**T&L 584**

*Research in Teaching Mathematics & Science*

Wednesdays, 5:45 – 8:30
Vancouver: VECS 209
Pullman: Cleveland 312
Tri-Cities: West 224

Dr. Tamara Holmlund Nelson
Office: VUCB 324
tnelson1@wsu.edu
360-546-9663

Office hours available by appointment for students across campuses through email, phone, Skype, or other communication apps.

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**Course Goals**

- Become knowledgeable about current, central issues or *problems of practice* in science and mathematics teaching and multiple perspectives on those issues.
- Develop a rich understanding of the role of theoretical frameworks in research.
- Develop the knowledge and skills needed to construct a research proposal.

In T&L 584 we will critically review research on teaching K-12 mathematics and science. In order to prepare you for your dissertation work, we will study historical and current theoretical frameworks and research methods in STEM education. We will consider both the ways in which research on teaching is conducted and the findings that result from significant areas of research. Readings will come from current and historically influential books, journal articles, and online sources. Essential questions that frame our exploration of research on teaching are:

- What is the research base that underpins current ideas about science and mathematics teaching?
- What are current key areas of research in mathematics and science teaching? What perspectives are represented? What tensions exist? How do these inform your own work?
- What can be learned from top researchers in science and mathematics education about problems of practice, theoretical or conceptual frameworks, and research design?

In preparation for your own research endeavor, you will have an opportunity to apply these ideas and methods by developing a research proposal based on your own interests. This is a seminar style class and our meetings will be supported by the AMS video system and Edmodo. In this course we will engage as a professional learning community (PLC) and nurture a collective inquiry stance. Learning and enrichment occur as a result of the active and respectful participation of all members of our learning community. All students are
expected to share insights and analyses, raise questions, and apply a critical perspective to the ideas from course readings and our discussions in-class and online. We will use the Research in Mathematics and Science Teaching Edmodo page (access code 8hdbkj) and WSU email for communication. Please check these regularly.

**Grading**

Detailed descriptions of each assignment and related expectations are provided separately.

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Due Dates (may be revised)</th>
<th>Points Possible (approx. %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Edmodo original posts (5 @ 4 pts each) And responses to others’ posts (9 @ 3 pts each)</td>
<td>See schedule</td>
<td>47 (16%)</td>
</tr>
<tr>
<td>Post area of research interest &amp; problem statement</td>
<td>Sept. 7</td>
<td>5 (2%)</td>
</tr>
<tr>
<td>Weekly posting of citations for papers read (2 pts each)</td>
<td>Weeks 4-10</td>
<td>14 (5%)</td>
</tr>
<tr>
<td>Draft paper: Introduction (area of interest, research purpose &amp; goals)</td>
<td>Sept. 21</td>
<td>15 (5%)</td>
</tr>
<tr>
<td>Critical Review paper</td>
<td>Sept. 28</td>
<td>30 (11%)</td>
</tr>
<tr>
<td>Visual representation of CF/TF &amp; in-class explanation</td>
<td>Oct. 12</td>
<td>10 (3.5%)</td>
</tr>
<tr>
<td>Draft paper: Conceptual / theoretical framework</td>
<td>Nov. 3</td>
<td>15 (5%)</td>
</tr>
<tr>
<td>Lead class discussion (and pre-select article)</td>
<td>TBD</td>
<td>20 (7%)</td>
</tr>
<tr>
<td>Presentation of research proposal</td>
<td>Nov. 30 / Dec. 7</td>
<td>15 (5%)</td>
</tr>
<tr>
<td>Mini-research proposal</td>
<td>Dec. 7</td>
<td>100 (35%)</td>
</tr>
<tr>
<td>Participation in weekly seminars (2 pts/week)</td>
<td>Weekly</td>
<td>14 (5%)</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td>285</td>
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**Grading scale for the final grade, the culminating assignment, and other course assignments:**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>93% or above</td>
<td>Exceptional; creative and original; goes beyond requirements and expectations; meets all criteria for a B.</td>
</tr>
<tr>
<td>A-</td>
<td>90-92 %</td>
<td>Excellent; goes beyond requirements and expectations or has originality/creativity; meets all criteria for a B.</td>
</tr>
<tr>
<td>B+</td>
<td>88-89 %</td>
<td>Very good; some creative or original elements; meets all criteria for a B.</td>
</tr>
<tr>
<td>B</td>
<td>83-87 %</td>
<td>Good; all objectives for the course/assignment are reached; a complete understanding of the concepts, processes, theories, approaches of the course/assignment is clearly demonstrated.</td>
</tr>
<tr>
<td>B-</td>
<td>80-82 %</td>
<td>Good; some objectives for the course/assignment are not fully attained; understanding of most of the concepts, processes, theories, approaches of the course/assignment is clearly demonstrated.</td>
</tr>
<tr>
<td>C+</td>
<td>78-79 %</td>
<td>Acceptable; some objectives for the course/assignment are not fully attained; understanding of most of the concepts, processes, theories, approaches of the course/assignment is evident but not always clearly demonstrated.</td>
</tr>
<tr>
<td>C</td>
<td>73-77 %</td>
<td>Minimally satisfactory; minimal or partial requirements of the course/assignment objectives are accomplished; lack of evidence of understanding many of the concepts, processes, theories, approaches of the course/assignment.</td>
</tr>
<tr>
<td>F</td>
<td>72% or less</td>
<td>Unsatisfactory. Anything less than the criteria for a C will receive a failing grade.</td>
</tr>
<tr>
<td>I</td>
<td>Incomplete</td>
<td>Must be arranged with Tamara prior to end of semester.</td>
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</tbody>
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Expectations for Quality Work and Participation

