Exploring Transdisciplinary Approaches to STEM Teaching and Learning

Chris Jensen, Heather Lewis, & Mark Rosin
Pratt Institute, Brooklyn, NY
June 17th, 2024

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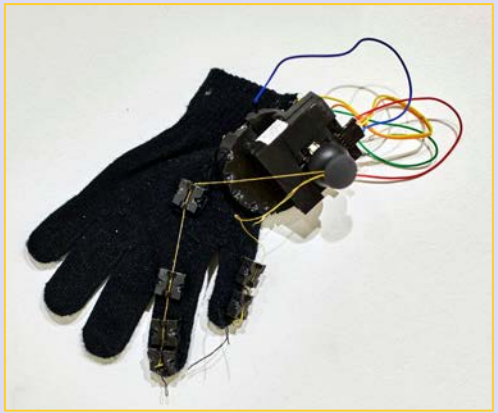
National Science Foundation Grant #2141287

Transdisciplinarity at Pratt

Pratt MSCI

Sustainability

“Coming together of two (or more) nominally different disciplines to create something greater than the sum of the parts”



Applied Technology

Gallery exhibition photos by Draven Zhao

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Transdisciplinary Epistemic Practices

Pratt MSCI

- Noticing & questioning
- Exploring materiality
- Defining the problem space
- Producing tentative representations
- Conducting principled iterations
- Engaging multiple modalities and materials
- Finding relevance
- Critical engagement
- Holding commitments to standards of the field
- Sharing results/audiencing

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Pratt MSCI

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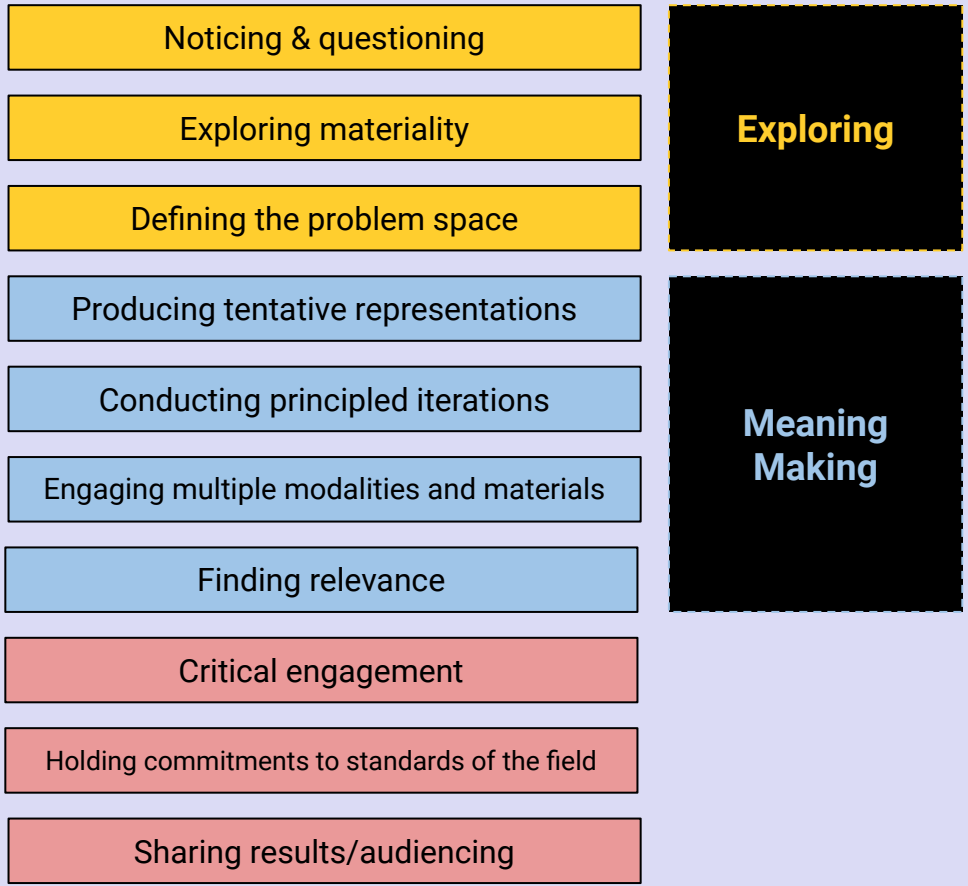
Transdisciplinary Epistemic Practices



