

COURSE TITLE: **EMPOWERING SCIENCE TEACHING & LEARNING: Next Generation Science Standards (NGSS)**
WA CLOCK HRS: **50**
OREGON PDUs: **50**
PENNSYLVANIA ACT 48: **50**

NO. OF CREDITS: **5 QUARTER CREDITS**
[semester equivalent = 3.33 credits]

INSTRUCTOR: **Charity Staudenraus**
charity.heritage@gmail.com

COURSE DESCRIPTION:
This course meets OSPI's STEM requirements.

Explore how you can use the Next Generation Science Standards (NGSS) to engage your students and expand learning across the curriculum. In 2009, a Carnegie Foundation study concluded that, "the nation's capacity to innovate for economic growth and the ability of American workers to thrive in the modern workforce depend on a broad foundation of math and science learning, as do our hopes for preserving a vibrant democracy and the promise of social mobility that lie at the heart of the American dream." The Next Generation Science Standards are a new way of looking at science instruction. Through a three dimensional lens teachers can help students keep their ingrained excitement about science. With the Disciplinary Core Ideas, Science Practices, and Cross Cutting Concepts, focus is no longer on rote memorization, but rather on helping students to understand the phenomena that are at the core of science teaching and learning.

This course will help teachers K-12 explore the possibilities with NGSS in order to improve instruction and student engagement. Teachers in this course will learn about the various aspects of the NGSS, and begin to implement changes in their own instruction. Collaboration with other teachers is also possible.

This course is applicable for any K-12 teachers and/or administrators who wish to better prepare for NGSS implementation and future assessments. There is no textbook for this class; all references and materials are located on-line.

LEARNING OUTCOMES: Upon completion of this course, participants will have:
Upon completion of this course, participants will:

- Understand what the NGSS are and how they can improve science instruction.
- Understand how to implement NGSS in the classroom.and aligned curriculum with NGSS
- Will have reviewed and explored the cross curricular possibilities.
- Understand how NGSS can enhance collaboration both inside and outside of the classroom.
- Understand how NGSS increases student engagement.

COURSE REQUIREMENTS:
Completion of all specified assignments is required for issuance of hours or credit. The Heritage Institute does not award partial credit.
The use of artificial intelligence is not permitted. Assignment responses found to be generated by AI will not be accepted.

HOURS EARNED:
Completing the basic assignments (Section A. Information Acquisition) for this course automatically earns participants their choice of CEUs (Continuing Education Units), Washington State Clock Hours, Oregon PDUs, or Pennsylvania ACT 48 Hours. The Heritage Institute offers CEUs and is an approved provider of Washington State Clock Hours, Oregon PDUs, and Pennsylvania ACT 48 Hours.

UNIVERSITY QUARTER CREDIT INFORMATION

REQUIREMENTS FOR UNIVERSITY QUARTER CREDIT
Continuing Education Quarter credits are awarded by Antioch University Seattle (AUS). AUS requires 75% or better for credit at the 400 level and 85% or better to issue credit at the 500 level. These criteria refer both to the amount and quality of work submitted.

1. Completion of Information Acquisition assignments 30%

2. Completion of Learning Application assignments 40%
 3. Completion of Integration Paper assignment 30%
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CREDIT/NO CREDIT (No Letter Grades or Numeric Equivalent on Transcripts)

Antioch University Seattle (AUS) Continuing Education Quarter credit is offered on a Credit/No Credit basis; neither letter grades nor numeric equivalents are on a transcript. 400 level credit is equal to a "C" or better, 500 level credit is equal to a "B" or better. This information is on the back of the transcript.

AUS Continuing Education quarter credits may or may not be accepted into degree programs. Prior to registering, determine with your district personnel, department head, or state education office the acceptability of these credits for your purpose.

ADDITIONAL COURSE INFORMATION

REQUIRED TEXT

There is no required printed textbook for this course. All required reading and resources are online.

None. All reading is online.

MATERIALS FEE

None. All required reading and resources are online.

ASSIGNMENTS REQUIRED FOR HOURS OR UNIVERSITY QUARTER CREDIT

A. INFORMATION ACQUISITION

Assignments done in a course forum will show responses from all educators who have or are taking the course independently. Feel free to read and respond to others' comments.

Group participants can only view and respond to their group members in the Forum.

Assignment #1: Course Forum: Introduce Yourself

Briefly introduce yourself (250-500 words) including your professional situation, your reasons for being interested in this course, what you expect to gain from taking this course, and your general level of experience and proficiency with the Next Generation Science Standards. Feel free to respond to any other postings from educators who are also taking this course.