• This is a doctoral level course grounded in social constructivist learning theory and a strong belief in collaborative learning through dialogue. We are all professionals and colleagues, with something to learn in all areas and with expertise in some areas. As such, be responsible to the group by actively and substantively participating in class (whether face-to-face, online, or on-screen). Practice active listening, and prepare to professionally challenge ideas and receive challenges to/questions about your own thinking.

Note: Attendance is important, given this is a seminar. We all will benefit from your ideas, your preparation in pre-reading and thinking about the materials, and your questions and experiences. Emergencies always arise, and you may have to miss a class, even two. Missing three or more classes becomes problematic, however. Please plan to meet with me if you reach three absences or more. It is not possible to receive an A if three or more classes have been missed.

General specifications for all written work (Professional Communication / Proposal/Other):

• Use Word or an equivalent program.
• Save all documents with your last name as the first word in the title.
• Be professional in form (APA format, spelling, syntax, and punctuation count).
• Be professional in thought—respecting others’ perspectives and experiences, citing the source for ideas that come from others, asserting your own ideas and warranting them.
• Be thorough – writing is an ongoing process, not a night-before-its due event. Write early and often, and test your ideas with the group.
• Be creative and original!
**Tentative Reading List**

The following is a working list. Not all will be required; others may be added. All articles are available through the WSUV library course reserves* system and/or online. Course Reserve code b4pdce32

NOTE: You will each need to find additional literature to support your assignments.


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**General Information**

*Academic Integrity*. Academic integrity is the cornerstone of the university and will be strongly enforced in this course. Any student found in violation of the academic integrity policy will be given a failing grade for the course and will be referred to the Office of Student Conduct. Please take time to read the full statement on student conduct at [http://www.conduct.wsu.edu/](http://www.conduct.wsu.edu/).

*Disability Accommodation*. Reasonable accommodations are available for students with a documented disability. All accommodations must be approved through your WSU Disability Services office. If you have a disability and need accommodations, we recommend that you begin the process as soon as possible. For more information, contact a Disability Specialist on your home campus.

- **Spokane**: [students/current/StudentAffairs/disability/index.html](http://students/current/StudentAffairs/disability/index.html)
- **Pullman**: [http://accesscenter.wsu.edu](http://accesscenter.wsu.edu)

*WSU Safety Statement*: Washington State University is committed to maintaining a safe environment for its faculty, staff, and students. Safety is the responsibility of every member of the campus community and individuals should know the appropriate actions to take when an emergency arises. In support of our commitment to the safety of the campus community the University has developed a Campus Safety Plan, [http://safetyplan.wsu.edu](http://safetyplan.wsu.edu). It is highly recommended that you visit this web site as well as the University emergency management web site at [http://oem.wsu.edu/](http://oem.wsu.edu/) to become familiar with this information.
Classroom and campus safety are of paramount importance at Washington State University, and are the shared responsibility of the entire campus population. WSU urges students to follow the “Alert, Assess, Act” protocol for all types of emergencies and the “Run, Hide, Fight” response for an active shooter incident. Remain ALERT (through direct observation or emergency notification), ASSESS your specific situation, and ACT in the most appropriate way to assure your own safety (and the safety of others if you are able).

