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Rutgers, The State University of New Jersey

15:256:552:01 Teaching Physical Science
Spring 2015
Tuesdays 4:50 – 7:30 PM
ED-025A

Instructor: Jim Flakker	Email: jim.flakker@gse.rutgers.edu
Phone Number : 201-213-6746	Location: GSE – By Appointment
Office Hours: By Appointment	Prerequisites or other limitations: *Admission to the Teacher Education Program*
Mode of Instruction: ___ Lecture _X_ Seminar ___ Hybrid ___ Online ___ Other	Permission required: _X_ No __Yes

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Course Description

Learning goals:

At the end of the course students will be able to answer the following questions:

1. What are the goals of learning physics/physical science in a high school? How do these goals relate to NGSS standards? How does one formulate assessable goals for instruction?
2. How is physics curriculum structured? What are the main topics and how do they relate to each other?
3. What are students' ideas about most important physics concepts and how do we build on them?
4. How do we make students active participants in the learning process and how do we make this process mirror scientific inquiry?
5. How do we help students develop scientific habits of mind – scientific abilities?

6. What is the difference between formative assessment, summative assessment, standards-based assessment and how do we implement each in each of the high school physics/physical science units?
7. How does one create a lesson and unit plan?
8. How do we create a positive, supportive and caring classroom for all students?

New Jersey Professional Standards for Teachers (2014)[1]:

[INSERT ALL APPLICABLE STANDARDS HERE]

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

[INSERT ALL APPLICABLE STANDARDS HERE]

Course catalog description:

The goal of the course is to help pre-and in-service physics teachers acquire pedagogical content knowledge and skills that are necessary to teach physics/physical science for understanding, appreciation and interest by all students. The course includes the analysis of high school physics curriculum, a detailed development of teaching strategies for most of the topics with the adjustment for different students, classroom management and diverse student engagement techniques, observation protocols, unit and lesson planning, and design of formative and summative assessment tools and guides to standards-based assessment.

Class materials:

1. Required: Etkina, Gentile, Van Heuvelen, College Physics, Pearson, San Francisco, 2014 (includes the Active Learning Guide and the Instructor Guide)
3. Required: Physics Union Mathematics (PUM) Curriculum modules, to download the modules and final assessment go to http://pum.rutgers.edu then click on Teacher login, then download newest modules. *Please make sure you have all modules downloaded before the semester starts.*
4. Required: A set of papers from the Reading List will be posted on the class website: https://sites.google.com/a/gse.rutgers.edu/teachingphysicalscience/ every week on Wednesday for the next class on Tuesday;
5. Strongly recommended (can be shared with a friend): A. Arons, Teaching Introductory Physics, Wiley&Sons, 1997. Available from Amazon.com. ISBN 978-0471137078
6. Good to have G. P. Wiggins & J. McTighe, Understanding by Design, 2005.
7. You will need to use materials from http://www.diagnoser.com/diagnoser/
   -To use this resource, create your own teacher login and password before the semester starts. Browse the website and do as many activities as you can.
8. New Jersey Core Curriculum Content Standards [available on line] at http://www.edusite.com/nj/science/cccs.htm
   -Please download everything on your computer so you can use it preparing your homework And New Generation Science Standards [available on line] at http://www.nextgenscience.org/next-generation-science-standards .
9. ActivPhysics by Alan Van Heuvelen [available on-line] at http://wps.aw.com/aw_young_physics_11
10. PHET resource by University of Colorado, Boulder: http://phet.colorado.edu
    -Web sites with class activities: http://paer.rutgers.edu/pt3 and http://paer.rutgers.edu/scientificabilities

[1] http://www.state.nj.us/education/code/current/title6a/chap9.pdf
[2] http://caepnet.files.wordpress.com/2013/09/final_board_approved1.pdf

-Make sure you are familiar with the content of both websites; browse them before the semester starts. Especially pay attention to the activities in the kits and the labs in the design experiments section.

11. A great resource website: http://www.physics.usyd.edu.au/super/physics_tut/credits.html
12. Another great resource is Physics and Astronomy digital library at http://www.compadre.org/
13. R. Knight, Five Easy Lessons: Strategies for Successful Physics Teaching, ISBN 0-8053-8702.