Assignment #2: NGSS Introduction

Welcome to the next generation of science. This is where you will become familiar with the NGSS and the opportunities that are made possible to engage our students by changing the way we teach science. You should be able to explain what the NGSS are to a colleague. Watch the videos below, review the attached documents, and become familiar with NGSS. After you have read the review questions, briefly discuss what you believe will be most useful about incorporating NGSS, one change in the NGSS that surprised you or changed your thinking, and most importantly, what you want to know more about.

- NGSS: A Vision for K-12 Science Education:

<https://www.youtube.com/embed/uYERSTFZpZM?si=d3FCFYmp7g1GmwvL>

- Science Unscrambled: A Framework for K-12 Science Education:

<https://www.youtube.com/embed/aF5bCOIGd5w?autohide=1&controls=1&showinfo=0>

- [Report Brief: A Framework for K-12 Science Education](#)
- [Next Generation Science Standards – Executive Summary](#)

Assignment #3: Course Forum: Implementing the NGSS

Implementing the NGSS with your class will require time, resources, and an ongoing commitment. Successful implementation of the NGSS will ensure that all K-12 students have high-quality opportunities to learn science. The guide to implementing the NGSS Report is a helpful document, but at 102 pages it is a bit lengthy. Click the link below and read through the "Summary" and watch the short video. In a 1-2 page paper, discuss some of the possible pitfalls to avoid as you work to implement the NGSS and how you plan to overcome difficulties.

- Implementing the NGSS Video:

<https://www.youtube.com/embed/bt417P-TyQE?autoplay=1&controls=1&showinfo=0>

- [Guide to Implementing the NGSS Report](#)

Assignment #4: Three Dimensional Learning – Disciplinary Core Ideas

Three Dimensional Learning will require a complete shift in how we think about science education. The next three assignments will each focus on one of the strands that make up 3D Learning. We will start by exploring the disciplinary core ideas as this is the strand most similar to traditional science education. Once you have reviewed the links to "Disciplinary Core Ideas" in the document below as well as the attached video, write a 1-2 page paper outlining your understanding of the role of disciplinary core ideas in the NGSS. Explain how you plan to incorporate three dimensional learning and specifically the disciplinary core ideas, including potential pitfalls.

- [3D Learning- Follow the link for Disciplinary Core Ideas](#)
- Disciplinary Core Ideas:

<https://www.youtube.com/embed/eCjJEwq6YM?si=n1Qyop6-VsskzT6X>

Assignment #5: Three Dimensional Learning – Science & Engineering Practices

The NGSS standards now require a focus on the Science and Engineering Practices. Once you have reviewed the links to "Science & Engineering Practices" in document below, as well as viewed the attached video, write a 1-2 page paper outlining your understanding of the role of science and engineering practices in the NGSS. Explain how you plan to incorporate three dimensional learning and specifically the science and engineering practices while avoiding potential pitfalls.

- [3D Learning- Follow the link for "Practices"](#)
- [Science Practices](#)
- [Science vs. Engineering Practices: How do they differ?](#)

Assignment #6: Three Dimensional Learning – Crosscutting Concepts

The NGSS standards require incorporation of Crosscutting Concepts. Once you have reviewed the links to "Crosscutting Concepts" in the document below, as well as reviewed the attached video, write a 1-2 page paper outlining your understanding of the role of crosscutting concepts in the NGSS. Explain how you plan to incorporate three dimensional learning and specifically the crosscutting concepts. How will you avoid potential pitfalls?

- [3D Learning- Follow the link for Crosscutting Concepts](#)
- Crosscutting Concepts

<https://www.youtube.com/embed/7axBNmfbhJM?si=WRYcloeX1VRJYbGo>

- [Crosscutting Concept incorporation ideas.](#)

Assignment #7: Course Forum: 3D Learning- College and Career Readiness – Putting it together

The NGSS standards require that we change the way we think about science education. The focus is no longer on rote memorization, but rather on the ability to intertwine the Disciplinary Core Ideas with Science Practices and Crosscutting Concepts. Once you have reviewed the documents below and watched the attached video, write 250-500 words outlining your understanding of how three-dimensional learning will change how we prepare our students for future STEM careers. Explain how you plan to incorporate three-dimensional learning and what additional steps you can incorporate in order to encourage your students to consider STEM college majors and STEM careers..

