COURSE TITLE: **STEM LESSONS FOR GRADES K-8 TEACHERS**

WA CLOCK HRS: 30
OREGON PDUs: 30

NO. OF CREDITS: **3 QUARTER CREDITS**
[semester equivalent = 2.00 credits]

INSTRUCTOR: **Suzanne Warner**
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COURSE DESCRIPTION:
This course meets OSPI's STEM requirements

In this course, you will learn how to incorporate STEM (Science, Technology, Engineering, Mathematics) into your lessons, and why the integration of STEM is important to students and their future careers. Your students will become engaged in learning the many occupations available that incorporate STEM components, and how that translates into greater opportunities for professional growth and future learning. You will find yourself engaged in learning how to create great STEM lessons for your classroom through the use of rich resources, creative activities and the use of templates that will enhance students learning and confidence. Participants will view the popular movie The Martian, which is a rich resource for STEM activities. All reading is online. This course fulfills OSPI requirements for Washington State teachers needing STEM hours, and is appropriate for teachers K-8.

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

1. an understanding of the importance of STEM education
2. learned how to integrate STEM components into the classroom.
3. knowledge of how to create a quality STEM lesson.
4. a knowledge of connections between STEM and future careers of your students
5. confidence that no matter that grade/subject you teach, that you can integrate STEM successfully.

COURSE REQUIREMENTS:
Completion of all specified assignments is required for issuance of hours or credit. The Heritage Institute does not award partial credit.

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

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%

CREDIT/NO CREDIT (No Letter Grades or Numeric Equivalents 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 text. All readings are completed online.

None. All reading is online.

MATERIALS FEE
There is no required text. All readings are completed online.

ASSIGNMENTS REQUIRED FOR HOURS OR UNIVERSITY QUARTER CREDIT

A. INFORMATION ACQUISITION
Assignments done in a **course forum** will show responses from all educators active in the course. Feel free to read and respond to others comments.

Assignment #1: COURSE FORUM: Why is STEM education so important?
Read the following three articles about the importance of STEM education:

- Why STEM Education Matters
- Why is STEM Education Important?
- The Immediate Value of a STEM Education

In at least 500 words, answer the following questions:

1. What are some of the benefits for STEM education for our students?
2. What are some of the benefits of STEM education in the classroom for the United States, both in terms of the economy and its position as a world leader??
3. How does a STEM lesson differ from a traditional lesson in terms of the methodology of teaching the lesson and how students are engaged in the lesson?
4. Describe two examples of lessons or activities you have given students that integrate two or more STEM disciplines.

Feel free to respond to others who have posted as well.

Assignment #2: What Makes a Good STEM Lesson?
Read the following three articles about creating STEM lessons:

- Six Characteristics of a Great STEM Lesson
- 8 Ways to Make a Great STEM Lesson
- 12 Steps to Designing Great STEM Lessons

All three of these articles describe the characteristics or the methods to develop a STEM lesson. Create your own list of 7-10 steps with descriptions to create a STEM lesson. You do not need to create a lesson, simply describe what a teacher needs to consider and incorporate when creating such a lesson. To what degree did the STEM lessons or activities you mentioned in assignment #1 align with your list of STEM lesson attributes?

Assignment #3: COURSE FORUM: Examples of STEM Lessons
Take an in-depth look through the following websites (or websites that you have found in researching STEM education) that offer

examples of STEM lessons and activities:

- Exploratorium
- STEM Lessons from Space
- STEM and the Ocean
- Teaching STEM: The Scoop on Earth Science

After reviewing multiple STEM lessons, select four (4) STEM lessons and in 250-500 words, summarize the lessons and comment on how they might be adapted to your teaching. (Again, you are not writing a lesson plan.)

Feel free to respond to others who have posted as well.

Assignment #4: The Martian, STEM in the movies
Watch the movie The Martian. (Alternatively, you may read the book, however this will obviously take more time.) Make notes of as many areas as you can find where a STEM lesson plan could be developed. (For example, when the character Mark must determine how many potatoes he can grow, how many calories they will afford him, and the mathematics behind his calculations.) Which, if any, of these areas could you make into a STEM lesson? This movie may be viewed via Netflix or Amazon or can be purchased on YouTube for about $3.

Assignment #5: COURSE FORUM: How to incorporate engineering
The one area of STEM education that is often misunderstood is the engineering component. In K-12 education engineering is best understood as a way of thinking and problem solving using certain activities to demonstrate principles. Take a look at some STEM engineering activities and projects on Pinterest. Review 2-3 projects/activities and share in a 2-3 page paper how you could incorporate the activity into a lesson that you already teach. How would the activity enhance the lesson? What would you need to consider as you teach the lesson?

Feel free to respond to others who have posted as well.

Assignment #6: STEM Components & STEM-Related Career Choices
Now that you have learned about STEM, its importance, and how to include STEM activities/lessons into your teaching, you will complete a template (see below where it says "Download file") that will help you organize what you have learned and help identify STEM-related career choices.

First, read through this Career Planning Article on STEM careers.

Template:

Download file

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 active in the course. Feel free to read and respond to others comments.

