SED 541 Topics in Science Education: Teaching Weather Concepts: Using Tools for Multi-Disciplinary Teaching

This course combines approximately 90 hours of instruction, online activities, and assignments for 3 credits.

**Instructor:**
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541-737-1811  
Skype name: matt.w.nyman

**Prerequisites**
Participants should be either a K-12 teacher, free-choice learning educator or have access to an educational setting. A variety of assessments will be used to demonstrate learning. However, part of assessments require participants to be able to use spreadsheets to import and organize data and produce graphs, acquire images from webpages and construct short videos, presentations, websites, or other visual media that will be used to assess learning.

**Course Description**

**Introduction**
Science content and pedagogy in learning and teaching basic weather concepts. A focus of this class is using archived and real-time data sets and visualizations to elaborate on basic weather concepts as well as investigate avenues to integrate these tools in informal and formal learning environments. For K-12 classroom teachers a central outcome for this class is the emergence of mathematics and science educators prepared to be leaders in using innovative technology and data-rich strategies in their educational programs. Free choice participants will grow in their knowledge of weather concepts and gain background in the rich visual and data resources available for engaging a diversity of learners.

**Weather Stations and Notebooks**
Participants are required to buy, set up and maintain a small weather station at their educational setting. Free-choice educators can choose to set up the station at their homes or institutions. We recommend purchasing the [Ambient Weather WS-1171 Wireless Advanced Weather Station with Temperature, Dew Point, Barometer and Humidity](https://www.ambientweather.com/product/ws-1171), which is relatively inexpensive but has all the features required for obtaining good measurements. During the term each participant is required to collect data from the weather station and enter data into a spreadsheet. One of the course requirements will be to produce graphs and other representations of the data. Also, each participant is required to purchase a scientific notebook or use an online science notebook in which to record weather observations. Details of the requirements are included below. Notebook entries will be collected at the middle and end of the term via mail or email. For participants teaching elementary grades, Michael Klentschy’s book *Using Science Notebooks in*
Elementary Classrooms is a good reference to see how science notebooks can be integrated into your practice.

Classroom Practice

Each unit is linked to recently articulated science and engineering practices (NRC, 2012; Next Generation Science Standards (NGSS). These are linked to key pedagogy questions for each unit that will be the prompts for reflection on how new content and skills about weather can be included in participants’ science practice. Two pedagogy questions thread through each unit: How can archived data be used in educational settings? and How can models be used in educational settings? Other key pedagogy questions will center on some of the following issues:

1. How to implement various Internet resources into practice;
2. Recognizing and addressing incorrect weather preconceptions;
3. Discussions of NGSS crosscutting concepts that support multi-disciplinary learning;
4. Connections between NGSS and math and literacy Common Core Standards;

Final or capstone projects provide an avenue for participants to develop weather related materials or curriculum appropriate for their setting.

Norms for Learning

Although this class uses an online, asynchronous mode of communication, the plan is to establish a learning community such that participants share ideas and support each other as they explore the course ideas. Rather than face-to-face discussions as in a traditional class, participants will use electronic means for engaging in the discussions. You are expected to interact consistently through each week of each unit in the course in the process of collaborating with each other in the development of the ideas for the class. At the end of each unit, you will submit specific products developed through the unit. These expectations provide the norms for your learning in this class.

- **Discussions and Assignments:** Engage in discussion with your classmates throughout this course, paying careful attention to the unit expectations. Keep in mind that you are in a graduate level class and that the interactions are among professionals from different learning environments.
- **Communication:** It is essential that you establish and maintain a consistent class discussion presence throughout the course. You will have multiple ways of inserting your voice in the class:
  - **Blackboard** course link in which you are a participant. This course link is where you will be able to communicate with all students. This link provides you with easy discussion access through specified Discussion Board forums and threads, Group Pages, and email to specific users.
  - Communicate with the instructors or individual students using the Blackboard Tools link on Blackboard.
  - Use **Skype** to communicate with your peers or the instructors. A common courtesy is to ask, “Do you have time for a chat?”
  - Receive feedback on assignments along with viewing your grades through the button titled **My Grades**. This link allows you to obtain the instructor feedback.
at regular intervals throughout the term.
  o The key with access to these various means of communication is to maintain a consistent class presence where you are a part of establishing and maintaining a community of learners throughout the course.
  • Inform the instructor **prior to the due date** if you **need an extension** on an assignment.