Inclusion statement. The instructor of this course is committed to teaching equitably and inclusively, addressing the academic needs, concerns, and interests of every student, regardless of age, gender, race/ethnicity, religion, social class, sexual orientation, English language proficiency, or disability.

Instructional approach. The primary instructional approach used in this course will be small and large group discussions. An emphasis will be placed on active student participation in discussions and activities.

Professional communication. The faculty members of the Teaching & Learning Department and the College of Education emphasize the importance of effective written and oral communication for professional educators. Students of the program are expected to demonstrate that they can meet standards of professional communication on all of their assignments. A student who fails to adhere to the conventions of writing (e.g. makes consistent grammatical and/or spelling errors, frequently misuses words or phrases, fails to organize writing in an effective manner) may be required to work with the Writing Center or complete additional coursework. Students who fail to meet expectations after being provided with opportunity for remediation and improvement may be removed from the program. Students will also be held accountable for demonstrating that they are capable of clear and professional verbal communication.
T&L 584 Schedule - 2016  
(This is a working document and will be revised as needed)

**August 24 - Week 1**
- Discussion: What areas of research (past and future) are important for informing mathematics and science teaching?
- Readings:
  - Treagust & Tsui, 2014
  - Hiebert & Grouws, 2007

**August 31 - Week 2**
- Discussion: What does it mean to “frame” research?
- Readings:
  - JRME (2008). Appendix 1 & II (will be provided in class)
  - Maxwell, 2005
  - Lewis, 2008
- Due: Edmodo discussion posts 1&2 (before class) and 3 responses to others (by 9/4). Use the discussion questions from weeks 1 and 2 to prompt your thoughts for your posts.

**Sept. 7 - Week 3**
- Discussion: How does a conceptual / theoretical framework inform research?
- Readings:
  - Ball, Lewis, & Thames, 2008
  - Horn, 2008
  - Posner, 2008
- Due: Post your area of interest and problem statement (4-5 sentences) on Edmodo before class

**Sept. 14 – Week 4**
- Discussion: What can literature reviews tell us about past, present, and future research in mathematics and science teaching?
- Readings:
  - Windschitl & Calabrese Barton, 2016
  - Chazan, Herbst, & Clark, 2016
  - At least 2 articles related to your area of interest
- Due: Post the citations for what you read in your area of interest on our Edmodo wall. Include #citation at the end of your post.
Sept. 21 - Week 5
- Discussion: How does a theoretical framework serve the research design, analysis, findings, and conclusions?
- Readings:
  - Brown et al., 2010
  - 3+ readings in your area of interest.
- Due: Post the citations for what you read on Edmodo. Include #citation at the end of your post.
- Due: Area of interest and problem statement paper draft. Submit to Edmodo dropbox by 9/21.

Sept. 28 - Week 6
- Discussion: How do systematic reviews of research on mathematics and science teaching contribute to the field?
- Readings:
  - Brotman & Moore, 2008
  - Franke, Kazemi, & Battey, 2007
  - At least 2 articles related to your area of interest
- Due: Post the citations for what you read on Edmodo. Include #citation at the end of your post.
- Due: Critical review paper. Submit to Edmodo dropbox before class.

Oct. 5 - Week 7
- Discussion: Student-led focus (2 people)
- Readings:
  - 2 articles for class discussion will be determined by discussion leaders (1 from each person) and sent to all by Oct. 5
  - At least 2 articles related to your area of interest
- Due: Post the citations for what you read on Edmodo. Include #citation at the end of your post.
- Due: Edmodo discussion post 3 based on class discussion (post by 10/15) and 2 responses to others’ posts (before class on 10/19)

Oct. 12 - Week 8
- Discussion: Peer review of conceptual / theoretical frameworks.
- Readings:
  - 3+ readings in your area of interest.
- Due: Post the citations for what you read on Edmodo. Include #citation at the end of your post.
- Due: Visual representation of your conceptual/ theoretical framework. Bring this to class as a powerpoint slide or hard copy for the document camera. If time, send a copy to class members prior to class.
Oct. 19 - Week 9
- Discussion: Student-led focus
- Readings:
  - Will be determined by discussion leaders / send to all by Oct. 12
  - Continue reading in your area of interest
- Due: Post the citations for what you read on Edmodo. Include #citation at the end of your post.
- Due: Edmodo discussion post 4 based on class discussion (post by 10/22) and 2 responses to others’ posts (before 10/26, 5:45)