PLEASE IF YOU OWN A LAPTOP, BRING IT TO ALL CLASS MEETINGS, MAKE SURE YOU CAN ACCESS ALL OF THESE WEBSITES AND HAVE THE SOFTWARE TO USE THE RESOURCES

Grading policy:

Your course final grade will be based on how you meet the standards listed below. Each standard will be assessed multiple times according to the rubric – you HAVE to convince me and your classmates that you meet the standard. If at any point you fail to meet the standard, you will have an opportunity to be assessed again. **Each assignment can be improved.** I encourage you to try as many times as you need to make the assignment perfect.

Rubric: 1 – working towards but is not meeting expectations yet, 2 – moving towards meeting expectations; 3 – meets expectations; 4 – exceeds expectations (I want to brag about you). I believe that every student in this course will work to exceed my expectations.

General standards:

GS1: Is familiar with NJ Science Core Curriculum Standards and New Generation Science Standards and can use them when planning and instruction and assessing student learning.
GS2: Is able to formulate the goals of the instructional unit that reflect the important ideas and practices in this unit and can be assessed.
GS3: Is able to interpret student responses (oral or written) and revise planned instruction based on the responses during microteaching.
GS4: Is able to collect (or to describe) evidence that will indicate that students achieved a proposed goal.
GS5: Is able to write a lesson plan that has all required elements and implement the lesson in practice.
GS6: Is able to write a unit plan that has all required elements.
GS7: Is able to devise a beginning of a lesson that builds on student ideas and engages them in meaningful exploration of physics ideas during microteaching.
GS8: Is able to solve (or explain why the solution is not possible) for any physics problem at the level of algebra-based physics in the areas that are addressed in the course.

Lesson Specific Standards (broken down into Content Standards – CK and Pedagogical Content Knowledge Standards – PCK)

Area of physics	CK	PCK
Kinematics	**CK1 - Can make connections between physical quantities used in kinematics and concrete and graphical representations, knows how derive $x(t)$ functions for different motions and is able to articulate the connections between the concepts and science practices in the unit, including what concepts yield better to specific practices.**	**PCK1 - Is able to demonstrate an understanding of students' ideas in kinematics (productive and unproductive), is able to interpret student work on graphs and provide examples of formative and summative assessment in kinematics. Is able to use the concept of index to help students write linear functions.**
Dynamics	**CK2 - Is able to articulate the relationships between Newton's laws and explain why particular representations are important.**	**PCK2 - Is able to provide an example of how to set the goals for one lesson on Newton's laws and show the evidence that the goals are achieved.**
Force laws	**CK3 - Is able to explain the relationship between normal and friction force and demonstrate how to approach multiple-objects problems**	**PCK3 - Is able to interpret student work on forces and suggest instructional sequences to address student difficulties.**
Circular motion	**CK4 - Is able to identify productive and unproductive language in circular motion and derive the expression for centripetal acceleration without calculus**	**PCK4 - Is able to design a 2-hour laboratory for circular motion where students develop specific scientific abilities while constructing, testing or applying physics concepts**
Energy	**CK5 - Is able to demonstrate fluency with the system approach to energy and productive representations of work-energy processes; Is able to explain why the energy of a bound system is negative.**	**PCK5 - Is able to show how to help students develop mathematical expressions for 4 types of energy used in mechanics and work. Can demonstrate understanding of student difficulties in this area. Can articulate the curriculum sequence for teaching work-energy unit.**
Fluids	**CK6 - Is able to explain where the expressions for the fluid pressure and buoyant force come from**	**PCK6 - Is able to show how research-based questions related to student learning of this material help design instructional units**
Vibrations	**CK7 - Can explain the difference between periodic motion and simple harmonic motion; can describe and explain SHM; Is able to demonstrate familiarity with useful representations in this area.**	**PCK7 - Is able to demonstrate an understanding of students' ideas in the area of vibrations, can design an instructional progression for the unit and final assessment**

Electric field	**CK8 - Can explain the difference between the concept of electric field and the physical quantities characterizing it; Is able to use multiple representations to explain the behavior of conductors and dielectrics in electric field.**	**PCK8 - Is able to address common difficulties that students have with the concept of electric potential in a lesson**
DC current	**CK9 - Is able to reason through complex problems in electric circuits (including power) using the language of potential difference**	**PCK9 - Is able to design a lesson in which the students learn to reason through complex problems in electric circuits (including power) using the language of potential difference and connect this material to their every day experience**
Magnetic field	**CK10 - Is able to articulate the differences between magnetic forces and central forces and use right hand rules productively**	**PCK 10 – Is able to interpret student work in the magnetic fields unit and is able to design a motivating beginning for a magnetism lesson**
Electromagnetic induction	**CK11 - Is able to explain WHY electromagnetic induction occurs**	**PCK 11 – Is able to outline the sequence of student learning of electromagnetism concepts (static electricity, DC circuits, magnetic fields and electromagnetic induction).**

Description of activities

Attendance and participation in class discussions: Attendance and participation in each class are essential for your learning in class. There is one field trip (Physics Lecture Hall) during the semester that will be done outside of class (extra time). The time for the trip will be scheduled during the first two weeks of the semester based on students' schedules. Attendance is required.

