**ED 276C: CURRICULUM AND INSTRUCTION IN SCIENCE**

**COURSE SYLLABUS**

**Winter, 2017**

**INSTRUCTORS:**

Jonathan Osborne Catherine Lemmi

Office: Cubberley 222 Office: Cubberley 213

Phone: 650-725-1247 Phone: 901-233-9771

osbornej@stanford.edu clemmi@stanford.edu

Office hours: T, W, Th Office hours: M, T, F

By appointment. By appointment.

**REFERENCE TEXTS:**

Wiggins and McTighe. *Understanding By Design*

Haysom, J., & Bowen, M. (2010). *Predict, Observe, Explain: Activities Enhancing Scientific Understanding*. Arlington, VA: NSTA Press.

Keeley, P., Eberle, F., & Farrin, L. (2005). *Uncovering Student Ideas in Science, Vol. I: 25 Formative Assessment Probes*. Arlington: VA: NSTA Press.

Keeley, P., Eberle, F., & Farrin, L. (2007). *Uncovering Student Ideas in Science, Vol. 2: 25 Formative Assessment Probes*. Arlington: VA: NSTA Press.

Keeley, P., Eberle, F., & Farrin, L. (2008). *Uncovering Student Ideas in Science, Vol. 3: 25 Formative Assessment Probes.* Arlington: VA: NSTA Press.

Keeley, P. (2008). *Science Formative Assessment*. Thousand Oaks, California: Corwin Press.

National Research Council (2012). *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas.* Available for free download at: <http://www.nap.edu/catalog/13165/a-framework-for-k-12-science-education-practices-crosscutting-concepts>

Achieve, Inc. (2014). *Next Generation Science Standards (NGSS).* Available for free download at: <http://www.nextgenscience.org/next-generation-science-standards>

Selected readings: See listings as assignments in the syllabus. Available on Canvas.

**PHONE APPS:**

*For Iphones.*

|  |  |
| --- | --- |
| Digital Sound Meter | UHear |
| Fourier Lite | Iseismometer |
| Fourier Touch  Earthquake Lite | Pulselite  Reflex Tester |
| Instant Heart Rate |  |

*For Android phones*. Please search for similar apps as listed above.

Android Sensor Box

**COURSE DESCRIPTION AND LEARNING GOALS:**

Where we have been in C&I to date

By this time of the year at STEP, you are each in different places with respect to your learning and understanding about how to teach any particular science topic well for your specific students. In our summer course and since, you have been studying in four major sources of understanding that inform effective science teaching: the Nature of Science, the Nature of Learning, the Nature of Learners, and the Nature of Teaching. This spiral curriculum continues in this winter course. Although each of you has begun to construct your own sense of these four areas, and are making connections from them to your work as a teacher in your placement school, we do expect that you will put these understandings into practice as you embark on Independent Student Teaching.

Where we are going:

This third quarter you will continue to study in the four areas:

*The Nature of Science*:

We will examine the nature of science, for two reasons in order for you to:

1. Restructure your own science knowledge into a deeper understanding of the subject you have chosen to teach and to deliberately develop your Pedagogical Content Knowledge (PCK), by:

1. understanding that, since the best way for people to make meaning in science is for them to begin with objects and a phenomenon to be explained, teachers need to put the events and objects of the real world as central to their science lesson plans.
2. helping make meaning clear for your students first, adding definitions, equations, and specialized vocabulary only after some understanding exists and the concept labels can be attached to some objects and events.
3. making evident both your deep understanding and the values that you have attached to particular content through a “60 second story” which represents the big picture of a particular scientific view of the world, e.g. photosynthesis, so you can examine it in a new way and use it in curriculum development,
4. developing real ownership of the science by critical examination of misconceptions and alternate conceptions research, texts, models, diagrams and other representations in the public domain. What we teach in science is best seen as a set of ‘crazy ideas’ which are challenging for students to understand.

