Course Syllabus

Edit

`STEM Pedagogies TLL 3475

Fall 2025

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Course Description

In this course we will wrestle with our approaches to and understanding of instruction and learning in STEM education. We will develop an aptitude for designing STEM pedagogy in connection with learning theories. Through this examination we will also grapple with how concepts from each disciplinary element of STEM (i.e. Science, Technology, Engineering and Math) are connected through interdisciplinary/transdisciplinary pedagogy. Finally, we will explore different knowledge traditions that can contribute to rich, critical and relational STEM educational discourse.

What can we learn and know together?

Guiding Questions

Here are some of the guiding questions we will use to drive our inquiry into STEM pedagogies:

- What is learning? What is the relationship between teaching and learning?
- What is the relationship between teaching, learning and assessment?
- What role does criticality play in teaching and learning?
- What are critical STEM pedagogies?
- How are critical STEM pedagogies realized within classrooms and other learning contexts?
- How do we design for authentic and meaningful learning experiences within STEM disciplines?
- How do we create the conditions for learners in STEM disciplines to flourish?
- What are the systems that support critical STEM pedagogies?

Learning Goals

1. Understand how learning is constructed, socially situated, embodied, and political.
2. Explore how criticality is fundamental to embodied, authentic, and connected learning in STEM classrooms.

3. Understand the relationship between teaching and learning.
4. Co-construct a definition of critical STEM pedagogies.
5. Leverage critical perspectives in the design of critical STEM learning experiences. and its central role in STEM education.

How will we engage in our learning?

This class is rooted in *Critical Constructionist Pedagogical Praxis*, a theoretical space I hope to develop further as we engage in this class together. To be **critical** is to examine, to look closely, to question why something is the way it is, instead of taking it at face value. Paulo Freire talked about criticality as the way we read both the *word and the world*. What Freire meant was we cannot engage in any discussion of literacies without recognizing the role of power and authority in our understanding and practice of literacies.

Constructionism was coined by Seymour Papert, whose prescient work (detailed in texts like *Mindstorms, 1980*) predicted the powerful role that technology, namely computers, would have on how we learned and how we could make sense of ideas. But he also realized the potential for technology to facilitate creative production or *making*. To that end, Constructionism is a theory of learning that argues *we learn through personally meaningful making.*

Paulo Freire (2003) defines praxis as "reflection and action upon the world in order to transform it" (p. 51). Freire asks us to not just do but reflect and be actively engaged in the process of understanding and deconstructing our understanding of the world. We will engage in critical praxis throughout this course. We will read, write, reflect, make, play, and share, and continue to ask how, what, why, about our practices. In doing so we can deepen our learning.

Course Structure Overview

This course is organized into three interconnected modules that build and connect to each other, and will be punctuated by our in-class sessions. This is a hybrid course that will include four in-person sessionsSeptember 6, October 4, November 8, December 6, that will take place in Imagination PLAYce (5163), in Posvar Hall.

Module 1: Perspectives on Learning

Module 2 : Centering Knowledge Traditions

Module 3: Designing and Assessing Formative Learning Experiences

Module 4: Towards Authentic Assessments in STEM

Coursework

Community and Class Participation

Digital Journal: You will keep a digital journal where you will respond/reflect/post examples. At times I will give you a specific prompt, where you might answer several questions and synthesize those responses into one paragraph as part of a class assignment. At the end of the semester, you will read and annotate this journal and draw upon your thinking/critical reflection in your final written work. Make sure you date entries and include the prompts so that you can follow your own journey of reflection and critical analysis of the texts, concepts, and theories we engage with in the course. This journal is guided by the underlying philosophy of *writing as thinking*. When we are writing things, we are engaged in a process of articulating our ideas, and as we write, revise, and rewrite, we clarify our intentions and our understanding. We also will consider how reading others' writing can reveal other ideas and ways of thinking. This will be an artifact you will use in your final assignment.