Assignment #7: Creating STEM Lesson Plan
Now that you have read about the importance of STEM in the classroom, how to create a STEM lesson, and have completed a lesson template to help get you started, you will create or adapt from another source 2 - 3 STEM-based lessons that you could teach to your current students. (If you are not currently in the classroom, create two lessons that you could teach to future/past students.) You may use any template that works best for you (you are welcome to use the Heritage Lesson Plan Template if you'd like) . Be sure to include possible careers that your STEM lessons may lead

. If possible, implement your lesson and include a 1-2 paragraph reflection on what went well, what did not, and what needs improvement for next time.

Once your lessons are completed, select one and upload it into The Heritage Institute lesson library following the correct methods to properly classify it.

Assignment #8: Mentoring
Mentor another teacher in the methods and information from this class and observe her/him in the classroom. Write 250-500 words summarizing your observation, results, and reflection.

Note - If you currently are not in your own classroom, you are welcome to do a different assignment, such as: interviewing 2 – 3 teachers about how they integrate STEM activities into their classroom, create a blog describing STEM activities for your content area, or with instructor approval, you may create an assignment that better fits your needs. Please consult your instructor if you elect to do an alternative assignment.

Assignment #9: (500 Level ONLY)
In addition to the 400 level assignments, complete **one** of the following:

Option A)
Create a 15-20 minute PowerPoint Presentation about STEM education that could be used as an in-service to colleagues in your school.

OR

Option B)
Conduct research of 3-5 online periodicals, online articles or videos on STEM education and related careers. Document the key points in a mind-map or 4-page paper analyzing how your research supports and/or contradicts what you've read in the text.

OR

Option C)
Another assignment of your own design with the instructor's prior approval.

C. INTEGRATION PAPER
Assignment #10: (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 350-500 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?

INSTRUCTOR COMMENTS ON YOUR WORK:
Please indicate by email to the instructor if you would like to receive comments on your assignments.

QUALIFICATIONS FOR TEACHING THIS COURSE:
Suzanne Warner, M.S., received her Masters Degree in Education from the University of Rochester, New York. She has taught mathematics in the middle school, high school, and college settings, most recently in Oregon. Suzanne has been lauded by administrators, colleagues, students and parents regarding her teaching and classroom management skills. Her students enjoy learning in a respectful, productive environment, where each student is in control of her/his own learning and behaviors. She strongly believes that all students want to do well, and creates a teaching environment for them to succeed.

When not in the classroom, Suzanne enjoys spending time with her family reading, hiking, backpacking and traveling.

BIBLIOGRAPHY

STEM LESSONS FOR GRADES K-8 TEACHERS

Bybee, Rodger W., *The Case for STEM Education: Challenges and Opportunities*, National Science Teachers Press, paperback, 2013, ISBN 978-1936959259

The book starts by putting STEM in context, as the early chapters outline the challenges facing STEM education, draw lessons from the Sputnik moment of the 1950s and 1960s, and contrast contemporary STEM with other education reforms. The author then explores appropriate roles for the federal government as well as states, districts, and individual schools. Finally, the book offers several ideas you can use to develop actual action plans for STEM. Throughout the book, author Rodger W. Bybee puts an emphasis on both thinking and acting.

Felder, Richard M. and Rebecca Brent, *Teaching and Learning STEM: A Practical Guid*e, John Wiley & Sons, 2016, paperback, ISBN 978-1118925812

Teaching and Learning STEM presents a trove of practical research-based strategies for designing and teaching courses and assessing students' learning. The book draws on the authors' extensive backgrounds and decades of experience in STEM education and faculty development. Its engaging and well-illustrated descriptions will equip you to implement the strategies in your courses and to deal effectively with problems (including student resistance) that might occur in the implementation

Myers, Ann O. and Jill Berkowitz, *The STEM Shift: A Guide for School Leader*s, Corwin Publishing, 2015, paperback ISBN 978-1483317724

This resource makes the process of shifting to a comprehensive, integrated STEM school or district within reach! Invaluable case studies featuring STEM pioneers model how successful, STEM-centered learning takes place. You'll find process-specific best practices and strategies to help you: Understand, create, and lead the STEM change process, Prepare the school community for STEM, Integrate 21st Century Skills, the arts, and humanities.

Includes step-by-step checklists and visual mapping guides. Use this groundbreaking resource to systematically implement STEM instruction that prepares students for the global economy!

Vasquez, Jo Anne, Michael Comer, and Cary Sneider, *STEM Lesson Essentials, Grades 3-8: Integrating Science, Technology, Engineering, and Mathematics*, Heinemann, 2013, paperback, ISBN 978-0325043586

STEM Lesson Essentials provides all the tools and strategies you'll need to design integrated, interdisciplinary STEM lessons and units that are relevant and exciting to your students. With clear definitions of both STEM and STEM literacy, the authors argue that STEM in itself is not a curriculum, but rather a way of organizing and delivering instruction by weaving the four disciplines together in intentional ways. Rather than adding two new subjects to the curriculum, the engineering and technology practices can instead be blended into existing math and science lessons in ways that engage students and help them master 21st century skills