**Class schedule**

<table>
<thead>
<tr>
<th>Unit 1: Tools for Learning and Teaching (Week 1)</th>
<th>Content Topics: Introductions. Gaining expertise with Google Earth, accessing Internet data sets, setting up weather stations and acquiring paper science notebooks or accessing electronic notebooks.</th>
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</thead>
<tbody>
<tr>
<td>Unit 2: Understanding Earth’s energy balance (Week 2)</td>
<td>Content Topics: Earth’s energy balance, heat capacity, radiative forcing, temperature, temperature measurements.</td>
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<tr>
<td>Unit 3: Water in the Atmosphere (Week 3 &amp; 4)</td>
<td>Content Topics: Clouds, precipitation, humidity, layers of atmosphere</td>
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<tr>
<td>Unit 4: Convective Processes (Week 5 &amp; 6)</td>
<td>Content Topics: Lapse rate, stability and convective storms</td>
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<tr>
<td>Unit 5: Weather maps (Week 7 &amp; 8)</td>
<td>Content Topics: Air pressure, wind, fronts and weather maps, global circulation</td>
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<tr>
<td>Unit 6: Weather forecasting and extreme events (Week 9 &amp;10)</td>
<td>Content Topics: Formation of Mid-latitude cyclones and case studies of extreme events.</td>
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**Learning Outcomes**

- Increased knowledge of basic weather concepts;
  - Participants examine online resources to investigate essential questions about weather. Each unit involves specific tasks and expected products for motivating participants to reflect on their current knowledge, explore concepts and demonstrate new content knowledge.
- Experience with using archived datasets in learning and teaching;
  - Participants use online archived and real-time weather data sets to elaborate on their newly acquired knowledge of weather concepts.
- Experience with application of various technologies in learning and teaching;
  - Participants apply a range of technologies and skills to learn and demonstrate their learning of the concepts. Participants become proficient in the following applications:
    - Setup and maintain a small weather station;
- Navigate Google Earth and load content onto the Google Earth platform;
- Download online weather datasets and modify these files to use in a spreadsheet program;
- Identify, access and accurately reference images and other visual media from the Internet;
- Use Google documents to share and collaborate on data collection and writing;
- Produce short videos of weather related phenomena.

- Acquire resources and knowledge to teach weather concepts to diverse students in diverse educational settings using teaching strategies that stress science and math practices
  - Participants collect and develop a variety of weather media that can be used in education;
  - Investigate avenues to use a weather station in their educational setting;
  - Participants investigate, evaluate and accumulate available weather curricula consistent with newly crafted science standards and useful in their educational situations;
  - Participants gain and/or improve on technology skills that can be used in their educational pursuits.

### Evaluation of Student Performance

<table>
<thead>
<tr>
<th>Item</th>
<th>Points</th>
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<tbody>
<tr>
<td><strong>Complete specific tasks for each unit (5 units, 30 points each)</strong></td>
<td>150</td>
</tr>
<tr>
<td>Each unit contains specific tasks aimed at answering content questions and supporting participant learning. Frequently these tasks involve accessing and interpreting online archived data. The production of visual models and media is used to support learning and integration into participant’s practice. Collaboration within an assigned community of learners supports learning and engaging in discussions around key content and pedagogy questions.</td>
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<tr>
<td><strong>Maintain and analyze weather data (5 units, 20 points each)</strong></td>
<td>100</td>
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<tr>
<td>All participants are required to maintain a weather station including downloading data into a spreadsheet program to produce time series graphs (changes in variable with time). For each unit participants are assigned team members and share their results including discussion of reasons for differences between locations.</td>
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<tr>
<td><strong>Maintain a weather notebook (Midterm: 50 points)/(End of semester: 50 points)</strong></td>
<td>100</td>
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<tr>
<td>Science notebooks are used to collect observations of daily weather conditions, especially of clouds and changes in weather over the day. Hypotheses supported by data of why specific weather is occurring are required and should reflect growing capacity and understanding of weather concepts. For example, following learning cloud types, participants should use appropriate terms for cloud classification. Sketches or photographs of weather related phenomena and the impact of weather events are encouraged. Participants may opt to use an electronic notebook supplied</td>
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free by Sparklix. Electronic or paper notebooks will be graded at the 5th week and end of the semester. Participants who use paper notebooks will mail photocopies or email scanned notebook pages to the instructor for grading.