*And*

2) build a more accurate understanding of the nature of science, i.e. of what science is, as a discipline, especially to re-understand the nature of inquiry and the fallacy of “The Scientific Method”, and to connect the ways science is done to the outcomes of those activities, by

1. using approaches to the science in lesson plans that promote opportunities for students both to argue what they know, how they know it, and why they trust it (inquiry processes) and to build understandings of concepts ( the products of the scientific enterprise).
2. using approaches that ask and encourage students to figure something out, using evidence.
3. helping students to build an understanding of science as an activity devoted to constructing explanatory models of the world and the cross-cutting concepts of patterns, scale, energy transfer that are common to all the sciences .
4. understanding the issues surrounding current efforts to promote “Intelligent Design”/ Creationism in schools and/or to undercut the consensus understanding of biological evolution in schools around the nation,

*The Nature of Learning:*

We will examine the processes of learning in order for you to:

1. Comprehend that understanding can be neither given nor received, and to act on this understanding in your teaching.

2. Distinguish between information we can give and the understandings that students will construct.

3. Comprehend that scientific meaning of an event is first built not in specialized vocabulary, definitions and equations, but in ordinary everyday language and that when we add specialized vocabulary after such meaning making has occurred it is learned more successfully.

4. Understand that each of us makes deep meaning from two sources: what we already know of the objects, phenomena and domain to be learned, and new information and new phenomena.

5. Understand that we must find out what alternate conceptions our students bring to their learning that will interact with the new information we give them, using research literature and pre-assessment work.

7. Use ideas in your teaching that are based on a cognitive science view of human cognition, e.g. concept mapping, advance organizers, working memory overload, chunking, the pause principle, wait time, etc.

8. Begin seriously to question the notion that our students’ capacity to learn is a fixed, unchangeable capacity (the legacy of I.Q.) in favor of the idea that useful, challenging cognitive work and effort will lead students to make real progress in the academic work that they do.

*The Nature of Learners:*

We will examine the question of who are your students, in order for you to:

1. Find out what your students have already experienced outside school about objects, events, behaviors to which a science topic is or could be connected.

2. Find out both the strengths they bring to class on which you can plan to build, and uncover any alternate conceptions about fundamental ideas they might bring to their studies.

3. Uncover what specific, prior knowledge they have from science classes and from their everyday experiences, including misconceptions.

4. Find out something about them as individuals re. their current academic functioning levels, about their English language fluency, what they do well, and what they need help with.

5. Become very aware of them as individual teenagers, especially re. language, culture, and gender, with rich lives outside of school, rather than lumping them together as a single unit e.g. “they don’t want to …”, or “my class is very ….”

6. Create and set a plan in motion for their progress and achievement over a distinct time period.

*The Nature of Teaching:*

We will examine the work of effective teachers, in order for you to:

1. Construct an image of teaching different from that of teacher as deliverer of curriculum, sharer of knowledge, star performer, magician with a bag of tricks, etc.,

2. Construct new images of teaching the foci of which are both:

a) teacher as designer, designing work for students to do in order to build understanding, and

b) teacher as assessor, designing ways to constantly monitor/assess learning, so that you can help close the gaps between where a student is and where you want her to be.

3. Feel the power of student engagement, learning, and your ownership of what happens in your class that good plans, made well ahead of time, have.

4. Create a well-integrated curriculum unit plan, based on the text “Understanding by Design”, and through the process of ‘Backwards Planning’, and build a plan with your CT to teach it after C&I is over.

5. Know how to make effective lesson plans, in which the goals, strategies and assessments are aligned.

6. Constantly collect data (assess), during class time, about what students are understanding vis-à-vis your intentions so that you can make modifications to close learning gaps, on the spot, or asap,

7. Know that it is hugely valuable to work collaboratively with other teachers, other candidates, your supervisor and Jonathan and Catherine on the details of your specific classes and your specific science topics in sponsoring your growth and progress as a science teacher, and act on this knowledge.

**In this last quarter of C&I we will work with two perspectives:**

• Your Context:

The very individual issues of your own teaching context, shaping **your** teaching, to help **your** students, in **your** school, to make progress and to achieve in science, i.e. for you to continue to make yourself into an effective science teacher, and

• The Big Questions of Science Education:

Beyond your own classrooms, at the national and even international levels so that you are positioned to take your place as a leader in the world of science education.

