Discovering transdisciplinary ways of knowing: An epistemic approach to integrating STEM into art and design education

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Pratt Institute



"Exploring Transdisciplinary Approaches to STEM Teaching and Learning"



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Improving Undergraduate STEM Education: Education and Human Resources (IUSE: EHR)

"The IUSE: EHR is a core NSF STEM education program that seeks to promote novel, creative, and transformative approaches to generating and using new knowledge about STEM teaching and learning to improve STEM education for undergraduate students."

Contemporary challenges are transdisciplinary challenges



Climate Change



Social Justice



Biodiversity Crisis

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Pratt as a unique incubator for transdisciplinary STEM



STEM in General Education



STEM in the majors



How do we get students who don't identify as **STEM-oriented to infuse STEM understanding into** their work?

A focus on epistemology ("ways of knowing")

What epistemological practices are endemic to Science, Technology, Engineering, and Mathematics (STEM)?

What transdisciplinary practices exist at this interface? What epistemological practices are endemic to Art, Design, and Architecture (AD&A)?

Precedents in K-12 and informal learning contexts



Guerilla Science \rightarrow Informal science learning at public events



A "Transdisciplinary Epistemic Practices" framework

	STEM practices	Transdisciplinary practices	Arts practices
Exploring	 Asking questions/defining problems Planning and carrying out investigations Using mathematical and computational thinking 	 Noticing and questioning Exploring materiality Defining the problem space 	 Deep noticing Deconstructing component elements and their respective meanings
Meaning-m aking	 Developing and using models Analyzing and interpreting data Constructing explanations/designing solutions 	 Producing tentative representations Conducting principled iterations Engaging multiple modalities and materials Finding relevance 	 Applying artistic principles to augment meaning Designing interrelations within and across multiple sign systems Referencing or combining existing works and ideas
Critiquing	 Arguing from evidence/peer review Evaluating and communicating findings 	 Critical Engagement Holding commitments to standards of the field Sharing results/Audiencing 	 Critical historicity; negotiating what constitutes a "good" project Given a particular artistic goal, evaluating how successfully this goal has been met



Research Questions

- How can Transdisciplinary Epistemic Practices (TEPs) provide a conceptual framework for faculty development in a higher education art and design context?
- 2. How can faculty use this conceptual framework to design and execute transdisciplinary STEM learning opportunities for all students?

Project participants

3 Principal Investigators:

- → Mark Rosin, Math & Science
- → Heather Lewis, Art & Design Education
- → Chris Jensen, Math & Science

11 Faculty Learning Community (FLC) Participants from:

- ★ School of Architecture (2)
- ★ School of Art (2)
- ★ School of Design (3)
- ★ School of Information (1)
- ★ School of Liberal Arts & Science (3)

A transdisciplinary Faculty Learning Community (FLC)



Individual Activities

Collective Activities

How we selected our FLC participants



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Architecture **Digital Arts**





Many art & design fields are also STEM fields

Industrial Design



Information Science

Image Source

https://www.pratt.e

Research structure



Project timeline



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Analysis and

Some initial findings

- These transdisciplinary epistemic practices (TEPs) are used widely by the members of our Faculty Learning Community (FLC)
- 2. Some FLC members have a strong transdisciplinary practice built into their teaching
- 3. Other FLC members are still exploring / discovering transdisciplinary spaces in their courses
- 4. FLC members deeply value the opportunity to spend time in the classroom of fellow faculty members from other disciplines

Questions or comments?