Perusall Readings: Reading together, using the practice of *social annotation*, is to support you in shared sense-making. It is also modeling a practice that is increasingly common (and possible!) due to the technology we have. Reading together is also an essential component of community building and shared sense-making. Use the following prompts to guide your responses:

- Connections: how does the current text relate to other concepts/ideas/texts in our course or even in your everyday practice?
- Questions: what are you left wondering about? What do you want to learn more about?
- Quandaries: what are things you disagree with or push up against your existing understanding?

Peer Feedback: Throughout this course, you will give and get feedback on your ideas, questions, insights, and learning from our peers. Think of your peers as providing windows into your work – they will see/interpret your ideas in ways that you don't anticipate, this will help you rethink and examine how you are conceptualizing and communicating your ideas. In other words, your peers offer another source of course content. In addition, together with your peers (and myself) you will be actively engaged in using a range of online tools and resources to explore new ideas, concepts, theories, and practices. When you comment you are offering insight into your perspective, and building on your own lived experience and expertise, and the same is true for your peers.

When otherwise not specified, we will be using the: *I like, I wish, I wonder* feedback structure. These comments should be respectful and focused on the work but also offer critique that goes beyond 'this is good' or 'I like that.' **Your feedback should help your peers think differently and expansively about their work/ideas/questions. Here are some general guidelines:**

I like - what resonates? What works about this? What is meaningful or valuable?
I wish - what are constructive critiques? What isn't there that could offer more clarity?
I wonder - what isn't clear? What questions may help someone think differently about their work?

Key Assignments

These are brief descriptions, see Canvas for additional details.

STEM questions – *Due August 31*

Respond to prompts before you begin reading, spend time thinking about why you believe what you do and how you came to understand your perspectives on STEM. Document your full responses in your digital journal and share a synthesis in a discussion post. Come prepared having read your peers' responses.

Annotated Syllabus - *Due September 5*
Review and annotate the course syllabus with clarifying questions, opinions about readings and assignments, confusions and uncertainties, responses to policies, advice, and reflections on what works and what can change. You will also make recommendations for potential texts to read, reflect on the guiding questions and learning goals, and even consider the assignment descriptions below. We will revise the syllabus together when we meet on 9/6.

STEM Pedagogy Autobiography - *Due October 2*
A 5–7-page reflection (or creative equivalent) on your experiences learning STEM throughout your educational journey. This assignment invites you to examine how your personal learning experiences shape your views about teaching STEM.

3. **Develop a STEM Case Study Analysis** *Due November 6*
   Develop a case study that could facilitate a learning experience for other practitioners (e.g. K-12 teachers, higher education faculty, museum educators, etc.). Provide rich context (e.g. who are the key players, what are the contexts, systems and people that inform this problem of practice), develop inquiry questions, and a meaningful learning activity.
4. **Assessment Archeology Due December 5**

Examine two assessments within your praxis. Think about the ways you leverage assessment in your everyday work- this will look different depending on your learning context. After engaging in an archeology of two assessments, you will reimagine one of them, integrating theories of reaching, learning and assessment, in your rationale for those changes.

5. **Final Pedagogy Philosophy Statement** - *Due December 12*
   A 3-5 page purposeful and reflective essay where you share your beliefs and practices about STEM education, written in first-person, present tense, with 1-2 concrete examples of experienced or anticipated experience.

Grading Scheme

All coursework will be graded as **Complete** or **Incomplete**. If you receive a Complete, then your work is complete. If you receive an Incomplete, then you have an opportunity to submit a revision that addresses the comments from your instructor. The revision must be submitted within 1 week of receiving feedback from your instructor. If an assignment is not turned in, it will be marked incomplete. Out of respect to peers, assignments over 2 weeks late, will be marked and remain in incomplete status. Your grades will

be comprised of weekly and in-person class participation (50%) and your culminating module assignments (50%).