Hence, in our weekly sessions, we will revisit the same four areas of learning for teaching, again and again, in the spiral curriculum of C&I, but we will also engage what scholars have to say about questions such as: ‘Why teach science?’, ‘What is science?’, and ‘What science should we teach?’

The Syllabus and Assignments documents make these intentions clear.

The philosophy of our sessions is driven by some very simple ideas:

First that science is engaging because it is either AWESOME or it is DISTURBING or both. That means rethinking about how the ordinary may seem extraordinary.

Second, that teaching science is really teaching a set of CRAZY IDEAS e.g. that day and night are caused by a spinning Earth rather than a moving Sun, that air has mass, that the continents have moved, that you look like your parents because every cell in your body carries a chemically coded message about how to reproduce yourself and so on.

Third, that is there are 5 elements to learning science. There are:

**Doing Science** – this is the experimental exploration part.

**Talking Science** – by the students or with the students but not just you the teacher

**Writing Science** – and not just lab reports.

**Reading Science** – how do you help students to read science texts. It is your responsibility not the language arts teacher.

**Representing &** – ways of representing scientific ideas

**Drawing**

Finally, this quarter we will continue to practice and discuss the use of Scientific and Engineering Practices.These are:

1. Asking questions (for science) and defining problems (for engineering)

2. Developing and using models

3. Planning and carrying out investigations

4. Analyzing and interpreting data

5. Using mathematics and computational thinking

6. Constructing explanations (for science) and designing solutions (for engineering)

7. Engaging in argument from evidence

8. Obtaining, evaluating, and communicating information

So in each session, we will explore how you can enable students to do one or more of these elements.

We believe that you become a better teacher by sharing your challenges with others, reflecting on them and learning from your mistakes. Hence many of these sessions will have an element where you will share a video with others.

Finally, this is one of the few opportunities that you will have to think a little bit more broadly about some of the challenges of teaching science. Hence, we will look at a few seminal readings