Oct. 26 - Week 10
- No class – work on your conceptual / theoretical framework paper
- Reading:
  - Continue reading in your area of interest
- Due: Post the citations for what you read on Edmodo. Include #citation at the end of your post.
- Due: Conceptual / theoretical framework paper draft. Submit to Edmodo dropbox on or before end of day, 11/3

Nov. 2 - Week 11
- Discussion: Student-led focus
- Readings:
  - Will be determined by discussion leaders / send to all by Oct. 26
- Due: Edmodo discussion post 5 based on class discussion (post by 11/5) and 2 responses to others’ posts (before before class 11/9)

Nov. 9 - Week 12
- Discussion: What shapes the changing foci of research on mathematics and science teaching?
- Readings:
  - Look over some of the reports and articles about the TIMSS and PISA tests in the Edmodo folder titled “International Tests.”
  - Do some searching online for policies, testing results, standards-related tensions, or other questions that might be shaping the research agenda in math and science teaching.
  - Post the URL or related article on Edmodo for others to access before class. Use #shapingresearch
Nov. 16 - Week 13
- Discussion: How are questions about mathematics and science teaching studied?
- Readings:
  - Look across the readings from the semester
  - Continue reading as needed in your area of interest
- Due: Final papers due soon; work on these!

Thanksgiving Break (Nov. 21-25, 2016)

Nov. 30 - Week 14
- Presentations: first 3

Dec. 7 - Week 15
- Presentations: second 3
- Due: Full research “mini” research proposal
Critical Reviews of Research Studies
Research in Mathematics & Science Teaching  2016

Overview

- Your critical reviews will support your introduction section in the mini-research proposal.
- Based on your research area of interest and the initial list of research articles you have identified, select one article to critically review. The articles must reports of empirical research, published in high quality research journals.
- Critically review this article in a 5-6 page paper. This is NOT merely a summary of the article! Submit your review in the appropriate dropbox on Edmodo.
  Use your last name as the first word of the document title.
- Submit an electronic copy of the article.
- Use this as a guideline for the class session you will lead (on a different article).

Expectations for the paper: The written review should be about 5-6 pages, not including the reference list (1.5 line spacing; 1 inch margins; 12 point Times New Roman or equivalent font). Use APA style for formatting the paper (except line spacing), including section headers, running head and page numbers, citations, and reference list. The review should address the sections described below. All cited materials must be included in a reference section, including the article that you are reviewing. Refer to the rubric in addition to the guidelines below.

You can and should draw from other readings used in this class (or others) to construct your argument(s) and clarify your position.

Critical Review Paper Sections
1. Provide the full reference for the article before the following sections.

2. Description of area of interest (1-2 paragraphs): Briefly explain the focus of your critical review. This area of interest will be the same for your mini-research proposal, although you might refine it or come to understand it differently during the semester. Explain how the article connects to and/or informs your area of interest; i.e., why did you choose this article?

3. Summary (about one page, enough so that a reader can make sense of your critical review): Concisely summarize the main elements of the study discussed in the article. Briefly describe the following:
   a. The research problem or area and the goals / purpose of the study
   b. The main ideas addressed in the literature review
   c. The conceptual or theoretical framework (there may not be one!)
   d. The research design, including the participants, duration and context of the study, data collection and analysis methods (this may include an analytic framework)
   e. The findings or results
   f. The conclusion or implications

4. Critique (3-4.5 pages): A critique involves analytic, synthetic, evaluative, and creative thinking. (You might want to read a comparison of analytic and synthetic thinking at http://www.gooisoft.com/articles/syntheticthinkingvsanalyticthinking.aspx)
Your critique should be the bulk of your paper. Examine the elements of the article that you describe in the summary (see above). **Look across these elements** to identify strengths and weaknesses in the study overall, and/or in individual elements of the study. Compare elements of this study to other related studies. Use the following questions, as relevant, to look across the different aspects of the study (e.g., findings in relation to the theoretical framework, or methods in relation to the question):

a. What assumptions does the author make in defining the problem and in the research question(s)? Are these assumptions stated or implied?