Final project: Application to practice
Participants identify a semester long or capstone project related to weather concepts that is appropriate for their learning environment. Project ideas submitted by end of the 3rd week of term and subject to approval from instructor (10 points). Update on project due at 6th week of term (10 points). Final project due week 10 of term (130 points)

Total 500

Grading scale:

<table>
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<tr>
<th>Grade</th>
<th>Points</th>
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<tr>
<td>A</td>
<td>470-500</td>
</tr>
<tr>
<td>A-</td>
<td>450-469</td>
</tr>
<tr>
<td>B+</td>
<td>435-449</td>
</tr>
<tr>
<td>B</td>
<td>420-434</td>
</tr>
<tr>
<td>B-</td>
<td>400-419</td>
</tr>
<tr>
<td>C+</td>
<td>385-399</td>
</tr>
<tr>
<td>C</td>
<td>370-384</td>
</tr>
<tr>
<td>C-</td>
<td>350-369</td>
</tr>
<tr>
<td>D+</td>
<td>335-349</td>
</tr>
<tr>
<td>D</td>
<td>320-334</td>
</tr>
<tr>
<td>D-</td>
<td>300-319</td>
</tr>
<tr>
<td>F</td>
<td>&lt;300</td>
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Note to students: Keep a copy of everything you submit. Letter grades for assignments in the course will be determined using the following scale:

All assignments have due dates. **Since this course is an online course, the times for submission on those due dates is no later than midnight of the identified date.** If you need to request an extension for an assignment, a request must be made to the instructor by email prior to the due date. Late points may be deducted at the instructor's discretion.

A letter grade (A, A-, B+, B, B-, C+, C, C-, D+, D, D-, F) is awarded if the student completes all work, including the final project.

Extensions: Students may request an extension or an incomplete because of illness or other extenuating circumstances-if they have been doing acceptable work prior to the request. The instructor will define the requirements and timelines to complete the course. Please Note: Instructors are not obligated to give extensions.

Withdrawal: The OSU policy for student withdrawal requests is governed by the OSU policies that you find at [http://ecampus.oregonstate.edu/services/policies-and-regulations.htm](http://ecampus.oregonstate.edu/services/policies-and-regulations.htm)

Learning Resources


Digital Library for Earth System Education: http://www.dlese.org/library/index.jsp


Earth System Science Education Alliance: http://esseacourses.strategies.org/

EdTech: http://www.edtechmagazine.com/

Edudemic: http://edudemic.com/

Edutopia: http://www.edutopia.org/

Exploring Earth: http://www.classzone.com/books/earth_science/terc/navigation/home.cfm

Giovanni – The bridge between data and science: http://disc.sci.gsfc.nasa.gov/giovanni/overview/index.html

Global Climate Change: http://climate.nasa.gov/

Google in Education: http://www.google.com/edu/teachers/

Google Scholar: http://scholar.google.com/schhp?hl=en&tab=ws

To search for resources relevant to a topic of interest or by a particular author, type keyword or author’s name into the search box and click on “search” (See also electronic databases under Oregon State University Library)

Student Support and Expectations

Statement of Expectations for Student Conduct -
http://oregonstate.edu/admin/stucon/achon.htm

Academic Integrity — Students are expected to comply with all regulations pertaining to academic honesty, defined as: An intentional act of deception in which a student seeks to claim credit for the work or effort of another person or uses unauthorized materials or fabricated information in any academic work. For further information, visit Avoiding Academic Dishonesty, or contact the office of Student Conduct and Mediation at 541-737-3656.

Conduct in this online classroom — Students are expected to conduct themselves in the course (e.g., on discussion boards, email postings) in compliance with the university's regulations regarding civility. Students will be expected to treat all others with the same respect, as they would want afforded themselves. Disrespectful behavior to others (such as harassing behavior, personal insults, inappropriate language) or disruptive behaviors in the course (such as persistent and unreasonable demands for time and attention both in and out of the classroom) is unacceptable and can result in sanctions as defined by Oregon Administrative Rules Division 015 Student Conduct Regulations.