**10-Week Outline of Course**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Week #** | **Instructional Goals** | **Major Activities** | **Science Activities** | **Science Teaching Strategies** | **Assignment Due** | **Reading** |
| **1**  **Jan**  **10** | • Introduction and Goals & Reviewing Work to date  • Explaining Assignments  • Philosophy of the Course  • Adding to your repertoire of instructional practices | * Introduce Do-It, Talk-it, Read-It, Write-It * Introducing Concept Mapping (Summarizing Activity) * Making Science Relevant: Watching video from tools4 teaching and discussing the implications. (Disrupt:Predict-Observe-Explain) * Activating Student Background knowledge (Concept Map) * Introduce Practices | Awesome and Disturbng Science  Teabag  Van de Graaf  Two balloons connected by clamp   * Starting Fast Plants   Analyzing and Interpreting Data Measurement | Concept Mapping  Predict-Observe-Explain  Exit Slips  POMS |  | None. |
| **2**  **Jan 17** | * Building a Model for Learning Science * Exploring What it means to teach science | * Making science relevant Activating Prior Knowledge about Plants * Introducing Big Idea Materials * Watching videos in small groups. Using Consultancy protocol * Discussing First Reading * Practices as a model for teaching about science * Video assignments for presentation | * Fast Plants | Discussion of Instances | * Reading Assignment 1: Teaching Students to read, write and talk science | Pearson et al  Osborne |
| **3**  **Jan 24** | * Building a Model for Learning Science * Adding to your repertoire of instructional practices | * Discussing readings * Considering Videos * Promoting Reflection – Small group work. Think-pair share & Listening Triads | * Finishing Fast Plants * Using the Projection Microscope – Awesome science. | *Think-Pair Share*  Listening Triads | * Reading Assignment 2: How Science is learned/taught? | Driver et al.  Falk & Dierking |
| **4**  **Jan 31** | * To build practice * Exploring the teaching of science * Synthesizing Practice | * Discussing readings * Considering Videos * Putting it all together  1. Eliciting Prior Knowledge 2. Promoting Reflection 3. Summarising  * Circus of Air pressure Activities | Challenging science  Air Pressure Phenomena  Tumbler and Water  Water Barometer  Syringes and Liquids/Gases  Lifting the Table with Trash can lid  Lifting piece of paper by blowing over it | Freyer Diagrams | * Assignment 3A: What is the big idea that will be the focus of your Course Unit * Group 1: Classroom Video & Commentary | None. |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Week #** | **Instructional Goals** | | **Major Activities** | **Science Activities** | **Science Teaching Strategies** | **Assignment Due** | **Reading** |
| **5**  **Feb**  **7** | • Improving Your Understanding of Science  • Improving Your understanding of instructional practices | | • Discussing readings  • Considering Videos  • Exploring the use of IT devices  • Introducing Predict-Observe Explain | Focus on collecting, analyzing and interpreting data.  Focus of IT | Predict, Observe, Explain (Radiation Bottles) | * Reading Assignment 3: How is Science Learning Experienced * Group 2: Classroom Video & Commentary | Boe  Millar |
| **6**  **Feb 14** | • Improving Your Knowledge of Instructional Practices.  • Working on Your Science Knowledge | | Discussing readings  • Why is Language Important in Science?  • What kind of language activities might we do?  • Using adapted primary literature | Nature of Science Activities  Lederman  Tricky Tracks  Tube Activity  Any positive number activity (falsification)  Ice Cube Activity | Writing Frames  Writing for Difference Audiences  Wordsift  Thick/Thin Questions | * Assignment 3B. Pre-Assessment Plan * Reading Assignment 4: What is Science * Group 3: Classroom Video & Commentary | Science for All Americans  Framework for Next Generation Science Standards |
| **7**  **Feb 21** | • Improving Your Knowledge of Instructional Practices.  • Working on Your Science Knowledge   * Thinking about where science is learnt | | * Discussing Reading * Relating science to the outside world * Youtube * Kahn Academy/CK12 website * Revisiting Concept Map | Planks Experiment | Argument in Science | * Reading Assignment 5: Why Teach Science * Group 4: Classroom Video & Commentary | Shamos  Millar and Osborne |
| **8**  **Feb 28** | • Improving Your Knowledge of Instructional Practices.  • Developing Your Knowledge of how students learn | | • Exploring how ask better questions  • Working on synthesizing strategies | Measuring your own power. | Constructing an Explanation  Asking Better Questions  Thick/thin questions  Productive Talk | * Assignment 3C. Pre-Assessment Results to analyze in class | None. |
| **9**  **Mar**  **7** | • Improving Your Knowledge of Instructional Practices  • Working on Student Understanding of Scientific Practices | | • How to organize discussion based work?   * Modeling Practice | (Osmosis Experiment) | (Revoicing)  Techniques  Listening Triads  Jigsaw | * Reading Assignment 6: What science to teach? * Assignment 3C. Pre-Assessment Results Write-up | Kitzmiller et al vs. Dover Area School District |
| **10**  **Mar 14** | | • Pulling it all together  • Reviewing Unit Plan Assignments | • Exploring Formative Assessment techniques  • Exploring Modeling. What does it mean to build a model? | • Presenting Unit Plan to Others | Summary Concept Map  Exit Slips  POMS | * Draft Unit Plan for presenting to class. * Final Unit Plan due March 21st at 9am. | None. |

# COURSE READINGS:

Readings in the Understanding by Design text are not assigned, nor are readings in the NGSS Standards documents. It is, however, expected that your work will be based on these texts. Other texts have been suggested as a good source for relevant instructional practices.

**Topic 1: Teaching students to read, write, and talk science**

*Work in pairs.* *Each pair should read two pieces, and respond to:* ***“****What have these writers said we must take into account about students when we think of trying to help them get better and better at learning science?” Your response should be in two, 2 page, double- spaced, papers, one per reading, and hand them in, as a pair, with both names.*

Pearson, D., Moje, E. B., & Greenleaf, C. (2010). Literacy and Science: Each in the Service of the Other. *Science, 328*, 459-463.

Osborne, J. (2010). Arguing to Learn in Science: The Role of Collaborative, Critical Discourse. *Science, 328*, 463-466.

**Topic 2: How is science learned and taught?**

*Read the following 3 pieces. Then write a 2 page, double-spaced, paper that both summarizes the common messages about learning in them and describes any differences that you see in them*

Driver, R., Guesne, E., & Tiberghien, A. (1985). Children's ideas and the learning of science. In R. Driver, E. Guesne & A. Tiberghien (Eds.), *Children's ideas in science* (pp. 1-9). Milton Keynes: Open University Press.