Quizzes: Every class will start with a short quiz related of your knowledge of student difficulties of particular concepts and abilities (all quizzes are linked to the standards). To prepare for the quizzes use the materials at http://www.diagnoser.com/diagnoser/ and make sure you can do relevant quizzes from the *PUM* modules. To do well on the quiz you need to do the readings and reflect on the learning in class. Each quiz can be improved. The number of attempts is not limited. The purpose is for you to learn, not for me to give you a grade. As the class time is limited, if you think that you need extra time for the quiz - please come early. We will be in the classroom at 4.30 pm.

Professional development activities: As a part of your preparation for being a physics teacher, you will need to participate in two of three professional development activities:

- The 2014 AAPT Regional Conference at Princeton University Friday-Saturday – March 14-15.
- A demo show for NJ high school teachers: "Dave's Dazzling Demos," which will be held on February 8th 9 am - 1 pm in the Physics Lecture Hall. For additional information check the NJ AAPT website.

To register for the NJ AAPT conference, you need to join the NJ AAPT; membership for the students is free. Go to http://njaapt.org to join. The organization offers numerous resources for physics teaching and provides you with contacts with the best teachers in the state, the membership is highly beneficial for your job.

RTOP: You will need to train yourself in using the RTOP (Reformed Teaching Observation Protocol) using Internet resources. http://physicsed.buffalostate.edu/AZTEC/RTOP/RTOP_full/index.htm

Homework: Every week after class you will

1) For the first 8 weeks of classes you will write a lesson plan or another assignment for one of the concepts discussed in class. Follow the outline at the end of the syllabus. The homework should be e-mailed to me as a word attachment by Thursday night. Use your first name and the week number to name your document: Mike1.doc. I will read the reports on Friday, provide feedback typed in the document in a different color, and you will make revisions in the third color and send the revised document back to me. You can revise the homework as many times as you wish to improve your grade but *you have to do it before the next class*. For the last 6 weeks of classes you will write a reflective journal answering 3 questions as if you were a student in that class (answers relate to physics not teaching):
   -What did I learn in class and how did I learn it?
   -What remained unclear?
   -If I were the teacher, what questions would I ask to find out whether my students understood the material?
   Or you will complete another assignment if necessary.
2) Work with chapters/sections of the College Physics, IG and the ALG to analyze the structure of the cycles and complete problem solving tasks – these are your responsibility. Every week you will be assigned problems from the College Physics, ALG or PUM modules to solve. To get help with the problems, attend a problem solving help session (we will schedule it to fit your schedules). If you need extra help, you can always stay after class.
3) Read chapters of the "Teaching Introductory Physics" book and "Understanding by design" book and assigned articles and be prepared for class discussions.

Reading List: The papers for each class will be posted on the class website.
Reflection on classroom observations (only for the students in the Teacher Preparation program): Every week during your 10 weeks of observations of science classrooms you will need to send me a report about your observations (the report should be submitted before Sunday of the week you did the observations). Each report should address specific questions that are listed at the end of the syllabus. During one of the observation visits you will need to teach a lesson or a part of the lesson, please make sure you arrange this with the cooperating teacher, submit the lesson plan to him/her and me in advance and then after you teach the lesson, you write a reflection.

Formative assessment activities: For the kinematics unit you will design 5 formative assessment activities that assess student construction of understanding of the concepts of velocity and acceleration and development of some scientific abilities. In the assignment you will specify: what the target understanding or ability look like when demonstrated by a student, how the activity assesses it, provide two possible student responses and describe how you will provide feedback to the student, and how you will modify your instruction based on the feedback from the student. Deadline: **February 15th.**

Summative assessment (a test): For the dynamics unit you will design a 45-min test. You will make a list of understandings and abilities that the test will assess, provide problems and tasks for the students, explain why you chose these problems and how they fit together in terms of difficulty. Tests will be discussed in class. **Deadline February 28th**.

