



College of Engineering, Forestry &  
Natural Sciences Center for Science  
Teaching and Learning

### **Vision Statement**

We develop educational leaders who create tomorrow's opportunities.

### **Mission Statement**

Our mission is to prepare competent professionals who will make positive differences for children, young adults, and others in schools.

### **SCI 630-Survey of Literature in Science Education**

3 credit hours

#### **General Information:**

Instructor's Name: Dr. Brooke Whitworth

Office address: SHB 525

Office Hours: MTu 9:00-10:30am & By  
Appointment

Email: [Brooke.Whitworth@nau.edu](mailto:Brooke.Whitworth@nau.edu)

Phone: 928.523.5083

Room: SHB 549

#### **Course Prerequisites:** None

**Course Description:** In this course, students will become critical readers of current science education research and its implications to classroom practice. Areas to be discussed include but are not limited to: curriculum and instruction, knowing and learning, equity, technology, professional development, nature of science and informal science education. Students will also receive instruction on basic educational research methods and gain experience in designing a study.

**Student Learning Expectations/Outcomes for this Course:** The main objectives that will be met through this course are:

- Identify, accurately characterize, and evaluate major areas of research in science education;
- Identify, describe, and evaluate a variety of methodologies currently being used in science education;
- Develop a scholarly argument in the form of a literature review; and,
- Describe and understand the application and process of IRB approval.

**Course Structure/Approach:** This is a seminar class. It is expected that the student read the required materials and be prepared to discuss the information in the class. Students may be asked to present their own synopsis of the weekly topic or work in groups to present the information.

#### **Textbook and Required Materials:**

- Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches (4<sup>th</sup> edition)*. Thousand Oaks, CA: Sage publications.
- American Psychological Association. (2010). *Publication Manual of the American Psychological Association (6<sup>th</sup> edition)*. Washington, DC: American Psychological Association.
- Other readings as assigned

**Emergency Textbook Loan Program:** To help students acquire the materials they need to be successful in class. NAU has partnered with Follett to create the Emergency Textbook Loan program. The program is administered by the LEADS Center. The program assists students with unmet financial need in obtaining required textbook(s) and other materials for courses. Students must apply and meet eligibility criteria before textbooks are purchased on their behalf. Textbooks must be returned at the end of the term in which the textbooks were loaned. More information can be found online:

<http://nau.edu/LEADS-Center/Textbook-Loan-Program/>

---

**Assessment of Student Learning Outcomes:**

Students will be assessed based on their class participation, completion of weekly assignments, and final literature review paper. General information on the class assignments can be found below. Specific instructions for completing assignments will be handed out or explained in class when the assignment is given.

<b>Assessments:</b>	<b>Points</b>
<b>Attendance &amp; Participation:</b> You are expected to attend every class and engage in in-class activities. Points will be deducted on a pro-rated basis for not attending and not participating. You will also be asked to complete two self-evaluations of your professional conduct in the course.	200
<b>Annotated Bibliography:</b> You will complete an annotated bibliography that will be collected periodically.	100
<b>Homework:</b> You will be asked to complete various homework assignments throughout the course. Some of these assignments will include: APA Assignment, Journal Assignment, Methods Assignment, and others as assigned.	100
<b>Micro Literature Reviews:</b> Each micro literature review will be a <b>1-2 page (single-spaced)</b> discussion of one or more articles you have chosen to read as part of your full literature review for the course. The purpose of the reviews is to provide practice and feedback opportunities for developing writing structure and style appropriate to the academic genre. Emphasis will be on the presentation of <b>scholarly argument</b> rather than the reporting or summarization of others' arguments.	100
<p><b>Classroom Presentations:</b> You will be responsible for three small presentations throughout the semester. These presentations will include:</p> <ul style="list-style-type: none"> <li>• <b>Research Design Discussion:</b> One person will lead <b>discussions</b> based on the research design readings for each week. As part of this presentation you will create a PowerPoint to support and guide your discussion.</li> <li>• <b>Reading Critique:</b> Most weeks we will read articles that describe studies and/or review literature. One person will lead the reading <b>discussion</b> that critiques how well the research design is presented, the argument is presented, and an overall critique of the paper. As part of this critique you will submit a summary critiquing the paper.</li> <li>• <b>Works-in-Progress (WIP) Meetings:</b> Each student will get a 20-25 minute session to describe their final literature review and get targeted feedback from the class. In this session, you should use the class as a resource to help you complete your final literature review. For example, the class can give suggestions on your research purpose or help to refine your argument. If you are working towards a thesis project, you can try out protocols or materials in the class. These sessions are meant to be very flexible and provide help at various stages of your projects. That being said, don't walk in without an agenda and plan on your classmates just talking vaguely. <b>Good WIPs should maximize the class resources and have specific tasks people in the class can help you with.</b> As part of this presentation, you will submit answers to specific reflection questions provided.</li> </ul>	150
<b>Full Literature Review &amp; Presentation:</b> A literature review of <b>approximately 15 double-spaced pages</b> in length (excluding references) will be required in this course. You can choose any empirical research topic relevant to STEM education issues. The topic selected <b>must be approved by the instructor in an email.</b> See the course schedule for approval and assignment deadlines. You will also deliver a presentation on your literature review at the end of the course. In preparation for submitting these final assignments, you will also submit multiple components that help prepare you for completing your full literature review.	350
<b>Points Possible:</b>	<b>1000</b>