Schwartz, M. S., Sadler, P. M., Sonnert, G., & Tai, R. H. (2009). Depth versus breadth: how content coverage in high school science courses relates to later success in college science course work. *Science Education, 93*(5), 798-826.

**Topic 3: How is learning science experienced?**

*Read and prepare a 4 page double spaced response to: For this you are asked to read the following two articles and summarize what the implications might be for your teaching.*

Lyons, T. (2006). Different Countries, Same Science Classes: Students' experience of school science classes in their own words. *International Journal of Science Education, 28*(6), 591-613.

Millar, R. (1991). Why is Science hard to learn? *Journal of Computer Assisted Learning, 7*, 66-74.

**Topic 4: What is the account of science we should teach?**

*For this assignment you must work in pairs. Read these 2 pieces and create one 4 page double spaced summary response attach both names. Your piece should simply attempt to (a) identify the main arguments; (b) contrast the differences that you see; and (c) identify any strengths and weaknesses that emerge in your reflection. (Make it a comparison)*

Osborne, J. F. (2014). Teaching Scientific Practices: Meeting the Challenge of Change. *Journal of Science Teacher Education, 25*, 177-196.

**Topic 5: Why teach science?**

**Assignmen**t: Create a personal, 4 page, double-spaced, paper re. one of the following pieces in the format:

1. a paragraph of your own answer to this question before you read,
2. a paragraph summarizing the author’s answer(s) to the question,
3. a response to the author’s position.

Please feel free to read individually, or in any sized reading group, according to any format; although we do hope that each piece will have been read by someone.

Shamos M (1995) *The Myth of Scientific Literacy* pp. 215-228, Rutgers University Press, New Jersey

Nuffield Foundation (1998) *Beyond 2000, Sections 1 & 4*, Millar R. & Osborne J. Eds., Kings College, London.

**Topic 6: What science to teach: Lessons from the teaching of evolution?**

Judge J.E. Jones 111, (Dec 2005) *Memorandum Opinion* in Kitzmiller et al vs. Dover Area School District,

Judge Jones, in his ruling in the Dover PA case, attempted to write an argument that other communities could use to determine whether what was intended for the science curriculum was in compliance with the law and the precedents. He did this with the express intention of reducing the time, money and effort that might well accrue if communities did not understand the law.

1. In no more than 2 pages, double-spaced, create a chunked outline of the Judge’s argument as a series of headings and subheadings with one sentence of explanation per issue to demonstrate your understanding of Constitutional Law re. the governance roles of “church” and “state” in The United States of America.

2. In no more than 2 pages double spaced, write about your personal responses to the case of teaching biology in a school in Dover, PA as you have understood it from the Judge’s ruling. For example, we are interested in what impressed and what dismayed you about the case, what guidance you have gleaned as a science teacher-to-be from it, and with what questions you are left.

**COURSE GRADING SYSTEM:**

**Course Expectations for Evaluation**

Regular attendance in class is expected. If you are going to be absent, please let us both know in advance via email ([clemmi@stanford.edu](mailto:clemmi@stanford.edu) and osbornej@stanford.edu).

As usual, you should assume you have an A in this course, which is to say that the A is yours to lose. This acknowledges that:

• you are each here to gain as much understanding and skill as you can,

• that you learn at different rates and in different chunks,

• that you will have each gained, at least, the fundamental understandings and skills that I intend by course end.

The grade for the course will be assigned on the basis of four assignments as detailed below.

Contribution of Assignments to the final grade

There are four kinds of assignments this quarter:

|  |  |  |
| --- | --- | --- |
| **Portion** | Assignment | Graded |
| 10% | 1. Reading Assignments | Credit/NC |
| 30% | 2. Classroom video and commentary | With rubric |
| 10% | 3. Preparation for your Course Unit Plan | Credit/NC |
| 50% | 4. Final Authentic Performance Task: A Curriculum Unit | With rubric |

COURSE ASSIGNMENTS:

1. Reading Assignments

It is expected that you will read, study, and use understandings from the basic text Understanding By Design, and for your science, the Next Generation Science Standards and the K-12 Framework for Science Education in C&I course work and assignments.