- Three Dimensional Learning:

<https://www.youtube.com/embed/W2yEWyvWznE?si=tQiWgv1OrTKuQDCK>

- [College and Career Readiness](#)
 - The shortfall in STEM employees is likely to increase. The Department of Commerce shows that in the past 10 years, STEM jobs grew at three times the rate of non-STEM jobs, a trend likely to continue and accelerate (Langdon et al., 2011).

The U.S. Department of Labor notes that companies have reported more than three million job openings every month since February 2011 because of an absence of applicants with the skills to fill these positions (Woellert, 2012). The National Science Foundation also reports that there are currently between two and three million unfilled positions in the STEM areas of science, technology, engineering, and mathematics.

- https://www.youtube.com/embed/XJBN6BX04Ms?si=8_YMr25Y5mmoA3iz

Assignment #8: Course Forum: The Four Domains

The Next Generation Science Standards group the Disciplinary Core Ideas into Four Domains: Physical Sciences, Life Sciences, Earth and Space Sciences, and Engineering, Technology, and Applications of Science. After you follow the links at the bottom of the page for each of the four domains, read the sections that pertain to you. These articles are extremely lengthy so you should use your time wisely, concentrating on the information that is relevant to you. Once you have reviewed the pertinent material, write a 1-2 page paper outlining your understanding of the four domains. Explain how you plan to incorporate the four domains including potential pitfalls.

- Follow the links at the bottom of the page for each of the Four Domains: <https://www.nextgenscience.org/three-dimensions>

Assignment #9: Course Forum: Exploring Phenomena

Phenomena are an essential part of the Next Generation Science Standards and yet many seasoned educators do not know this term or how it can be used to teach science. It is time to explore phenomena. Once you have reviewed the attached document including links and the video, write a 1-2 page paper outlining your understanding of phenomena. Explain how you plan to incorporate phenomena including how you will deal with potential pitfalls.

[Phenomena](#)

[NGSS Phenomena: A Heuristic for Coming up with Academically Productive Phenomena](#)

Assignment #10: Course Forum: Explore Your State Standards

Over 40 states have shown interest in the NGSS. As of February 2016, 16 states had adopted the Next Generation Science Standards, including Oregon and Washington. Once you have reviewed the pertinent document and the video on how to read the standards, write a 1-2 page paper outlining how the standards have changed in your state. Explain how you plan to make the shift to the NGSS including how you will deal with any potential pitfalls.

- [Oregon Standards](#)
- Washington Standards: <http://www.k12.wa.us/science/NGSS.aspx>
- Video: How to read the standards: <http://bit.ly/2d0A9qu>

Assignment #11: Course Forum: Exploring Resources

Finding quality resources for teaching NGSS is not a simple task. In this assignment, I'd like to share a few of my favorite resources and hope you will share yours as well. The first link below is to the Educators Evaluating the Quality of Instructional Products (EQuIP) Rubric for science which provides criteria by which to measure the degree to which lessons and units are designed for the NGSS. I've included an Ed Week article which outlines the difficulties in finding materials which are truly aligned with NGSS. Once you have reviewed the resources linked below, write a 1-2 page paper describing how you can utilize the resources and please include your favorite resources to share with others. Explain how you plan to incorporate the resources as well as how you will deal with any potential pitfalls.

- [EQuIP Rubric](#), [EQuIP Rubric Videos](#), [NGSS Now](#)
- [Review Achieve Examples of Instructional Material](#)
- Additional Resources: [NJ Model Curriculum](#) (links are at the bottom of the page), [KY Through Course Tasks](#), [CA Instructional Materials](#), [AR Standards](#) (I love their clarification statements and resources.)

ADDITIONAL ASSIGNMENTS REQUIRED FOR UNIVERSITY QUARTER CREDIT

B. LEARNING APPLICATION

In this section, you will apply your learning to your professional situation. This course assumes that most participants are classroom teachers who have access to students. If you do not have a classroom available to you, please contact the instructor for course modifications. Assignments done in a course forum will show responses from all educators who have or are taking the course independently. ?Feel free to read and respond to others' comments. Group participants can only view and respond to their group members in the Forum.

Assignment #12: (Required for 400 and 500 Level)

The Next Generation Science Standards call on educators to change the ways in which students learn science. With this assignment, teachers will create two lessons: one adapted from an existing science lesson and the second, a new lesson, developed from the ground up. Using the EQuIP Rubric as a guide, make sure you develop a Three Dimensional lesson: include a description and all applicable documents, links and/or videos. Choose either option A or B below depending on whether or not you have access to students.

Option A)

Create both of your lessons.