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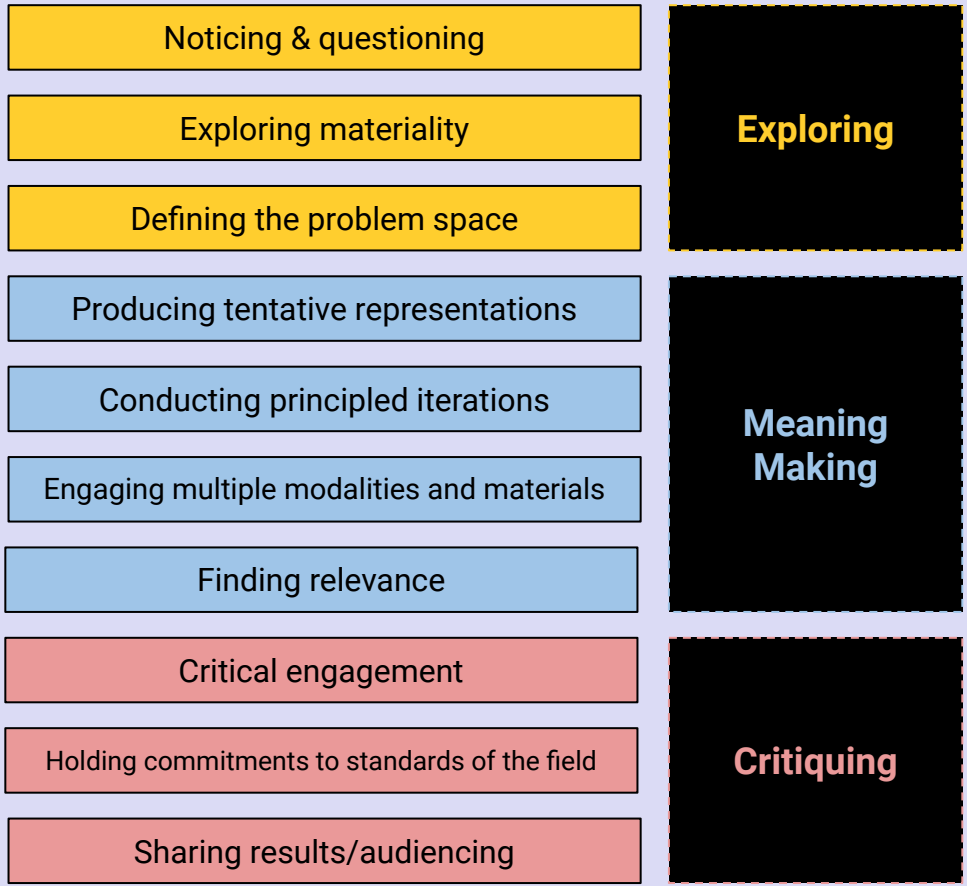

Pratt MSCI

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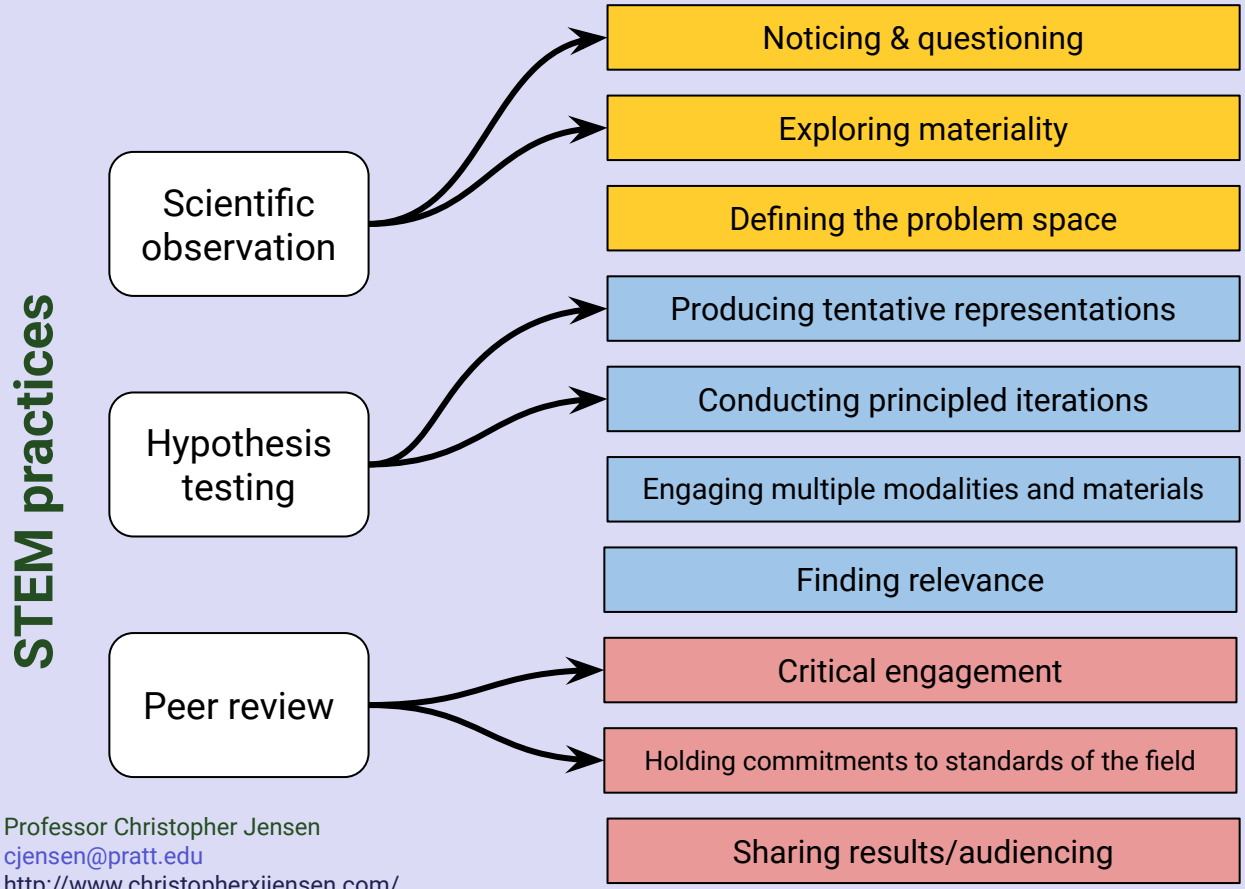