• Readings are **assigned** in six areas this quarter, and are intended to help frame answers to the big questions cited in the course description, the due dates accompany the assignment list below.

• For each reading assigned, there is a written summary required. Its exact nature is specified in the rubric above the reading

• You may read as a reading group, or as an individual, but please prepare each paper as a personal assignment.

• Some reading assignments may have specific questions for you to address, some may require a summary/response … see the Readings list.

• The readings are assigned in the first half of the course, and we will have discussions on these large questions, framed and informed by your readings.

2. Classroom video and commentary

*Starting on week 4, Jan 31st, and for four consecutive weeks, we will have 3 of your classroom videos in C&I; see the schedule for your own randomly scheduled assignment.*

We will, as a class, watch all the videos assigned for the day and then discuss evidence of your students engaging in any of the scientific practices requiring either reading, writing, talking, or doing science (or any combination of these). These videos need to show evidence of you scaffolding and supporting their practice and monitoring their understanding.

You will bring about 8 minutes of video of your class to C&I. (at least 6 min, no more than 10 min) The 8 minutes can be one continuous piece of video, or the sum of two smaller continuous pieces of video. The video should show the following:

• students engaged in some aspect of undertaking one of the scientific practices of arguing from evidence, developing and using models, constructing explanations or communicating and obtaining information which involves any one either doing, talking, reading, writing or representing science or any combination.

• you actively monitoring their learning and understanding

Your discussion should focus on what evidence there is of any student understanding of the science content or failure to understand.

On your day, you will bring the video clip, arrange a camera or other projection mechanism, be prepared to show the clip, provide our class with 1) a written list of the learning goals for that day, 2) a transcript as necessary, and 3) verbally in about a minute, any information about specific students that we need in order to interpret what is happening in the video.

You will also provide instructors with one printed copy of a short written response to the following prompts:

a) What is important for an observer to know in order to understand and interpret the interactions between and among you and your students? Please provide any other information needed to interpret the events and interactions in the video clips.

b) How novel or familiar is this activity for these students in science?

c) **In the clip**, what aspect of scientific practice(s) is/are shown?

d) **In the clip** what did you do to further the students’ understanding, and/or try to engage them intellectually while they were engaged in a scientific practice?

e) **In the clip**, what strategies did you use to monitor student learning during the portion of the task shown?

f) Cite examples of interactions **in the clip**, between you and a student(s) that provide evidence of what students were understanding, and discuss this evidence in light of your learning goals for the day.

g) In the clip or lesson, what specific strategies did you use to monitor student learning, either of all of your students and/or specific individual needs, especially address any language supports you used to help your students (including English language learners as well as other students struggling with language) understand the content and/or academic language central to the lesson.

This assignment will be assessed against how well the features (a) to (g) above are discussed.

3. Preparation for your Course Unit Plan (Final Assignment)

Assignment 3A: What is the Big Idea for your Unit? For this you are asked by Jan 31st to produce a 500 word document which outline what the focus of your course unit will be. The 500 words should explain:

1. What the big idea is?
2. What is challenging, disruptive or simply awesome about this idea.
3. A version of this that can be stated in 30 seconds.

Assignment 3B: The Pre-Assessment Plan For this assignment you are asked to produce a short document (no more than two pages) describing what strategy you have chosen to elicit and activate student prior knowledge and why you think it is appropriate. This is due on Feb 10th.

***Assignment 3C:*** ***The Pre-Assessment Results***. In class, session 8, February 28th, you are asked to bring in a class set of work that your students have completed. You should have given them some work to do the prior week, so you can collect a class set to bring to C&I. In class you will analyze the class set and discuss the process and the findings with other STEPPIES. You are asked to complete and write up an analysis of student work for the following week; so this assignment is due March 3rd.

In your work, you should discuss the following three questions:

1. What assessment did you use and why?
2. What were the main features observed in the student responses (with some measure of their frequency)
3. What are the implications for your teaching of this topic?