Unit plan: You will need to choose a unit from physics curriculum and make a unit plan (the lesson plan and microteaching described below will be for a lesson from this unit). In your unit plan you need to incorporate a project from the class "Demonstrations and technology in science education": either

relevant Web-based resources, or a videotaped experiment, or an activity involving computer probes. Deadline: **10 days after you teach the lesson in class.** The elements of a unit plan are provided at the end of the syllabus.

Lesson plan: Before you teach the lesson you will write a lesson plan; after teaching you will add a reflection and hand it in. Follow the guidelines given at the end of the syllabus. The deadline for the lesson plan with the reflection is **one week after** you teach the lesson in class.

Microteaching: During weeks 6-13 groups of students will teach lessons in class (the topic of the lesson is a part of the unit chosen for the above assignment). A 2-student group should work as a team. The length of a lesson is about 120 min. The goal of the lesson is that the students construct a physics concept through the *ISLE* cycle or through some other interactive engagement approach. Include the technological applications that you learn in the DTSE class. To prepare for classroom teaching each group has to meet with me for planning, first draft, and practice (2-3 meetings). Please, make sure that you schedule your work accordingly during the semester. You are responsible for the materials (equipment) used during the lesson. Discuss them with me in advance.

Interviews: You need to conduct, transcribe and summarize one interview (preferably for the topic of your unit): with a high school student during observations. The purpose of interviews is to learn to listen to the students and interpret their answers. The best choice for the interview is a problem that the high school student will solve and the interviewer asks questions.

Electronic portfolio (this assignment is only for the students in the Teacher Preparation program). By the end of the semester you will need to submit two artifacts for your portfolio: Early Lesson Plan and Early Unit Plan. Those who are in the post-bacc program also need to submit the Early Teaching Philosophy. Before you submit any documents, please send them to me for feedback. Without the submission of the documents you will receive an incomplete grade in the course but the rubric scores will not affect your course grade.

Academic integrity: Make sure that you provide proper citations for all materials that you use in your lesson and unit plans.

Final exam: At the end of the course on Tuesday, May 13th there is an oral examination. You will receive a list of questions to prepare (about 50) in the middle of the semester. During the exam students will be randomly assigned 2 of the questions. You will present your answer in front of the class. In addition, each student will be given a problem to solve or a laboratory investigation to perform. The problems and laboratory investigations will be from assigned problems from the ALG, PUM, diagnoser or the video website.

Class website: Materials for class will be posted on the class website https://sites.google.com/a/gse.rutgers.edu/teachingphysicalscience/home ; after you get the e-mail about the posting; you are responsible for printing them and bringing a copy to class.

Course Schedule

Topics for Discussions (by week)

Week	Topic	Assignment (Ch)	PTS	NJCCCS
1	*Backward Design approach to curriculum design Tools for teaching physics*. Relative motion and recording motion.	College Physics Intro and Ch. 1; ALG Ch. 1 PUM Kinematics module. UBD: Backward Design	PTS Standard III: iii (1). PTS Standard IV: i (1, 2).	5.1 (A-D)
2.	*Language and learning physics.* Kinematics.	College Physics Chapter 1; ALG Ch1; PUM Kinematics module. UBD: Understanding Understanding		5.1 (B, C, D), 5.2 (E)
3.	*What does it mean to understand?* Newton's laws, mass & force.	College Physics Ch. 2 ALG. Ch. 2 and 3 PUM dynamics module UBD: Clarity of goals	PTS Standard II: i (1).	5.1 (A-D) 5.2 (E)
4.	*What are the goals we set?* Force laws.	College Physics Ch. 3 ALG Ch. 3 UBD: Six Facets		5.1 (A-D), 5.2 (E)
5.	*Asking the right question.* Circular motion.	College Physics Ch. 4 ALG Ch. 4 UBD: Essential Questions	PTS Standard III: iii (1).	5.1 (A-D), 5.2 (E)
6.	*Evaluation of reformed teaching - RTOP protocol.* Energy. Multiple representations.	College Physics Ch. 5&6; ALG Ch. 6, PUM Energy UBD: Crafting understanding	PTS Standard VI: i (1, 2, 3); ii (2, 3).	5.1 (A-D), 5.2 (C, D, E)
7.	*Student difficulties or students strengths?* Density and Fluid Pressure	College Physics Ch. 9 &10; ALG Ch. 9, 10 PUM Matter UBD: Thinking like an assessor	PTS Standard I: ii (1). PTS Standard V: iii (1, 2).	5.1 (A-D), 5.2 (A)
8.	*Assessment in a physics course.* Archimedes principle.	College Physics Ch. 10 ALG Ch. 10 and11 UBD: Criteria and Validity	PTS Standard I: ii (2). PTS Standard II: ii (5).	5.1 (A-D), 5.2 (A)
9.	*Experiments in physics instruction.* Oscillations.	College Physics Ch. 19 ALG Ch. 19 Planning for learning	PTS Standard VI: iii (6).	5.1 (A-D), 5.2 (D, E)