**Grading System:** Your grade will be determined in the following way:

<b>Points</b>	<b>Grade</b>
<b>1000-800</b>	<b>A</b>
<b>799-600</b>	<b>B</b>
<b>599-400</b>	<b>C</b>
<b>399-0</b>	<b>F</b>

**Course Schedule (subject to change):**

Week	Date	Course Topic	Readings & Assignments Due
1	8/29	<ul style="list-style-type: none"> <li>Thesis vs. Non-Thesis</li> <li>Research Approaches</li> </ul>	<ul style="list-style-type: none"> <li>Creswell (2014) – Ch. 1</li> <li>Mackenzie, N. &amp; Knipe, S. (2006). Research dilemmas: Paradigms, methods and methodology. <i>Issues in Educational Research</i>, 16, 193-205. Retrieved July 27, 2016 from: <a href="http://www.iier.org.au/iier16/mackenzie.html">http://www.iier.org.au/iier16/mackenzie.html</a></li> </ul>
2	9/5	<b>LABOR DAY</b>	<b>NO CLASS</b>
3	9/12	<ul style="list-style-type: none"> <li>Reviewing Literature</li> <li>Use of Theory</li> <li>Introduce Final Project</li> </ul>	<ul style="list-style-type: none"> <li>Creswell (2014) – Ch. 2 &amp; 3</li> <li><b>Research Design Presentation #1:</b> Treagust, D. F., Won, M., &amp; Duit, R. (2014). Paradigms in science education research. In S.K. Abell &amp; N.G. Lederman (Eds.), <i>Handbook of research on science education (Second Edition)</i>. London: Lawrence Erlbaum &amp; Associates.</li> </ul>
4	9/19	<ul style="list-style-type: none"> <li>Writing Strategies</li> <li>Ethical Considerations</li> <li>IRB</li> </ul>	<ul style="list-style-type: none"> <li><b>Journal Assignment</b></li> <li><b>Research Design Presentation #2:</b> Creswell (2014) – Ch. 4</li> <li>APA (2010) – Ch. 1-3</li> </ul>
5	9/26	<ul style="list-style-type: none"> <li>Designing Research</li> </ul>	<ul style="list-style-type: none"> <li><b>Literature Review Topic</b></li> <li><b>APA Assignment #1</b></li> <li><b>Research Design Presentation #3:</b> Creswell (2014) – Ch. 5</li> <li><b>Research Design Presentation #4:</b> Creswell (2014) – Ch. 6</li> <li><b>Research Design Presentation #4.5:</b> Creswell (2014) – Ch. 7</li> <li>Review APA (2010) – Ch. 4-7 (Tab important pages for reference)</li> </ul>
6	10/3	<ul style="list-style-type: none"> <li>Research Methods</li> </ul>	<ul style="list-style-type: none"> <li><b>APA Assignment #2</b></li> <li><b>Research Design Presentation #5:</b> Creswell (2014) – Ch. 8</li> <li><b>Research Design Presentation #6:</b> Creswell (2014) – Ch. 9</li> <li>Creswell (2014) – Ch. 10</li> </ul>
7	10/10	<ul style="list-style-type: none"> <li>Inquiry &amp; Scientific Practices</li> </ul>	<ul style="list-style-type: none"> <li><b>Annotated Bibliography Check #1</b></li> <li><b>Literature Review Reference List Draft</b></li> <li><b>Article Critique Assignment</b></li> <li>Crawford, B. A. (2014). From inquiry to scientific practices in the science classroom. In S.K. Abell &amp; N.G. Lederman (Eds.), <i>Handbook of research on science education (Second Edition)</i>. London: Lawrence Erlbaum &amp; Associates.</li> <li>Osborne, J. (2014). Scientific practices and inquiry in the science classroom. In S.K. Abell &amp; N.G. Lederman (Eds.), <i>Handbook of research on science education (Second Edition)</i>. London: Lawrence Erlbaum &amp; Associates.</li> <li>Capps, D. K., &amp; Crawford, B. A. (2013). Inquiry-based instruction and teaching about nature of science: Are they happening? <i>Journal of Science Teacher Education</i>, 24, 497-526.</li> <li><b>Works In Progress Presentation #1</b></li> </ul>
8	10/17	<ul style="list-style-type: none"> <li>Nature of Science</li> </ul>	<ul style="list-style-type: none"> <li><b>Mid-term Professional Conduct Check</b></li> <li>Lederman, N. G., &amp; Lederman, J. S. (2014). Research on teaching and learning of nature of science. In S.K. Abell &amp; N.G. Lederman (Eds.), <i>Handbook of research on science education (Second Edition)</i>. London: Lawrence Erlbaum &amp; Associates.</li> <li><b>Reading Critique Presentation #1:</b> Akerson, V. L. &amp; Abd-El-Khalick, F. (2003). Teaching elements of nature of science: A yearlong case study of a fourth-grade teacher. <i>Journal of Research in Science Teaching</i>, 40, 1025-1049.</li> <li><b>Works In Progress Presentation #2</b></li> </ul>

