

Technology in Mathematics Teaching
 15:254:548:B1
 Summer 2021
 3 Credits

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| Instructor Name: Cheryl Van Ness | Email address: cvanness@vflonline.com |
| | Location: Online Class Meeting Times: Tuesday, Thursday: 6 pm to 9:40 pm |
| Office Hours: By appointment | Prerequisites or other limitations: <i>Undergraduate mathematics major or equivalent.</i> |
| Mode of Instruction: <input type="checkbox"/> Lecture <input type="checkbox"/> Seminar <input type="checkbox"/> Hybrid <input checked="" 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: |

Faculty Syllabus Statement for Disability Services:

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 documentation: <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 (<https://webapps.rutgers.edu/student-ods/forms/registration>).

Learning Goals:

See standard alignment at end of syllabus.

Course catalog description:

Focus on development of familiarity and facility with major technologies used in K-12 teaching. Highlighted hardware and software include graphing calculators; algebraic system, function plotting, and geometry construction software; and modeling, simulation, and tutorial software. Potential impact of technologies on traditional school mathematics curricula.

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

The central goal of this course is to help you use technology as an effective pedagogical tool in the mathematics courses that you teach. More specifically, after this course, you should:

1. Be comfortable using several types of technology found in school mathematics

classrooms.

2. Have a knowledge of some classroom activities that incorporate technology.
3. Be aware of the psychological and educational principles that make technology an effective teaching tool.
4. Be able to design lessons that incorporate technology and be able to critically evaluate these lessons and others that are presented to you.

Class materials:

The class will deal with different technologies and will take place remotely. The technologies include Excel Spreadsheets, GeoGebra, and Graphing Calculators. I encourage you to dig up your graphing calculator and replace the batteries in it, if necessary. If you don't have a graphing calculator, you can access a variety of online graphing calculators. Also, please install GeoGebra (<https://www.geogebra.org/download>).

Required readings:

These articles are available in the course page on Canvas.

Battista, M. T. (2002). Learning geometry in a dynamic computer environment. *Teaching Children Mathematics*, 8(6), 333-339.

Goldenberg, E. P. (1988). Mathematics, metaphors, and human factors: Mathematical, technical, and pedagogical challenges in the educational use of graphical representation of functions. *The Journal of Mathematical Behavior*.

Hewitt, D. (1999). Arbitrary and necessary part 1: A way of viewing the mathematics curriculum. *For the Learning of Mathematics*, 2-9.

McGraw, R., & Grant, M. (2005). Investigating mathematics with technology: Lesson structures that encourage a range of methods and solutions. In W. J. Masalski & P. C. Elliott (Eds.), *Technology-supported mathematics learning environments* (Vol. Sixty-Seventh Yearbook, pp. 303-317).

Reston, VA: National Council of Teachers of Mathematics.

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A new framework for teacher knowledge. *Teachers College Record*, 108(6), 1017-1054. [only read pages 1020- 1031]

Piez, C. M., & Voxman, M. H. (1997). Multiple representations—Using different perspectives to form a clearer picture. *The Mathematics Teacher*, 164-166.

Assignments:

Critique of technology lesson plan (15%) In the middle of the course, I will give you a technology activity written lesson plan by another teacher and you will be asked to evaluate the strengths and weaknesses of this activity. You will share your critique with others. You will then have the opportunity to revise the paper before you submit it to me for grading

Group technology presentation (15%) As a group assignment, you will work with several of your classmates to learn how to use a technology tool and design a presentation to introduce and train the other students how to use the tool. As part of this presentation you will include an activity that incorporates technology in a meaningful way, having the class

complete the activity (as if your group is the teachers and your classmates are the students). The activity should be designed to teach an appropriate high school or middle school math standard based on the NJSLs.

Individual Technology activity (15%) Except for the technology that you use in your group presentation, you will create technology-based activity based on the technology we have covered in class that week. This activity will be designed to teach an appropriate high school or middle school math standard and will be written individually, not in a group.