b. In what ways does the literature review situate this research in the existing body of research/knowledge; identify gaps or weaknesses in the existing body of research; provide a solid foundation that supports the study reported in this article; or inform your understanding of the study reported in this article? In what ways is the lit review a synthesis, or not, of important research related to the problem area?

c. If there is a theoretical or conceptual framework (TF/CF), how does this help you in your understanding of the author’s perspective on research, on the problem and on the conclusions/implications of the study? To what extent do you think the theoretical/conceptual framework shaped the interpretation of results? If there is no TF/CF, how does this impact your understanding of the author’s conclusions/implications? Are there unstated assumptions, expectations, beliefs, or theories that should have been addressed through a TF/CF?

d. Do you agree with the author’s research methods? Why or why not? How do these methods compare with other studies in the same area? What weakness/strengths do you see in the research design?

e. Do the findings/results respond adequately and clearly to the research questions? Are the findings believable? Are these supported with evidence that shows how the author came to specific claims? Do you have questions about the interpretation of the data presented? To what extent are all data addressed (e.g., is something obviously ignored)?

f. Do the implications or conclusions make sense in relation to the findings, previous research, the theoretical framework, and the methods? What are the strengths or weaknesses of the implications of this research?

5. **Application**: How can the information presented in this article be applied to K-12 classrooms? Policy? To your area of research interest?

Your reviews should be thoughtful and well-written in an academic register (see the general rubric for written work earlier in this syllabus). You will be assessed on the content and academic tone (i.e., not colloquial or diary-like) of your response.

We may discuss these critical reviews in class, where all students will share a brief summary of their critical reviews and participate in a class discussion to explore the questions these reviews raise for us. Our objectives will be to look across the areas of interest in these reviews to raise questions and examine the strengths and weaknesses of the research approaches, frameworks, and common themes in research on teaching and learning.

**Submit your review and a copy of the article in the appropriate dropbox on Edmodo.**
Rubric for Critical Article Reviews
(General Rubric for Written Work also applies in each category)

<table>
<thead>
<tr>
<th>Expectations Not Met</th>
<th>Acceptable</th>
<th>Exemplary</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Article submitted; Full reference provided on paper</td>
<td>Neither included</td>
<td>Only 1 of 2 included</td>
<td>Both included</td>
</tr>
<tr>
<td>Area of Interest Description &amp; Article Choice:</td>
<td>Selected area of interest was not included or is not well-defined. Article was from a practitioner journal and/or did not represent a rigorous research study from a high quality, peer-reviewed journal and/or article was not relevant to area of interest (i.e., not a good choice for an article to review) 0-3.1</td>
<td>Selected area of interest was described and reasonable to pursue. Article was a research study reported in a high quality, peer-reviewed journal (or instructor approved book/chapter*), and/or article had some connections to area of interest but other articles offer greater relevance/connections (i.e., an acceptable topic and/or article, but not a great choice). 3.2-4.7</td>
<td>Selected area of interest was well-focused and defined clearly. Article was a research study reported in a high quality, peer-reviewed journal (or instructor approved book/chapter*), published after 2000*. Clear connections and relevance to area of interest (i.e., an excellent / superb choice for a topic an article). 4.8-5</td>
</tr>
<tr>
<td>Summary:</td>
<td>Does not include all of the required elements for summarizing the research study. 0-4.9</td>
<td>Each element is summarized. A reader can gain a general sense of the study. 5-8</td>
<td>Concisely summarized for each element. A reader can easily gain a clear sense of the study and the salient features, as reported by the researchers/authors. 8.1-9</td>
</tr>
<tr>
<td>Critique &amp; Application to Practice:</td>
<td>Critique is merely a summary of the article and/or connections to practice are not made. 0-4.9</td>
<td>All critical elements are included but some arguments/connections/applications were not fully developed and/or well articulated. 5-8</td>
<td>Succinctly written critique with a thorough and scholarly analysis and evaluation of the study that connects to and compares/contrasts the study with other readings &amp; research to construct arguments and clarify position(s). Insightful applications to practice are discussed. 8.1-9</td>
</tr>
<tr>
<td>General Criteria for Writing, including clarity, voice, writing conventions, APA style</td>
<td>Approaches expectations 70-79% of points in each relevant section above</td>
<td>Meets expectations 80-89% of points in each relevant section above</td>
<td>Exceeds expectations 90-100% of points in each relevant section above</td>
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</table>

Total / 30

* Some influential studies that were published prior to 2000, book chapters, or portions of books may be considered as “exemplary” articles. However, in these cases, the manuscript must be a formal report of a research study (not a literature review or other type of book chapter) and you must receive prior approval from Tamara (i.e., do not assume that an older article or book chapter meets requirements).
Research on Mathematics or Science Teaching
Culminating Assignment: Mini Research Proposal
Description & Guidelines 2016

The development of this proposal provides you with an opportunity to engage in some of the thinking and practices involved in research on teaching mathematics or science. It is a “mini” proposal as it is limited in scope in relation to your eventual dissertation research proposal. However, the work you do will be authentic to the process and may serve to frame an actual research project you will carry out in the future.