9	10/24	<ul style="list-style-type: none"> <li>Equity Issues in Science Education</li> </ul>	<ul style="list-style-type: none"> <li><b>Basic Literature Review Outline or Map</b></li> <li>Parsons, E. C. (2014). Unpacking and critically synthesizing the literature on race and ethnicity in science education. In S.K. Abell &amp; N.G. Lederman (Eds.), <i>Handbook of research on science education (Second Edition)</i>. London: Lawrence Erlbaum &amp; Associates.</li> <li><b>Reading Critique Presentation #2:</b> Klapp, A. (2015). Does grading affect educational attainment? A longitudinal study. <i>Assessment in Education: Principles, Policy &amp; Practice</i>, 22, 302-323. DOI: 10.1080/0969594X.2014.988121</li> <li><b>Works in Progress Presentation #3</b></li> </ul>
10	10/31	<ul style="list-style-type: none"> <li>Discourse in Science Education</li> </ul>	<ul style="list-style-type: none"> <li>Kelly, G. J. (2014). Discourse practices in science learning and teaching. In S.K. Abell &amp; N.G. Lederman (Eds.), <i>Handbook of research on science education (Second Edition)</i>. London: Lawrence Erlbaum &amp; Associates.</li> <li><b>Reading Critique Presentation #3:</b> Smart, J. B., &amp; Marshall, J. C. (2013). Interactions between classroom discourse, teacher questioning, and student cognitive engagement in middle school science. <i>Journal of Science Teacher Education</i>, 24, 249-267.</li> <li><b>Works in Progress Presentation #4</b></li> </ul>
11	11/7	<ul style="list-style-type: none"> <li>Technology in Science Education</li> </ul>	<ul style="list-style-type: none"> <li><b>Revised Literature Review Outline or Map</b></li> <li><b>Annotated Bibliography Check #2</b></li> <li>Krajcik, J. S. &amp; Mun, K. (2014). Promises and challenges of using learning technologies to promote student learning of science. In S.K. Abell &amp; N.G. Lederman (Eds.), <i>Handbook of research on science education (Second Edition)</i>. London: Lawrence Erlbaum &amp; Associates.</li> <li><b>Reading Critique Presentation #4:</b> Ryoo, K., &amp; Linn, M. C. (2012). Can dynamic visualizations improve middle school students' understanding of energy in photosynthesis? <i>Journal of Research in Science Teaching</i>, 49, 218-243.</li> <li><b>Works in Progress Presentation #5</b></li> </ul>
12	11/14	<ul style="list-style-type: none"> <li>Professional Development</li> </ul>	<ul style="list-style-type: none"> <li><b>Micro Literature Review #1</b></li> <li>Luft, J. A. &amp; Hewson, P. W. (2014). Research on teacher professional development programs in science. In S.K. Abell &amp; N.G. Lederman (Eds.), <i>Handbook of research on science education (Second Edition)</i>. London: Lawrence Erlbaum &amp; Associates.</li> <li><b>Reading Critique Presentation #4.5:</b> Desimone, L. M., &amp; Garet, M. S. (2015). Best practices in teachers' professional development in the United States. <i>Psychology, Society and Education</i>, 7, 252-263.</li> <li><b>Reading Critique Presentation #5:</b> Allen, C. D., &amp; Penuel, W. R. (2015). Studying teachers' sensemaking to investigate teachers' responses to professional development focused on new standards. <i>Journal of Teacher Education</i>, 66, 136-149.</li> <li><b>Works in Progress Presentation #6</b></li> </ul>
13	11/21	<b>THANKSGIVING WEEK</b>	<b>NO CLASS</b>
14	11/28	<ul style="list-style-type: none"> <li>Incorporating research into teaching</li> </ul>	<ul style="list-style-type: none"> <li><b>Micro Literature Review #2</b></li> <li>Loughran, J. J. (2014). Developing understandings of practice: Science teacher learning. In S.K. Abell &amp; N.G. Lederman (Eds.), <i>Handbook of research on science education (Second Edition)</i>. London: Lawrence Erlbaum &amp; Associates.</li> <li><b>Reading Critique Presentation #6:</b> Herrington, D., &amp; Daubenmire, P. L. (2016, Advance Online). No Teacher Is an Island: Bridging the Gap between Teachers' Professional Practice and Research Findings. <i>Journal of Chemical Education</i>. DOI:</li> </ul>