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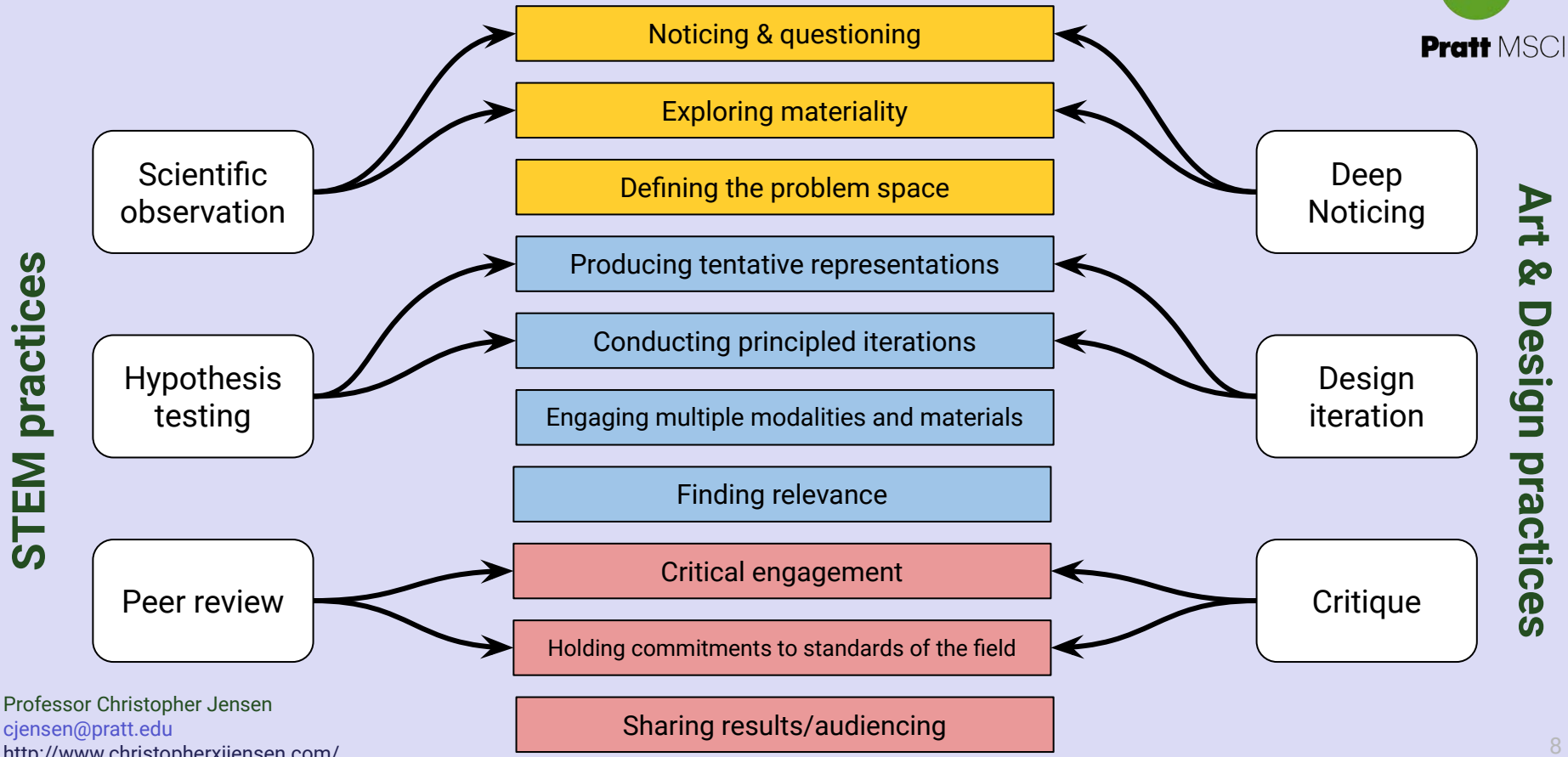
Transdisciplinary Epistemic Practices