Your final paper will include the introduction (including a brief literature review to situation your research problem), a conceptual/theoretical framework, your research design (including research question, methods for data collection and analysis), and potential threats to the validity/credibility of your study. You will get feedback from Professor Nelson and your peers on drafts of your introduction and your conceptual / theoretical framework (CF/TF). All elements of this paper should be well-supported with relevant literature. APA style (6th edition) is required for all formatting. The final paper will be somewhere in the range of 11-16 pages, plus references and figures.

Elements of the Mini-Proposal

A. Introduction: area of interest, research purpose and goals
   1. Identify a problem, issue, or phenomenon in mathematics or science teaching that you are interested in and that will be of interest to others (in this field). It should be a worthwhile problem! This area of interest may stem from personal experience, observations of others’ experiences or a phenomenon, or something you’ve read about and are interested in. Discuss why it is a worthwhile area for study.
   2. State a clear purpose and goals for the research. You may just want to know for your own curiosity. Better, you may want to contribute to an understanding of this phenomenon or problem. (Maxwell, 2005, calls this an intellectual goal.) You may want to inform practitioners and/or policy.
   3. What do we already know or do? Situate your area of interest in what is known, how what is known is not sufficient to satisfy your specific interest, and what you hope to figure out by pursuing this puzzle. Synthesize across at least six articles that connect this prior research to your area of interest.
   4. State a research question(s). Be clear about how this question relates to what is already known (and not known) or done.
   5. This section will probably be about 3-4 pages long. (remember to use 1.5 spacing, not double)

B. Conceptual or theoretical framework
   1. Explain and discuss the “system of concepts, assumptions, expectations, beliefs, and theories that support and inform your research” (Maxwell, 2005, p. 33). In other words, what theories and other constructs help you understand your area of interest, shape how you will study the problem, and influence how you will interpret the data you collect? You might think about this as: what variables are of interest and why are these important?
What are the relationships/interactions amongst/across these? What do you want to pay attention to in the study, and why?

2. Include a graphic depiction of your framework if that helps you and your audience better understand the relationship between constructs.

3. Cite relevant literature (at least 3 references) that informs your thinking.

4. This section will probably be about 2-4 pages long.

C. Research design

1. Methodology: What kind of study, what approach or strategy of inquiry (Creswell, 2003, p. 3) is reasonable given your research question(s)? Explain your selection.
   a. Will you employ a qualitative, quantitative, or mixed approach? Why—i.e., what do you think about how and what you will learn from this study?
   b. Within this broad methodology, what strategy or tradition of inquiry will you use: Case study? Narrative? Survey? Quasi-experimental? Some combination of these?

2. What specific data collection methods or procedures will you employ: Interviews (of whom)? Open-ended or close-ended? Observations of (what)? How? Pre and post tests (of what)? Collection of teacher-generated artifacts or student work?
   Why do you think these methods will inform your understanding related to your research question(s)?

3. Who will your participants be? (I.e., who will you be collecting data from/on?) Why are these the right participants to help you answer your research questions? What is the setting? (e.g., middle school classroom(s), professional development institute, university science methods class, etc.)

4. How will you analyze the data you collect? Talk about both the process as well as how your conceptual framework shapes your analytic lens.

5. Reference literature on research methods as needed in this section.

6. This will probably be about 5-6 pages, in total.

D. Credibility, trustworthiness, validity threats

1. What might cause consumers of your research to question your results? These differ in qualitative and quantitative approaches. Examples: researcher bias, researcher influence, alternative explanations,

2. How will you try to deal with these threats to credibility?
   Examples: rich, thick description (see Geertz); extended time; triangulation; comparison; negative cases or discrepant evidence; recognizing limitations.

3. Cite literature as relevant.

4. This will probably be 1-1.5 pages long.