10.	What is Pedagogical content knowledge and why should we worry about it? Static electricity – Electric field and electric potential	College Physics Ch. 14 & 15 ALG Ch. 14 & 15 PUM Electrostatics and Electric Fields modules (UBD: Teaching for understanding	PTS Standard II: i (1). PTS Standard III: iii(1). PTS Standard VIII: ii (1, 2).	5.1 (A-D)5.2 (C-E)
11.	*Teaching different students.* Current electricity. Series and parallel circuits.	College Physics Ch. 16 ALG Ch. 16. UBD: The design process	PTS Standard I: iii (3). PTS Standard III: iii (1, 4).	5.1 (A-D), 5.2 (C, D, E)
12.	*A meeting with an experienced teacher. Professional organizations for physical science teachers.* Current electricity. Electric power.	College Physics Ch. 16 ALG Ch. 16 UBD: The big picture	PTS Standard II: I (1). PTS Standard X: ii (2) iii (2).	5.1 (A-D), 5.2 (C, D, E)
13.	Magnetic field and magnetic force.	College Physics Ch. 17. ALG Ch. 17 UBD: Yes but…	PTS Standard IV: iii (3, 4).	5.1 (A-D), 5.2 (D, E)
14.	Electromagnetic induction.	College Physics Ch. 18 ALG Ch. 18	PTS Standard IV: iii (1).	5.1 (A-D), 5.2 (C, D)
15.	Final exam.			

Formative assessment tasks
(need to be rich so you can modify your instruction based on student feedback)

- Traditional conceptual questions
2. Explain XXX
3. How do you know that xxx
4. You friend thinks XXX – why would she think this way? Do you agree or disagree? If you disagree, how would you convince her in your opinion?
5. Traditional quantitative problems
6. "Tell all" problems
7. Multiple representation tasks
8. Jeopardy tasks
9. Ranking tasks
10. "What is wrong" tasks
11. "How would you convince somebody" tasks
12. "Why do you agree with?" tasks
13. Data analysis tasks
14. Experiment design tasks

Unit plan

1. Title
2. NJ and NGSS standards addressed in the unit. Explain why you chose those.
3. Length total (days and periods).
4. What students should know and have done before the start of the unit.
5. Goals of the unit e.g. conceptual (what ideas and concepts students should be able to understand), quantitative (what mathematical procedures they should be able to master, what quantitative problems to solve, etc.), procedural (what skills they should acquire), and epistemological (what should they learn about knowledge construction). Make sure that procedural and epistemological goals are content-appropriate. Relationships to other units. Important: relationships to the standards are clear!
6. What evidence will convince you that students met the goals? List and describe.
7. Most important ideas in terms of the subject matter - describe in detail. This is where I will look for your content knowledge, so make sure you go into details. List cross-curricula links.
8. Student potential difficulties and helpful prior knowledge. How can you help with the former and build on the latter? Specific difficulties of ELL students.
9. Lessons outline – list all lessons in the unit with goals and brief descriptions. This should be very short to give a sense of the flow of the unit.
10. Relevance to students' lives (diversity of the society). Family and community resources – how will you use them?
11. Full text of a 2-period lab. This should be the lab you designed, not the one you did in 193/194.
12. Final traditional (paper and pencil) and alternative (performance-based) summative assessment:

a. Traditional assessment – unit test (expected high quality responses to each assignment included). Make sure that your state the unit goals that you can assess with each assignment and no goals are left unaddressed. Describe the grading scheme for the assessment. Traditional does not mean multiple-choice, it means a limited time written test.
b. Alternative summative assessment (performance assessment). Provide descriptions with brief guidelines for the students and expected outcomes.
c. Student projects. Describe what they are and how you will provide guidance to the students.
d. Out of classroom activities if appropriate (field trips, fun competitions, plays, etc).