4. The Final Authentic Performance Task: A Curriculum Unit

You are asked to select a unit of study in which your class will engage during several days in April – May. You will develop a Science Curriculum Unit according to the Principles of Understanding by Design. The curriculum unit should be patterned after, but not limited to the model developed by Wiggins and McTighe, both in process and in content, and will be assessed according to the Rubric provided.

This task is both a learning and an assessment task in C&I. It is not intended that you complete this on your own and hand it in, de novo, at the end of the quarter.

You should make a plan to work on a section each week, e.g. begin making and using a pre-assessment asap. Then actively send me frequent and regular drafts for conversation and feedback as you work. This has to be an Individualized Learning Plan, since you will creating a unique plan. I expect that you will use office hours a lot! Your plan of work and drafts should be in the order of “Backwards by Design” and as in the order of listing below. The point of this revision and feedback is that by the time the Unit is presented as a whole, summative project, you will have learned a lot about planning for learning, through thorough discussion and revision.

**The Curriculum Unit is** **due, in hard copy, at the very latest, on**

**Tuesday, March 21st, before 9.00am.**

It should have the following components:

|  |  |
| --- | --- |
| **Context description**  This should include: | 1) Your 60 Second Story. This can be an updated and improved version of Assignment 3A  2) A description of how some data or information that you have about your students, the school, the department, the time of year, and etc. helped shape the unit plan,  ~ please pay particular attention to explaining what academic language issues you have identified in your students and how you might have allowed for these in your prior assessment.  ~ please describe and justify your chosen strategy for eliciting prior knowledge.  ~ please include a summary of your pre-assessment findings. The instrument and real data can be place in the Appendix.  3) Your Rationales both for teaching this content area, why it might be engaging for students, and for students wanting to learn it.  This |

*This section should include references to readings and any other relevant data to provide a context and justification for your choices.*

|  |  |
| --- | --- |
| **An Essential Question(s)** | This could look like a “Unit Question” (see Wiggins and McTighe), and could be the title. It is important that what your unit is addressing is a question whose answer will be understood by studying your course unit |
| **Learning Goals** | 1. These should be written as aims representing some understanding rather than single sentence definitions, equations, and etc. These chunks aims be lifted directly from, and will together comprise, your science statement and so will exemplify Pedagogical Content Knowledge. 2. The aims will be spelt out as outcomes – what will the students be able to do when you have finished th eunit. The outcomes will be measurable and should draw on the Next Generation Science Standards and specify which performance expecations are being addressed. They should make clear both what disciplinary core ideas will be included*, what scientific practices* will be addressed and any cross-cutting concepts |
| **Final Performance Task** | This task is an authentic summative assessment, given at the end of the unit and assigned a grade that is to be reported outside the classroom. You will have chosen to give your students both a description of this final project and the grading mechanism at the start of the unit. This can be an updated and modified version of Assignment 3B |
| **The Assessment Guide** | 1) The criteria for assigning grades or assessing at a rubric level.  2)The way in which “grades” will be assigned on the final performance task will be either a grading scheme and the rationale for it, *and* a rubric that tells the students why they earn what on the task. The grading scheme should be written in terms of the kinds of performance that might be expected from students. |
| **Lesson Plans** | You will provide a set of fully developed, sequential lesson plans for **five to seven** “instructional hours” or typical 50 minute high school class periods [this means only 3 to 4 of the 90 – 100 minute block class periods]. It could involve more, but talk to me first if it needs to be a little longer.  • At least one lesson should require students to interact with data en route to creating an argument and a conclusion; so Inquiry should be central in these plans.  • At least one lesson should involve the use of current technology as a route to learning  • Daily formative assessment strategies = strategies for monitoring learning and finding learning gaps during the lesson should be explicit.  • Plans for students to produce work of some sort during the unit should be explicit.  • The Lesson Plan format you use for the lesson plans should include the three key elements:  • Goals: They will come to understand that: (these ARE some of those already listed)  • Activities: To come to understand they will:  • Assessing: I’ll know they understand when they:  • It is useful also to have the teacher’s agenda and materials so include your To Do agenda for each lesson as well  • Each lesson plan should have attached to it all the handouts that accompany each lesson plan, and cite all resources by complete reference data. |
| **Appendices** | The pre-assessment instrument and data should be included. |