			10.1021/acs.jchemed.5b00700
15	12/5	• <b>FINAL PRESENTATIONS</b>	<ul style="list-style-type: none"> <li>• <b>Works in Progress Presentation #7</b></li> <li>• <b>Final Professional Conduct Check</b></li> <li>• <b>Course Evaluation</b></li> </ul>
16	12/12	<b>FINALS WEEK NO CLASS</b>	<ul style="list-style-type: none"> <li>• <b>Final Literature Review Paper Due by 7:00pm</b></li> </ul>

**Course policies:**

- **Attendance: Regular attendance is required.** The only excused absences that will be considered are institutional excuses for university related events. Emailing, calling, or leaving a phone message or note saying you will not be attending class is appreciated but does not constitute a valid excuse. You will be counted absent for that day. Contact the instructor immediately in case of any special circumstances or emergency situations.
- **Statement on plagiarism and cheating:** Plagiarism is considered as a willful act when a person knowingly uses the work of others and attempts to present it as his/her own. This academic dishonesty will not be permitted. Appropriate measures, as stated in the NAU Student Handbook, will be applied.
- **Cell phones:** No cell phones may be visible in class. Cell phones must be turned off. Cell phones in class are extremely disrespectful to the instructor and fellow colleagues. You are not exempted from this rule. This rule applies equally to all.
- **Safety:** You must evacuate the building if the fire alarm sounds.
- **Classroom Behavior:** Joint responsibilities regarding classroom behavior:  
<http://www4.nau.edu/stulife/handbookmanagement.htm>
- **Assignment Format:** All written assignments must be word processed and submitted electronically in pdf or word format. Writing errors such as spelling, punctuation, grammatical errors, etc., will be taken into consideration; any assignment with more than four errors will be returned for revision before grading. All assignments should be professional in appearance. Students are permitted and encouraged to proofread each other's assignments. APA guidelines must be followed for formal papers.
  - Problems with computer hardware or software will not be accepted as excuses for handing in work after the due date.
  - Additional assignments will NOT be given for extra credit.
- **Duplicating Assignments:** Assignments submitted as a requirement for another class should not be submitted for this class without permission from the instructor. All assignments should be the original work of the student completed for this class. If lab activities or lesson plans from another source are used and/or modified by the student for this course, a proper citation to the original author must be provided. I use technology to check for plagiarism.
- **Instructor/Course Evaluations:** When it gets close to the end of the course, all students are asked to complete a course evaluation through: [http://www.nau.edu/course\\_evals/](http://www.nau.edu/course_evals/).

The instructor reserves the right to revise the syllabus, assignments and course evaluation criteria. Students will be immediately notified of any of these changes in advance of any changes taking effect.

**Northern Arizona University Policy Statements available at:**

<http://jan.ucc.nau.edu/academicadmin/plcystmt.html>

**NORTHERN ARIZONA UNIVERSITY  
POLICY STATEMENTS**

NAU's Safe Working and Learning Environment Policy prohibits sexual harassment and assault, and discrimination and harassment on the basis of sex, race, color, age, national origin, religion, sexual orientation, gender identity, disability, or veteran status by anyone at this university. Retaliation of any kind as a result of making a complaint under the policy or participating in an investigation is also prohibited. The Director of the Office of Affirmative Action & Equal Opportunity (AA/EO) serves as the university's compliance officer for affirmative action, civil rights, and Title IX, and is the ADA/504 Coordinator. AA/EO also assists with religious accommodations. You may obtain a copy of this policy from the college dean's office or from the NAU's Affirmative Action website [nau.edu/diversity/](http://nau.edu/diversity/). If you have questions or concerns about this policy, it is important that you contact the departmental chair, dean's office, the Office of Student Life (928-523-5181), or NAU's Office of Affirmative Action (928) 523- 3312 (voice), (928) 523-9977 (fax), (928) 523-1006 (TTD) or [aaeo@nau.edu](mailto:aaeo@nau.edu).