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Faculty Learning Communities (FLCs) at Pratt

Since 2016, Pratt has been using 1-3 year FLCs to advance pedagogical exploration

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Scholarship of Teaching & Learning (SoTL) at Pratt

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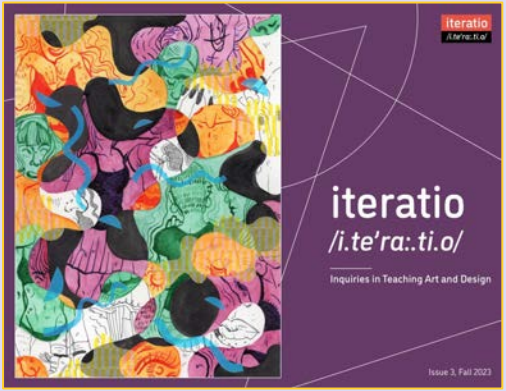
"Action Research"



Images courtesy of the Pratt Center for Teaching & Learning

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Our Transdisciplinary Epistemic Practices FLC

Ashley Bales
Math & Science

Leanne Bowler
Information Science

Robert Brackett
Architecture

Blake Marques Carrington
Digital Arts

Rafael De Balanzo
Math & Science

Gina Gregorio
Fashion Design

Zat Jamil
Social Sciences & Cultural Studies

Jeanne Pfordresher
Industrial Design

Jonathan Scelsa
Architecture

Sophia Sobers
Digital Arts

Keena Suh
Interior Design

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FLC members hailed from all 5 schools at Pratt

An FLC designed to explore the use of TEPs in SoTL

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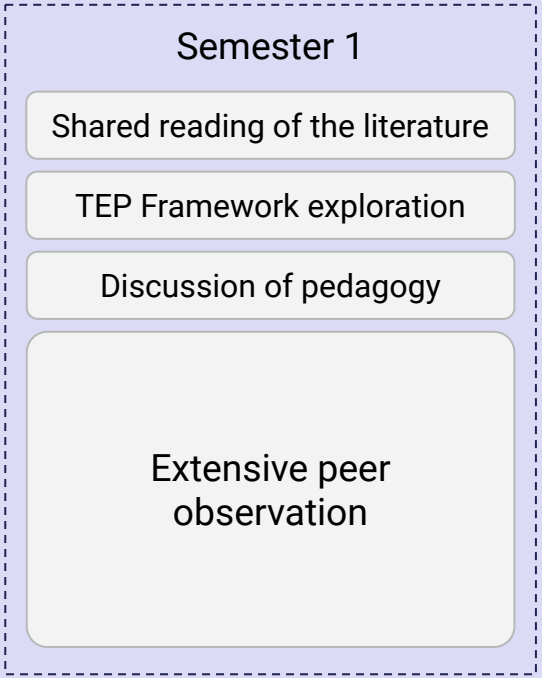
Our FLC design moved from **exploration** to **execution** to **exhibition**