- Implement one of your two lessons with students in your classroom.
- Write a 250-500 word commentary on what worked well and what could be improved.
- Include any student feedback or noteworthy student products.
- Submit your lesson to your instructor via the lesson tab below.
- Share what you've learned with other teachers taking our courses by checking the [lesson library](#) box when you submit your lesson.
- You may download a copy of THI's lesson plan template [here](#).

OR

Use this option if you do not have a classroom or students available.

Option B)

- Create your two lessons, but you do not have to implement.
- Write a 500+ word paper concerning a noteworthy success you've had as a teacher since you've started transitioning to the NGSS with one or more students.
- Please refer to the guidelines for our blog [What Works: Teaching at its Best](#) prior to writing your paper.
- When you submit your article to your instructor, please also email a copy to [Renee Leon](#) THI blog curator and media specialist.
- Indicate whether or not you are OK with having your article considered for publishing on our website.
- Submit your article to your instructor via Response field and the modified lesson via Submit Lesson.
- As you submit your lesson, consider sharing it with other teachers taking our courses by checking the lesson library box.

Assignment #13: (Required for 400 and 500 Level)

You have become a proficient Next Generation Science Teacher! In this assignment you are asked to reflect on the experience. Submit a 1-2 page (250-500 word) reflection regarding your exploration of the Next Generation Science Standards throughout this course.

1. Which aspects of the NGSS are most familiar to you?
2. Which aspects of the NGSS do you want to integrate into your teaching?
3. In the future, which part of the NGSS do you expect to use the most?
4. Are there any aspects of the NGSS that you are struggling with? Why?

Assignment #14: (500 Level ONLY)

In addition to the 400 level assignments, complete **one** of the following:

Option A)

Prepare a Presentation for an in-service for other teachers on what you learned through this course.

OR

Option B)

Complete an entire NGSS Unit making sure to use the EQuIP Rubric. The unit should include a minimum of 5 lessons. Write 2-3 pages; be sure to include all applicable documents, including lesson plans, assignments, links and/or videos as well as examples of

student work.

OR

Option C)

An assignment of your own choice with the instructor's prior approval.

C. INTEGRATION PAPER

Assignment #15: (Required for 400 and 500 Level)

SELF REFLECTION & INTEGRATION PAPER

(Please do not write this paper until you've completed all of your other assignments)

Write a 400-500 word Integration Paper answering these 5 questions:

1. What did you learn vs. what you expected to learn from this course?
 2. What aspects of the course were most helpful and why?
 3. What further knowledge and skills in this general area do you feel you need?
 4. How, when and where will you use what you have learned?
 5. How and with what other school or community members might you share what you learned?
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INSTRUCTOR COMMENTS ON YOUR WORK:

Instructors will comment on each assignment. If you do not hear from the instructor within a few days of posting your assignment, please get in touch with them immediately.

QUALIFICATIONS FOR TEACHING THIS COURSE:

CHARITY STAUDENRAUS, M.A.T., received her BA from Willamette University, her MAT from Willamette University. Charity has experience teaching math, science, social studies, business, and language courses at the middle and high school level. She is currently serving on the 2014-2017 Oregon Science Content and Assessment Panel as well as the Oregon Instructional Materials Criteria Development Committee. In addition Charity is consulting on a Rutgers University and WPI project funded through multiple Department of Education and National Science Foundation Grants.

BIBLIOGRAPHY

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- **"Videos And Lesson Plans For Teachers: Teaching Channel."** Teaching Channel. N.p., n.d. Web. 14 Sept. 2016. <https://www.teachingchannel.org>
- **"Next Generation Science Standards."** Next Generation Science Standards. N.p., n.d. Web. 14 Sept. 2016. <http://www.nextgenscience.org/>
- **"Achieve."** Achieve. N.p., n.d. Web. 14 Sept. 2016. <http://www.achieve.org/>
- **"International Society for Technology in Education."** 2011. <http://www.iste.org/welcome.aspx>
 - This website is the premier membership association for educators and education leaders engaged in improving learning and teaching by advancing the effective use of technology in PK-12 and teacher education.
- **"Northwest Council for Computer Education."** 2011. <http://www.ncce.org/>

NCCE is a non-profit organization dedicated to supporting effective uses of technology in education. In addition to hosting the largest educational technology conference in the Pacific Northwest, NCCE provides its members with resources and professional development opportunities throughout the year.

The mission of NCCE is to promote and support the effective use of technology in all aspects of education as Technology plays a fundamental role in lifelong learning and is used in all aspects of education such as teaching, learning, assessment, evaluation, record keeping, personal productivity, and communication systems. They put on an amazing conference every year in the Northwest.