## **STUDENTS WITH DISABILITIES**

If you have a documented disability, you can arrange for accommodations by contacting Disability Resources (DR) at 523-8773 (voice) or 523-6906 (TTY), [dr@nau.edu](mailto:dr@nau.edu) (e-mail) or 928-523-8747 (fax). Students needing academic accommodations are required to register with DR and provide required disability related documentation. Although you may request an accommodation at any time, in order for DR to best meet your individual needs, you are urged to register and submit necessary documentation ([www.nau.edu/dr](http://www.nau.edu/dr)) 8 weeks prior to the time you wish to receive accommodations. DR is strongly committed to the needs of student with disabilities and the promotion of Universal Design. Concerns or questions related to the accessibility of programs and facilities at NAU may be brought to the attention of DR or the Office of Affirmative Action and Equal Opportunity (523-3312).

## **ACADEMIC CONTACT HOUR POLICY**

Based on the Arizona Board of Regents Academic Contact Hour Policy (ABOR Handbook, 2-224), for every unit of credit, a student should expect, on average, to do a minimum of three hours of work per week, including but not limited to class time, preparation, homework, studying.

## **ACADEMIC INTEGRITY**

Integrity is expected of every member of the NAU community in all academic undertakings. Integrity entails a firm adherence to a set of values, and the values most essential to an academic community are grounded in honesty with respect to all intellectual efforts of oneself and others. Academic integrity is expected not only in formal coursework situations, but in all University relationships and interactions connected to the educational process, including the use of University resources. An NAU student's submission of work is an implicit declaration that the work is the student's own. All outside assistance should be acknowledged, and the student's academic contribution truthfully reported at all times. In addition, NAU students have a right to expect academic integrity from each of their peers.

Individual students and faculty members are responsible for identifying potential violations of the university's academic integrity policy. Instances of potential violations are adjudicated using the process found in the university [Academic Integrity Policy](#).

## **RESEARCH INTEGRITY**

The Responsible Conduct of Research policy is intended to ensure that NAU personnel including NAU students engaged in research are adequately trained in the basic principles of ethics in research. Additionally, this policy assists NAU in meeting the RCR training and compliance requirements of the National Science Foundation (NSF)-The America COMPETES Act (Creating Opportunities to Meaningfully Promote Excellence in Technology, Education and Science); 42 U.S.C 18620-1, Section 7009, and the National Institutes of Health (NIH) policy on the instruction of the RCR (NOT-OD-10-019; "Update on the Requirement for Instruction in the Responsible Conduct of Research"). For more information on the policy and the training activities required for personnel and students conducting research, at NAU, visit:

<http://nau.edu/Research/Compliance/Research-Integrity/>

## **SENSITIVE COURSE MATERIALS**

University education aims to expand student understanding and awareness. Thus, it necessarily involves engagement with a wide range of information, ideas, and creative representations. In the course of college studies, students can expect to encounter—and critically appraise—materials that may differ from and perhaps challenge familiar understandings, ideas, and beliefs. Students are encouraged to discuss these matters with faculty.

## **CLASSROOM DISRUPTION POLICY**

Membership in the academic community places a special obligation on all participants to preserve an atmosphere conducive to a safe and positive learning environment. Part of that obligation implies the responsibility of each member of the NAU community to maintain an environment in which the behavior of any individual is not disruptive. Instructors have the authority and the responsibility to manage their classes in accordance with University regulations. Instructors have the right and obligation to confront disruptive behavior thereby promoting and enforcing standards of behavior necessary for maintaining an atmosphere conducive to teaching and learning. Instructors are responsible for establishing, communicating, and enforcing reasonable expectations and rules of classroom behavior. These expectations are to be communicated to students in the syllabus and in class discussions and activities at the outset of the course. Each student is responsible for behaving in a manner that supports a positive learning environment and that does not interrupt nor disrupt the delivery of education by instructors or receipt of education by students, within or outside a class. The complete classroom disruption policy is in Appendices of [NAU's Student Handbook](#).

---