13. Modifications for different learners.
    Describe alternative instructional strategies for diverse learners (i.e. ELL students, students with disabilities, gifted students, minorities) such as the use of multi-sensory teaching approaches, use of instructional technologies, accommodations for test taking (e.g., extended time), advance organizers, peer tutoring and cooperative learning activities.
14. List equipment for the unit and resources for the students.
15. List complete references to all resources you use as a teacher.
16. Reflection on the implementation of the unit including commentary on obstacles in implementing it.

Lesson plan

1. Title
2. NJ and NGSS standards addressed in the lesson.
3. What students should know before they start the lesson and why this knowledge is important.
4. Goals of the lesson e.g. conceptual (what ideas or concepts will students construct during the lesson), quantitative (what mathematical relationships they will master), procedural (what skills they will learn and practice), and epistemological (what they will learn about the nature of knowledge and the process of its construction). Connect the goals to the standards you chose.

5. List the evidence that you will collect that will convince you that students met the goals. Be specific here.
6. Most important ideas in terms the subject area - describe in detail. Real life connections (make a list). Family and community resources.
7. Student ideas that they bring into the lesson, productive ideas and potential difficulties (what might cause trouble and resources (what you can build on). Make sure you explain what you will do to address the difficulties.
8. Equipment needed, group it into teacher use and student use.
9. Lesson description: a script of the lesson (What is going to happen, what you will say, what questions you will ask, what students will do, all handouts that you plan to give to the students). Choose activities that are best for the content of the lesson. Make sure you describe how you will start the lesson and how you will end it (to capture students' attention and to have some sort of closure).
10. Time Table – who is going to be doing what and when during the lesson to make sure that students are actively engaged.

Clock reading during the lesson	"Title of the activity" **Relation to the goals**	Students doing	Me doing
0 - 6 min	Homework quiz, receive feedback on student understanding of motion diagrams – the foundation of today's lesson	Writing	Checking up equipment for the first activity

11. All formative assessments that you plan to use, write what possible answers you expect from students and how you will provide feedback (e.g. if these are problems - include solutions).
12. Modification for different learners. Be specific of how those modifications are related to this particular lesson.

a. Compensatory activities for those students who lack prerequisite knowledge.
b. Describe alternative instructional strategies for diverse learners such as the use of multi-sensory teaching approaches, use of instructional technologies, advance organizers, and cooperative learning activities.
c. Describe modifications for ELL students.

13. Homework – make sure that it addresses two goals: strengthens this lesson and prepares students for the next lesson. Describe the guidance that you will provide to the students.

Questions for classroom observations

First describe in detail one of the lessons that you observed this week, next answer the question of the week with specific examples. In your reflection paste the questions from the syllabus and answer them one by one.

1. Week 1: Goals of the lesson and how did the teacher made sure the goals were achieved? What did student understanding look like? Please provide at least 3 specific examples. What aspects of classroom management did you detect? List all examples.

2. Week 2: What evidence did you find of the teacher's awareness of students' ideas (prior and current?). What did student difficulties look like? Please provide at least 3 specific examples. What aspects of classroom management did you detect? List all examples.
3. Week 3. What forms of formative assessment did the teacher use? When did she/he use it? What kind of feedback did she/he provide? How did student performance affect the continuation of the lesson? What aspects of classroom management did you detect? List all examples.
4. Week 4: What questions did the teacher ask? How can you classify them according to Bloom's taxonomy? Were any of those essential questions? What answers did the teacher find satisfactory? Provide examples of both questions and answers. What aspects of classroom management did you detect? List all examples.
5. Week 5: How did the teacher start the lesson (please record this moment word to word). Why did she/he do it this way? How much time were students actively engaged in the lesson? What did they do during this active engagement times? How much time did they spend sense-making? What did sense-making look like? How much time did they spend doing busy work? What did busy work look like? Why did they have to do it?
6. Week 6: What kinds of questions did the students ask? Were any of them essential questions? How did these questions shape the lesson? How did the teacher respond to the questions?
7. Week 7: What metacognitive strategies did students use? What were the examples of reflection?
8. Week 8. RTOP score with explanation. Examples of student understanding.
9. Week 9. RTOP score with explanation. Examples of student understanding.
10. Week 10 RTOP score with explanation. Examples of student understanding.

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.