Individual Lesson Plan (20%) As a final project for the class, you will design an individual lesson plan that incorporates technology in a meaningful way and is consistent with the Rutgers lesson plan format. You will share this lesson plan with 2 classmates to get their feedback. You will incorporate the feedback, as appropriate before you submit it to me for grading. Your lesson plan can be based on one of the individual technology activities you developed during the semester.

Synchronous classroom discussion and attendance (20%) It is expected that you will attend and fully participate in any synchronous meetings during the course. In addition, a few times during the course you will be asked to write a reaction paper.

Online class classroom discussion (15%) Participation in the online discussion forums is mandatory. Posts will be graded based on quality and interaction with other students' posts.

Grading policy:

Evaluation of written work and synchronous and asynchronous discussion participation.

Boiler plate language for Academic Integrity Policy:

Academic integrity: Make sure that you provide proper citations for all materials that you use in all written work. Any violation of academic honesty is a serious offense and is therefore subject to an appropriate penalty. Refer to <http://academicintegrity.rutgers.edu/> for a full explanation of policies.

Web site: (If any)

Course Schedule

Attendance Policy – Class attendance is mandatory. Classwork discussion and technology activity grades will be directly affected by absences.

Course Schedule by Week
Syllabus is subject to change

| Week | Topics & What's Due | Topics to be Covered, Assignments, Discussions |
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| Day 1 T – 6/1 | Synchronous meeting <ul style="list-style-type: none"> • Intro to class, schedule, syllabus • Sign ups • Excel basics • Desmos intro | <ul style="list-style-type: none"> • Sign up for technology group Excel Desmos Graphing Calculator GeoGebra • Sign up for a reading discussion facilitation group Mishra & Koehler, Hewitt Goldenberg, Piez & Voxman McGraw & Grant, Battista • Begin Desmos exploration graphing activities • Example of activity |
| Day 2 Th – 6/3 | Asynchronous meeting <ul style="list-style-type: none"> • NJCSS – comparison to CCSS <p>Due: Online discussion of TPACK</p> | <ul style="list-style-type: none"> • Read through the middle school and high school NJ State Standards – think about how these standards relate to the activities you will prepare for class • Note objectives that might lend themselves to the use of technology • Research TPACK in preparation of discussion on Tuesday • Work with group on presentations and reading discussions/questions |
| Day 3 T – 6/8 | Synchronous meeting <ul style="list-style-type: none"> • TPACK discussion • Excel • Distribute critique of technology lesson plan | <ul style="list-style-type: none"> • TPACK discussion • First presentations – Excel • Work on Excel activity |
| Day 4 Th – 6/10 | Asynchronous meeting <ul style="list-style-type: none"> • Excel • Readings: Standards | <ul style="list-style-type: none"> • Work on Excel activity • Summarize and discuss the NJ State Standards for MS and HS, with an emphasis on the technology standards and how technology can help with |