A **Complete** grade indicates that the work:

- Meets all assignment requirements as specified in the prompt
- Demonstrates substantive engagement with course readings, concepts, and theories
- Shows evidence of critical thinking and reflection
- Is written/composed with clarity and appropriate academic conventions
- Includes required citations and references in APA format
- Reflects doctoral-level work appropriate to an EdD program

What "Incomplete" Means:

An **Incomplete** grade indicates that the work does not yet meet the standards above. This may be because:

- Assignment requirements are not fully addressed
- Engagement with course concepts is superficial or absent
- Critical analysis is lacking
- Work does not reflect doctoral-level thinking or writing
- Required elements (citations, format, length) are missing

Revision Policy:

If you receive an **Incomplete**, you have **one opportunity to revise** within **one week** of receiving feedback. The revision must directly address the feedback and meet the standards for Complete work. Only one revision per assignment is permitted.

Late Work Policy:

- Assignments are expected on time. If you need an extension, you must request it **at least 3 days before** the due date.
- Assignments submitted **within 2 weeks** of the due date without prior approval will be accepted but marked late.
- Assignments submitted **more than 2 weeks late** without prior instructor approval will receive an **Incomplete** grade and **cannot be revised**. This Incomplete will factor into your final grade as described below.
- Assignments submitted late will be evaluated on whether they meet Complete standards, but late submission itself demonstrates insufficient engagement with course expectations.

Final Grade Calculation:

Your final grade is based on:

- **Participation (50%)**: Includes in-person class attendance and preparation, weekly Canvas discussions, peer feedback, and timely engagement with course activities
- **Culminating Module Assignments (50%)**: Four major assignments, each weighted equally

Letter Grade Scale:

- **A (90-100%)**: All or nearly all assignments Complete, consistent strong participation, work reflects doctoral-level critical engagement
- **B (80-89%)**: Most assignments Complete, good participation, work meets expectations with occasional gaps
- **C (70-79%)**: Several assignments Incomplete or significant participation gaps, work meets minimum expectations
- **D (60-69%)**: Multiple assignments Incomplete or missing, inconsistent participation, work frequently below expectations
- **F (Below 60%)**: Majority of work Incomplete or missing, minimal participation

Calculating Your Grade:

Each Complete assignment = 100% for that assignment. Each Incomplete assignment = 0% for that assignment (unless successfully revised).

For example:

- 4 Complete culminating assignments + strong participation = A range
- 3 Complete + 1 Incomplete assignments + good participation = B range
- 2 Complete + 2 Incomplete assignments = C range or below

Grade of Incomplete (I):

Per EdD program policy, an **I** grade is only available for students who have completed the majority of coursework and have documented extenuating circumstances that prevent timely completion. An I grade must be requested in writing and approved by the instructor. It provides an additional 3-6 weeks maximum to complete outstanding work.

An **I** grade is **not** a substitute for inadequate work or chronic late submissions.

There are no G grades assigned in the EdD program. If you cannot complete the work of the course, you can request an I (if you have circumstances that allow for this grade), which will give you an additional 3-6 weeks (max) to complete the course.

Participation (50%)

In-person classes: You are expected to come prepared having read/ engaged with materials within the salient module to in-person classes. Everyone is expected to attend all in-person sessions and have completed their culminating assignments before coming to class.

Online participation: We will have weekly discussion / journal prompts that will be facilitated via canvas. Canvas discussion prompts should be completed within the deadline. If you need an extension, please email me a request at least three days ahead of the due date. If you do not respond within two weeks, then the grade will remain as incomplete. Please engage / give feedback to your peers.

Culminating Module Assignments (50%)

Each module will have a culminating assignment. Those assignments will ask you to engage critically with the texts/ materials from the preceding module and create/ compose an artifact that will be detailed fully in canvas. Those assignments are listed above. While the format will remain flexible, the goal is to root you in the theoretical and practical and therefore should be attended to with fidelity. All assignments should be completed in APA format and include relevant references. Rubrics (as needed) will be shared in Canvas as well. These assignments should be submitted on time. You will receive a complete/ incomplete with written feedback.