Course Completion Policy

A student who registers for a Distance Learning course is assigned a "start date" and an "end date." It is the student's responsibility to note due dates for assignments and to keep up with the course work. If a student falls behind, she/he must contact the instructor and request an extension of her/his end date in order to complete the course. It is the prerogative of the instructor to decide whether or not to grant the request.

Statement Regarding Students with Disabilities

Accommodations are collaborative efforts between students, faculty and Disability Access Services (DAS). Students with accommodations approved through DAS are responsible for contacting the faculty member in charge of the course prior to or during the first week of the term to discuss accommodations. Students who believe they are eligible for accommodations but who have not yet obtained approval through DAS should contact DAS immediately at 737-4098.
http://oregonstate.edu/admin/aa/apaa/academic-programs/curriculum/curricular-policies-and-procedures#116

Plagiarism and Expectations for Student Conduct

You are expected to submit your own work in all your assignments, postings to the discussion board, and other communications, and to clearly give credit to the work of others when you use it. Academic dishonesty will result in a grade of “F.” Any student whose work indicates a violation of the OSU Academic Misconduct Policy (cheating, plagiarism) can expect penalties as described in the Dean of Students’ webpage:
The following link provides information on writing in general and specific guidance on proper citation techniques. [http://cwl.oregonstate.edu/](http://cwl.oregonstate.edu/)

Civility Policy

The Office of Student Conduct & Community Standards supports the mission of the university by providing programs and services designed to meet the educational and developmental needs of students in relation to community standards, civility, accountability, diversity, respect and truth. For details see: [http://ecampus.oregonstate.edu/orientation/success/conduct.htm](http://ecampus.oregonstate.edu/orientation/success/conduct.htm)

Netiquette

Do not use ALL CAPITALS when speaking to someone electronically! This is rude. As you will see after you have been working electronically for a while, all capital letters feel as if someone were shouting at you. Do not write in all bold letters, either. This is rude because it is very hard to read after awhile.

Be cautious with irony, humor, and satire. Do not jump to conclusions about others’ communications and try to mark yours appropriately. The :-) (or smiley) is one tool for this purpose? Remember: You cannot see the people you are communicating with, and they cannot see you. Because you cannot rely on visual cues, you need to exercise an additional measure of care when you communicate online.

If you are truly angry, take a break before responding; get some perspective.

Contribute; do not just consume. Remember that the Internet is largely composed of volunteers. If you only take and never give, you are not adding to the diversity that makes the Internet as rich as it is.

Be sure to spend some time with a new group. Read their messages and catch the flow of conversation before you contribute.

Minimize clutter on the Internet. Think twice before you fire off a message, and keep your messages short and to the point. This is also called "not wasting bandwidth."

Be polite and dialogue on a friendly basis.

Financial Aid Policy

If you are receiving financial aid of any kind, it is your responsibility to protect your eligibility to receive financial aid by meeting the requirements of this class.

Change of Contact Information
Please use the student online services at http://oregonstate.edu/students/onlineservices if you have a change in any of your contact information, including name, phone number, and address.

Link to Conceptual Framework, Knowledge Base, and National and State

This course is associated with the Professional Teacher and Counselor Education (PTCE) unit Conceptual Framework, which is based on four foundational or core values that are listed below. To find out more about how the knowledge base relates to the National Council for Accreditation of Teacher Education (NCATE) guidelines, review the Conceptual Framework at the website: http://oregonstate.edu/education/accreditation/

1. Ethics and Professionalism
2. Reflective Practitioner
3. Lifelong Learners
4. Diversity and Equity

With respect to national standards, this course includes application of NCATE content knowledge, professional and pedagogical knowledge and skills, dispositions, and student learning. NCATE Unit Standards: http://www.ncate.org/public/unitStandardsRubrics.asp?ch=4

The Oregon TSPC Standards addressed in this course include the following:

- Standard 1: Plan Instruction that supports student progress in learning and is appropriate for the developmental level.
- Standard 2: Establish a classroom climate conducive to learning.
- Standard 3: Engage students in planned learning activities.
- Standard 4: Evaluate, act upon, and report student progress in learning.
- Standard 5: Exhibits professional behaviors, ethics, and values.

Authorization Level Focus

- Elementary, Middle, High School levels.
- Free choice learning includes public and private groups, pre-K, community colleges and science outreach specialists.