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| | <p>Due: First reaction paper Online discussion of standards</p> | <p>other standards (student led discussion online)</p> <ul style="list-style-type: none"> ● First reaction paper. |
| <p>Day 5 T – 6/15</p> | <p>Synchronous meeting</p> <ul style="list-style-type: none"> ● Student technology recommendations ● Excel ● Desmos | <ul style="list-style-type: none"> ● Technology show and tell (moved to end of semester) ● Present Excel activity ideas get feedback ● Second presentations – Desmos ● Discussion comparing Excel and Desmos (moved to Day 7) ● Work on Desmos activity |
| <p>Day 6 Th – 6/17</p> | <p>Asynchronous meeting</p> <ul style="list-style-type: none"> ● Excel ● Desmos ● Graphing Calculator ● Critique ● Readings – Mishra & Koehler; Hewitt <p>Due: Online discussion of readings Excel activity</p> | <ul style="list-style-type: none"> ● Work on and finish Excel activity ● Work on Desmos activity ● Work with group on presentation and reading discussion questions ● Work on critique of technology lesson plan ● Student led discussion on Mishra & Koehler questions ● Student led discussion on Hewitt questions <p>Review Graphing Calculator manual</p> |
| <p>Day 7 T – 6/22</p> | <p>Synchronous meeting</p> <ul style="list-style-type: none"> ● Logic Lab ● Desmos ● Graphing Calculator ● Lesson plan <p>Distribute lesson plan assignment</p> | <ul style="list-style-type: none"> ● Mishra & Koehler; Hewitt highlights ● http://www.neuroproductions.be/logic-lab/ ● Present Desmos activity ideas and get feedback ● Third presentations – Graphing Calculator ● Work on Graphing Calculator activity ● Start working on lesson plan** – discuss ideas/questions ● Compare Excel and Desmos, strengths and weaknesses |
| <p>Day 8 Th – 6/24</p> | <p>Asynchronous meeting</p> <ul style="list-style-type: none"> ● Desmos ● Graphing Calculator | <ul style="list-style-type: none"> ● Work on and finish Desmos activity ● Work on Graphing Calculator activity ● Work with group on presentation and reading discussion questions |

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| | <ul style="list-style-type: none"> • Lesson plan • Critique • Readings – Goldenberg; Piez & Voxman <p>Due: First draft of critique of technology lesson plan -- share with 5 classmates, update based on feedback others' ideas Online discussion of readings Desmos activity</p> | <ul style="list-style-type: none"> • Give feedback on critique of lesson plan • Work on critique of technology lesson plan revision based on classmate feedback • Student led discussion on Goldenberg questions • Student led discussion on Piez & Voxman questions |
| Day 9 T – 6/29 | <p>Synchronous meeting</p> <ul style="list-style-type: none"> • Graphing Calculator • GeoGebra <p>Due: Second reaction paper</p> | <ul style="list-style-type: none"> • Goldenberg; Piez & Voxman highlights • Present GC activity and get feedback • Fourth presentation – GeoGebra • Work on GeoGebra activity** • Help on all assignments • Submit second reaction paper |
| Day 10 Th – 7/1 | <p>Asynchronous meeting</p> <ul style="list-style-type: none"> • GeoGebra • Lesson plan • Readings – McGraw & Grant, Battista <p>Due: Online discussion of readings Graphing calculator activity</p> | <ul style="list-style-type: none"> • Work on GeoGebra activity • Work on and finish GC activity • Work on lesson plan • Give feedback on classmates' lesson plan • Student led discussion on McGraw & Grant questions • Student led discussion on Battista questions |
| Day 11 T – 7/6 | <p>Synchronous meeting</p> <ul style="list-style-type: none"> • Student technology recommendations • GeoGebra • Smartboard • Lesson plan • Critique <p>Due:</p> | <ul style="list-style-type: none"> • McGraw & Grant; Battista highlights • Present GeoGebra activity and get feedback • Technology show and tell • Share lesson plan ideas and get feedback. • Work on lesson plan • Final critique of technology lesson plan due • Share lesson plan with two classmates |

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| | Final critique of technology lesson plan Lesson plan draft | to get feedback |
| Day 12 F – 7/9 | All assignments due <ul style="list-style-type: none"> • GeoGebra activity <ul style="list-style-type: none"> • Individual (3) and group activities (1) • Lesson plan • Third reaction paper | <ul style="list-style-type: none"> • Submit all revised activities • Revise Lesson Plan based on classmates' feedback • Submit third reaction paper • Submit Final Lesson Plan. |

**Note: GeoGebra activity and Lesson Plan are both due at the end of the semester.

Learning Goals:

Teaching standards: This course is based heavily upon ISTE NETS standards located here: <http://www.iste.org/standards.aspx>

The course addresses the following **New Jersey Professional Teaching Standards (2014)**. You can find the complete listing of NJPTS here:

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

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.

i. Performances:

2) The teacher creates developmentally appropriate instruction that takes into account individual learners' strengths, interests, and needs and that enables each learner to advance and accelerate his or her learning

iii. Critical Dispositions:

2) The teacher is committed to using learners' strengths as a basis for growth, and their misconceptions as opportunities for learning

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

i. Performances:

3) The teacher designs instruction to build on learners' prior knowledge and experiences, allowing learners to accelerate as they demonstrate their understandings

ii. Essential Knowledge:

6) The teacher knows how to access information about the values of diverse cultures and communities and how to incorporate learners' experiences, cultures, and community resources into instruction.

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

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.

i. Performances:

- 2) The teacher develops learning experiences that engage learners in collaborative and self-directed learning and that extend learner interaction with ideas and people locally and globally

ii. Essential Knowledge:

- 1) The teacher understands the relationship between motivation and engagement and knows how to design learning experiences using strategies that build learner self-direction and ownership of learning;
- 2) The teacher knows how to help learners work productively and cooperatively with each other to achieve learning goals

iii. Critical Dispositions:

- 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.

i. Performances:

- 1) The teacher effectively uses multiple representations and explanations that capture key ideas in the discipline, guide learners through learning progressions, and promote each learner's achievement of content standards
- 7) The teacher uses supplementary resources and technologies effectively to ensure accessibility and relevance for all learners

iii. Critical Dispositions:

- 1) The teacher realizes that content knowledge is not a fixed body of facts but is complex, culturally situated, and ever evolving. He or she keeps abreast of new ideas and understandings in the field

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.

i. Performances:

1) The teacher develops and implements projects that guide learners in analyzing the complexities of an issue or question using perspectives from varied disciplines and cross disciplinary skills

ii. Essential Knowledge:

4) The teacher understands how to use digital and interactive technologies for efficiently and effectively achieving specific learning goals

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.

i. Performances:

4) The teacher engages learners in understanding and identifying quality work and provides them with effective descriptive feedback to guide their progress toward that work;

5) The teacher engages learners in multiple ways of demonstrating knowledge and skill as part of the assessment process

Standard Eight: Instructional Strategies. The teacher understands and uses a variety of instructional strategies to encourage learners to develop a deep understanding of content areas and their connections, and to build skills to apply knowledge in meaningful ways

i. Performances:

7) The teacher engages learners in using a range of learning skills and technology tools to access, interpret, evaluate, and apply information

ii. Essential Knowledge:

3) The teacher knows when and how to use appropriate strategies to differentiate instruction and engage all learners in complex thinking and meaningful tasks;

4) The teacher understands how multiple forms of communication (oral, written, nonverbal, digital, and visual) convey ideas, foster self-expression, and build relationships;

5) The teacher knows how to use a wide variety of resources, including human and technological, to engage students in learning

iii. Critical Dispositions:

3) The teacher is committed to exploring how the use of new and emerging technologies can support and promote student learning

The course addresses the following **Council for the Accreditation of Education Professionals Standards (2013)**. You can find more about the CAEP standards here:

<http://caepnet.org/~media/Files/caep/knowledge-center/caep-evidence-guide.pdf>

Standard #2: Learning Differences. The teacher uses an understanding of individual differences and diverse cultures and communities to ensure inclusive learning environments that enable each learner to meet high standards.

Standard #3: 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.

Standard #5: 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.

Standard #8: Instructional Strategies. The teacher understands and uses a variety of instructional strategies to encourage learners to develop a deep understanding of content areas and their connections, and to build skills to apply knowledge in meaningful ways.

Standard #9: Professional Learning and Ethical Practice. The teacher engages in ongoing professional learning and uses evidence to continually evaluate his/her practice, particularly the effects of his/her choices and actions on others (learners, families, other professionals, and the community), and adapts practice to meet the needs of each learner.