**Abstract for Masters Thesis version 1:**

It is a paradox of science education that new teachers are encouraged to “teach with inquiry”, but rarely experience appropriately structured inquiry in their education courses. Most teachers are aware of Bloom’s Taxonomy and the buzz-words that are what administrators want to hear, but few know what those words *look like* in their own classrooms already, or how they can alter their approaches to make their courses more “sciencey”.

In my experience, even well-seasoned educators are skeptical and unsure of the inquiry approach encouraged by the NGSS. The thought of purposefully giving students time to try, fail, edit, try again, fail again, etc, is daunting to some. So many have worked within the time confinement that an expansive curriculum calls for, and focused on the stlye of question asking on their corresponding standardized test. It is disheartening to speak with colleagues that have the potential to be great inquiry teachers that are just too afraid of the unfamiliar experience to try. A colleague of mine put it well- “It’s like letting go of the reigns of a horse you only just started training”. But how else can we know that our students really can embody the resilient mindset to try and try again?

New teachers that want to employ Inquiry need to have a firm understanding of what it means to be scientifically literate, what “Critical thinking” means in terms of a skill set, and the different levels of inquiry that can and should be carefully planned. It’s important to know what is reasonable to expect of your students within the context of their age and educational background.

In my experience, inquiry appears to the untrained eye (be it students, their parents, or skeptical colleagues) as “the lazy teacher’s lesson plan”. In reality, inquiry demonstrations, lessons, labs, and projects can go horribly awry if the educator has not carefully planned a progression in skill development through a unit. I am speaking a bit from personal experience.

There is a general common issue that I and my colleagues-across disciplines – feel is chronic: student’s lack of being comfortable will failure. Employing inquiry-first, student-centered teaching techniques and corresponding curriculum is something that we as science teachers can always strive to do in our classrooms to combat this issue.

Teaching High School Physics: Volume 1 by Wenning and Vieyra addresses the meaning of critical thinking, teaching, and learning, outlines the levels of inquiry that a physics teacher can employ, and uses appropriate physics examples from high-school curriculum to help illustrate the progression suggested in the book.

They offer hardly any advice for how to get students, parents, administrators, and colleagues to “buy-in” to the process except for supplying them with research that supports the inquiry method, and to give it time. However, they address the importance of climate-setting in the classroom and what “snags” to anticipate.

Outline:

1. Introduce need for understanding inquiry as an educator.
   1. Reference other research that supports this lack of preparation in science education courses. If possible differentiate between undergraduate and graduate programs.
2. Give general overview of what the “teaching high school physics” series has to offer. Note the digital-only limitation to the texts as a downside.
   1. Volume 1: focused on philosophy and epistemology of science education: what is teaching, what is learning, what are intellectual skills, what is inquiry, how do you minimize resistence to inquiry
   2. Volume 2: focused on student success; preconceptions, metacognitive strategies, differentiation in the classroom, and developing dialogue strategies as a teacher
   3. Volume 3: classroom management, planning, assessments, and advice on the career.
3. Define critical thinking/intellectual skills as a broad term and under the scientific lens ;
   1. *according to Wenning and Vieyra. Ch 2, 4, 7 10*
4. Define Inquiry according to Wenning and Vieyra, as well as a general overview of the different levels of inquiry.
   1. Comment on own experience in chemistry, application of these principles to other science disciplines as wel as physics.

*According to Wenning and Vieyra ch5-6, 8-10:*

* 1. Note what levels seem most appropriate by grade level and discuss vertical alignment within the science department with the skillset.
  2. Note what time of year, progression in a unit that each level of inquiry can/should be employed.

*According to NGSS and supporting documents:*

* 1. Note what is directly asked for in NGSS high school standards for physics/chemistry standards.

1. Special interest in mathematical models; different levels of complexity
   1. Address the need for mathematical model skill-building; goes hand-in-hand with “conceptual understanding”. What good is conceptual understanding if a student can’t apply the associated mathematical problem solving with real numbers?
   2. Identify different levels of complexity
   3. Relate place where this can be done in chemistry, physical science in lower grades (such as density unit!)
2. Touch on the usefulness and loftiness of the first volume again. First volume is really something useful for any teacher, either pre-service or one that’s taught 20 years, for a refresher in what it means to teach “inwuiry” in physics.
   1. Volume 2 and 3 are better suited for pre-service or new teachers.
   2. Volume 2 chapters 16, 18-21, 25-27 I think are of particular interest to new teachers, regardless of discipline.
   3. 26-27 have a particular disposition towards Modeling Instruction; dialogues and whiteboarding in the classroom.
   4. Volume 3 chapters 30-35 provide a basis for planning and data analysis that is something all teachers should work to do well with, and the sooner you start the reflection on authentic assessments and analysis of results, the better.
3. Conclusion: is it necessary if I end by talking about the other two volumes in brief?

Directions from syllabus:

- start your manuscript with a 1-3 paragraph overview of those scholarly references to published works directly relevant to your manuscript.

This means you must have done a literature search of the topic you are writing about in the general science and physics education databases, and especially in JPTEO, TPT, PE and the STANYS Bulletin, especially in the journal you are publishing in.

Remember your audience – you're almost certainly writing to other master teachers of physics like yourself, or principals, science curriculum advisors or science department chairs—classroom teachers and supervisors of teachers, not usually researchers..

Keep any opinion and interpretation out of the start and middle of your manuscript – you may hint at opinion at the end in your conclusions.

Describe your problem, issue, curriculum or device at length, including what you did.

Describe your students (if appropriate) and the kind of course you are considering this article to address.

If students have tried your intervention or apparatus, then describe who tried it, what happened and what was thought of the experience. Only at the very end can you allude to opinion.