, linguistic, social, emotional, and physical development influences learning and knows how to make instructional decisions that build on learners' strengths and needs;

iii. Critical Dispositions:

- (1) The teacher respects learners' differing strengths and needs and is committed to using this information to further each learner's development;
- (2) The teacher is committed to using learners' strengths as a basis for growth, and their misconceptions as opportunities for learning;
- (3) The teacher takes responsibility for promoting learners' growth and development;

Standard Two: Learning Differences. The teacher uses understanding of individual differences and diverse cultures and communities to ensure inclusive learning environments that enable each learner to meet high standards.

ii. Essential Knowledge:

- (1) The teacher utilizes resources related to educational strategies for instruction and methods of teaching to accommodate individual differences and to employ positive behavioral intervention techniques for students with autism and other developmental disabilities;
- (2) The teacher understands and identifies differences in approaches to learning and performance and knows how to design instruction that uses each learner's strengths to promote growth;
- (5) The teacher understands that learners bring assets for learning based on their individual experiences, abilities, talents, prior learning, and peer and social group interactions, as well as language, culture, family, and community values;

iii. Critical Dispositions:

- (1) The teacher believes that all learners can achieve at high levels and persists in helping each learner reach his or her full potential;
- (3) The teacher makes learners feel valued and helps them learn to value each other;

Standard Three: Learning Environments. The teacher works with others to create environments that support individual and collaborative learning, and that encourage positive social interaction, active engagement in learning, and self motivation.

¹ <http://www.state.nj.us/education/code/current/title6a/chap9.pdf>

ii. Essential Knowledge:

- (2) The teacher knows how to help learners work productively and cooperatively with each other to achieve learning goals;
- (3) The teacher knows how to collaborate with learners to establish and monitor elements of a safe and productive learning environment including norms, expectations, routines, and organizational structures;
- (5) The teacher knows how to use technologies and how to guide learners to apply them in appropriate, safe, and effective ways;

iii. Critical Dispositions:

- (2) The teacher values the role of learners in promoting each other's learning and recognizes the importance of peer relationships in establishing a climate of learning;
- (3) The teacher is committed to supporting learners as they participate in decision-making, engage in exploration and invention, work collaboratively and independently, and engage in purposeful learning; and
- (4) The teacher seeks to foster respectful communication among all members of the learning community.

Standard Four: Content Knowledge. The teacher understands the central concepts, tools of inquiry, and structures of the discipline(s) he or she teaches, particularly as they relate to the Common Core Standards and the New Jersey Core Curriculum Content Standards and creates learning experiences that make these aspects of the discipline accessible and meaningful for learners to assure mastery of the content.

ii. Essential Knowledge:

- (1) The teacher understands major concepts, assumptions, debates, processes of inquiry, and ways of knowing that are central to the discipline(s) he or she teaches;
- (2) The teacher understands common misconceptions in learning the discipline and how to guide learners to accurate conceptual understanding;
- (5) The teacher has a deep knowledge of student content standards and learning progressions in the discipline(s) he or she teaches;
- (7) The teacher understands the concepts inherent in numeracy to enable students to represent physical events, work with data, reason, communicate mathematically, and make connections within their respective content areas in order to solve problems.

iii. Critical Dispositions:

- (4) The teacher is committed to work toward each learner's mastery of disciplinary content and skills; and
- (5) The teacher shows enthusiasm for the discipline(s) they teach and is committed to making connections to everyday life

Standard Five: Application of Content. The teacher understands how to connect concepts and use differing perspectives to engage learners in critical thinking, creativity, and collaborative problem solving related to authentic local and global issues.

ii. Essential Knowledge:

- (1) The teacher understands the ways of knowing in his or her discipline, how it relates to other disciplinary approaches to inquiry, and the strengths and limitations of each approach in addressing problems, issues, and concerns.
- (4) The teacher understands how to use digital and interactive technologies for efficiently and effectively achieving specific learning goals;
- (5) The teacher understands critical thinking processes and knows how to help learners develop high level questioning skills to promote their independent learning;
- (6) The teacher understands communication modes and skills as vehicles for learning (for example, information gathering and processing) across disciplines as well as vehicles for expressing learning;
- (7) The teacher understands creative thinking processes and how to engage learners in producing original work

iii. Critical Dispositions:

- (3) The teacher values flexible learning environments that encourage learner exploration, discovery, and expression across content areas.

Standard Six: Assessment. The teacher understands and uses multiple methods of assessment to engage learners in examining their own growth, to monitor learner progress, and to guide the teacher’s and learner’s decision-making.

ii. Essential Knowledge:

- (1) The teacher understands the differences between formative and summative applications of assessment and knows how and when to use each;
- (2) The teacher understands the range of types and multiple purposes of assessment and how to design, adapt, or select appropriate assessments to address specific learning goals and individual differences, and to minimize sources of bias;

iii. Critical Dispositions:

- (1) The teacher is committed to engaging learners actively in assessment processes and to developing each learner’s capacity to review and communicate about their own progress and learning;
- (2) The teacher takes responsibility for aligning instruction and assessment with learning goals;

Standard Seven: Planning for Instruction. The teacher plans instruction that supports every student in meeting rigorous learning goals by drawing upon knowledge of content areas, curriculum, cross-disciplinary skills, and pedagogy, as well as knowledge of learners and the community context.

ii. Essential Knowledge:

- (1) The teacher understands content and content standards and how these are organized in the curriculum;
- (2) The teacher understands how integrating cross-disciplinary skills in instruction engages learners purposefully in applying content knowledge;
- (4) The teacher understands the strengths and needs of individual learners and how to plan instruction that is responsive to these strengths and needs;

iii. Critical Dispositions:

- (1) The teacher respects learners’ diverse strengths and needs and is committed to using this information to plan effective instruction.