Student Expectations and Faculty Commitments

I expect all students to critically engage with the course materials (e.g. articles, podcasts, videos, online resources),and come prepared (virtually or in-person) ready to discuss, interrogate, and participate in healthy, respectful, productive dialogue around the ideas we are exploring.

My commitment to you is that I too will come prepared and create an open, inclusive, and dynamic classroom environment that is responsive to students' needs.

Academic Integrity and Professional Conduct:

As doctoral students preparing for leadership roles in education, you are expected to:

- Engage constructively with course content, even when you disagree with perspectives or approaches
- Direct concerns or critiques about course policies, assignments, or instruction to the instructor via email or office hours rather than within assignment submissions
- Focus assignment responses on engaging with course concepts and theories rather than personal grievances
- Maintain professional communication standards in all coursework and interactions.

Use of AI in this Class

In this class, you are expected to do your own writing and composing without AI assistance, because, as it says above, writing is an essential part of the thinking/exploration process. If you are using AI clients (e.g. ChatGPT, Google Gemini) or others, the expectation is that you explain - within your assignment response - how you have used the tool, what tool you have used, and the process you engaged in to

produce the work. Part of this is to build your own critical literacies praxis, and part is to continue for us to think about the implications of how tools can facilitate educational experiences. In module 3 we will explicitly be working with AI tools at which point I encourage you to try and test out many things. **My expectation for students in this class is for you to write/compose your own writing and compositions so you are engaging with the ideas,** and adhere to aforementioned guidelines regarding use of AI.

Course Summary:

Date	Details	Due
Sun Aug 31, 2025	**M1: Perspectives On STEM [start here!] (due August 31)** (https://canvas.pitt.edu/courses/339367/assignments/1934059)	due by 11:59pm
Fri Sep 5, 2025	**M1 Annotating the Syllabus (due September 5)** (https://canvas.pitt.edu/courses/339367/assignments/1938018)	due by 11:59pm
Sun Sep 14, 2025	**M1: Revising Perspectives on Learning** (https://canvas.pitt.edu/courses/339367/assignments/1940437)	due by 11:59pm
Sun Sep 21, 2025	**M2: Culturally Relevant Pedagogies Journal and Reflection** (https://canvas.pitt.edu/courses/339367/assignments/1946948)	due by 11:59pm
Sun Sep 28, 2025	**M2: Power - Taking the Line for a Walk (SKIP THIS, we will do together on 10/4)** (https://canvas.pitt.edu/courses/339367/assignments/1948511)	due by 11:59pm
Fri Oct 3, 2025	**STEM Autobiography (Due October 3)** (https://canvas.pitt.edu/courses/339367/assignments/1949616)	due by 11:59pm
Sun Oct 12, 2025	**M2: The Role of Bodies in STEM spaces- discussion** (https://canvas.pitt.edu/courses/339367/assignments/1957380)	due by 11:59pm

Date	Details	Due
Sun Oct 19, 2025	**M3: Digital Journal Prompt: Designing for Equity in Making and Play** (https://canvas.pitt.edu/courses/339367/assignments/1962417)	due by 11:59pm
Sun Oct 26, 2025	**M3: Design Principles** (https://canvas.pitt.edu/courses/339367/assignments/1964345)	due by 11:59pm
Fri Nov 7, 2025	**Assignment: STEM Case Study for Practitioner Learning** (https://canvas.pitt.edu/courses/339367/assignments/1970382)	due by 11:59pm
Sun Nov 16, 2025	**M4: Mapping Standardization** (https://canvas.pitt.edu/courses/339367/assignments/1975536)	due by 11:59pm
Sun Nov 23, 2025	**M4: Critical Wonder about AI** (https://canvas.pitt.edu/courses/339367/assignments/1975545)	due by 11:59pm
Fri Dec 5, 2025	**"What If..." from archeology to reimagining assessment** (https://canvas.pitt.edu/courses/339367/assignments/1975592)	due by 11:59pm
Fri Dec 12, 2025	**Pedagogical Philosophy** (https://canvas.pitt.edu/courses/339367/assignments/1975631)	due by 11:59pm