Council for the Accreditation of Education Professionals (2013)²:

Standard 1: Candidate Knowledge, Skills, and Dispositions

- 1.1 Content Knowledge and Pedagogical Knowledge
- 1.2 Instructional Practice
 - Learning Experiences
- 1.6 Learner and Learning
 - Learning Experiences
- 1.8 Learner and Learning
 - Relationships and Communication

Course catalog description:

In-depth study and concentration of some key ideas in the high school mathematics curriculum. Viewing of mathematics in terms of the ideas built up in the minds of students.

² http://caepnet.files.wordpress.com/2013/09/final_board_approved1.pdf

Other description of course purposes, context, methods, etc.:

This is a seminar course requiring substantial participation by students in discussions and mathematical activities, both during class and outside of class. Students will keep mathematical journals, post comments to forums on Sakai, prepare and present short lessons that develop concepts from high school mathematics, and create lesson plans and unit plans oriented toward conceptual understanding. Over the course of the semester, one or two classes may be conducted remotely.

Required texts:

There are no required textbooks for this course. Students will be responsible for reading selected articles, research papers, and other materials. These resources will be available on the Sakai course site under *Resources*.

Grading policy:

Grades for the course will be based on:

- 20% Class attendance and participation in discussions and activities
- 10% Quizzes
- 30% Written mathematical assignments, journal entries, Sakai postings
- 20% Lesson and unit plans
- 20% Final project and presentation

Numerical equivalents of letter grades:

- A 90%-100%
- B+ 86%-89%
- B 80%-85%
- C+ 76%-79%
- C 70%-75%
- D 60%-69%
- F < 60%

Academic Integrity Policy:

Any violation of academic honesty is a serious offense and is therefore subject to an appropriate penalty. Refer to <http://academicintegrity.rutgers.edu/integrity.shtml> for a full explanation of policies.

In assignments and class activities, quizzes, tests, papers, field projects, PowerPoint presentations, and other class-related work, no copying of any kind is allowed unless copied text is *placed within quotations and the author/source is appropriately cited*. Plagiarism is a serious offense, that carries strong sanctions.

Use of the internet and available curricula to research ideas for activities, lesson plans, assessments, etc., and working together with other students, is of course strongly encouraged,. But ideas that are taken from such resources must be cited properly, to prevent plagiarism. In addition, use of resources word for word, or problem for problem, even when the resources are cited properly, does not satisfy the requirements of the class – all work handed in must be original, expressed in your own words.

Web site:

<https://sakai.rutgers.edu/portal> (specific course Sakai access will be available to those who have officially registered for this course).

Course Requirements

Attendance Policy

Since this is a seminar course, attendance is an essential requirement. More than one unexcused absence will result in a reduction of the course grade. This policy is separate from the class attendance and participation component of your grade. For an excused absence, you are responsible for contacting me, obtaining course materials, and making up the class through out-of-class activity.

Summary of Requirements

Class participation in discussions and activities is essential. You need to be prepared to discuss and ask questions about assigned readings, and to engage in group work and individual activities designed to foster deeper understanding of the mathematics and of the nature of students' mathematical learning.

Quizzes each week or two are designed to cover assigned readings, and to assess your conceptual understanding of topics we cover in class.

Written assignments will typically be due each week. Individual journal entries are to be posted bi-weekly on the appropriate Sakai forum, addressing your own understanding of mathematical concepts and their learning in connection with class readings and discussions. Other Sakai postings include responding to the posts of other students, and commenting on current relevant news stories or educational policy issues. The final assignment will be a reflection of 1-2 pages addressing your knowledge of mathematics, how students learn, and implications for your philosophy of teaching high school mathematics.

Each student will develop a high school mathematics lesson plan, that aims toward teaching for conceptual understanding. Each student will participate in the creation of a unit plan taking responsibility for an individual component, making use of the appropriate Rutgers GSE teacher education portfolio templates. Individual lesson and unit plans are to be uploaded to your teaching portfolio at the end of the semester.

Each student will develop and submit a final project exploring the mathematical concepts underlying a selected topic. This includes a written development of no more than five pages, which may address the history and/or the logic behind the topic, and references to web-based resources about the topic. Each student will deliver a short class presentation of the project.

Tentative Course Schedule by Week (subject to change)

Week	Topics to be covered	Assignments & readings due (to be specified week by week)
1. Wed Sep 2 nd	Introduction. Number and representation.	
2. Wed Sep 9 th	Operations and patterns Student Growth Objectives	<i>Skemp, Relational Understanding and Instrumental Understanding</i>
3. Wed Sep 16 th	Algebra and algebraic thinking Common Core State Standards District tracking policies	Journal entry #1 <i>Reading to be specified</i>
4. Wed Sep 23 rd	Representation	<i>Activity to be specified</i>
5. Wed Sep 30 th	Geometry Reasoning and proof	Journal entry #2 <i>Reading to be specified</i>
6. Wed Oct 7 th	Reasoning and proof	<i>Activity to be specified</i>
7. Wed Oct 14 th	Measurement Advanced algebra Prerequisite knowledge	Journal entry #3 <i>Reading to be specified</i>

8. Wed Oct 21 st	Communication Common Core State Standards	<i>Activity to be specified</i>
9. Wed Oct 28 th	Functions	Journal entry #4 Lesson plan draft
10. Wed Nov 4 th	Modeling	Unit plan draft
11. Wed Nov 11 th	Statistics and probability	Journal entry #5 Lesson plan
12. Wed Nov 18 th	Analysis and calculus	Work on unit plan, reflection paper, and final project
13. Wed Dec 2 nd	Student presentations Calculus	Final reflection paper (due by Dec 14 th) Unit plan
14. Wed Dec 9 th	Student presentations Final discussion	Final project