An FLC designed to explore the use of TEPs in SoTL



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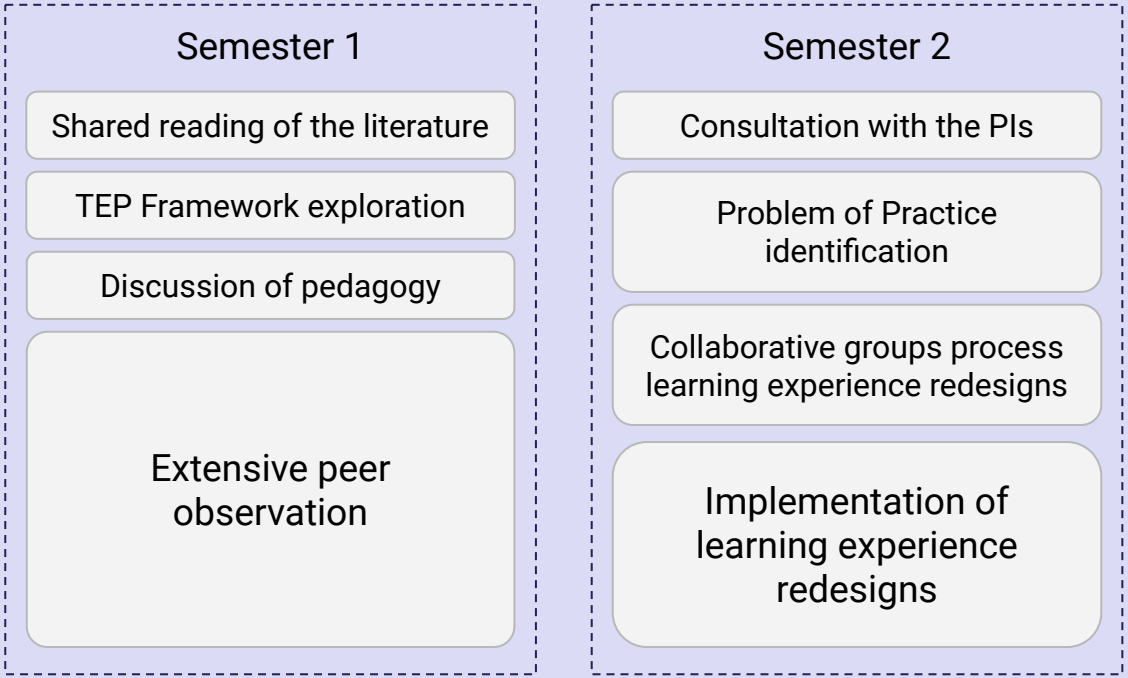

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Semester 1

- Shared reading of the literature
- TEP Framework exploration
- Discussion of pedagogy
- Extensive peer observation

Semester 2

- Consultation with the PIs
- Problem of Practice identification
- Collaborative groups process learning experience redesigns
- Implementation of learning experience redesigns

Semester 3

- Reflection on & analysis of learning experience redesigns
- FLC group gallery exhibition
- Final reflection on FLC work

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FLC projects and the TEP framework

Learning Experience Design
How can I design (or redesign) a transdisciplinary learning experience?

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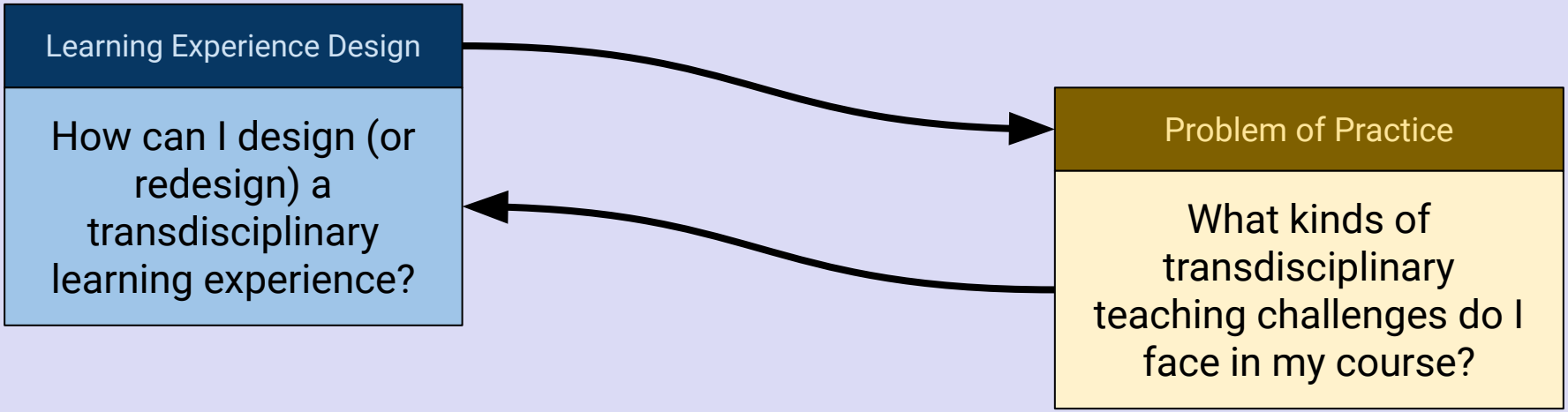

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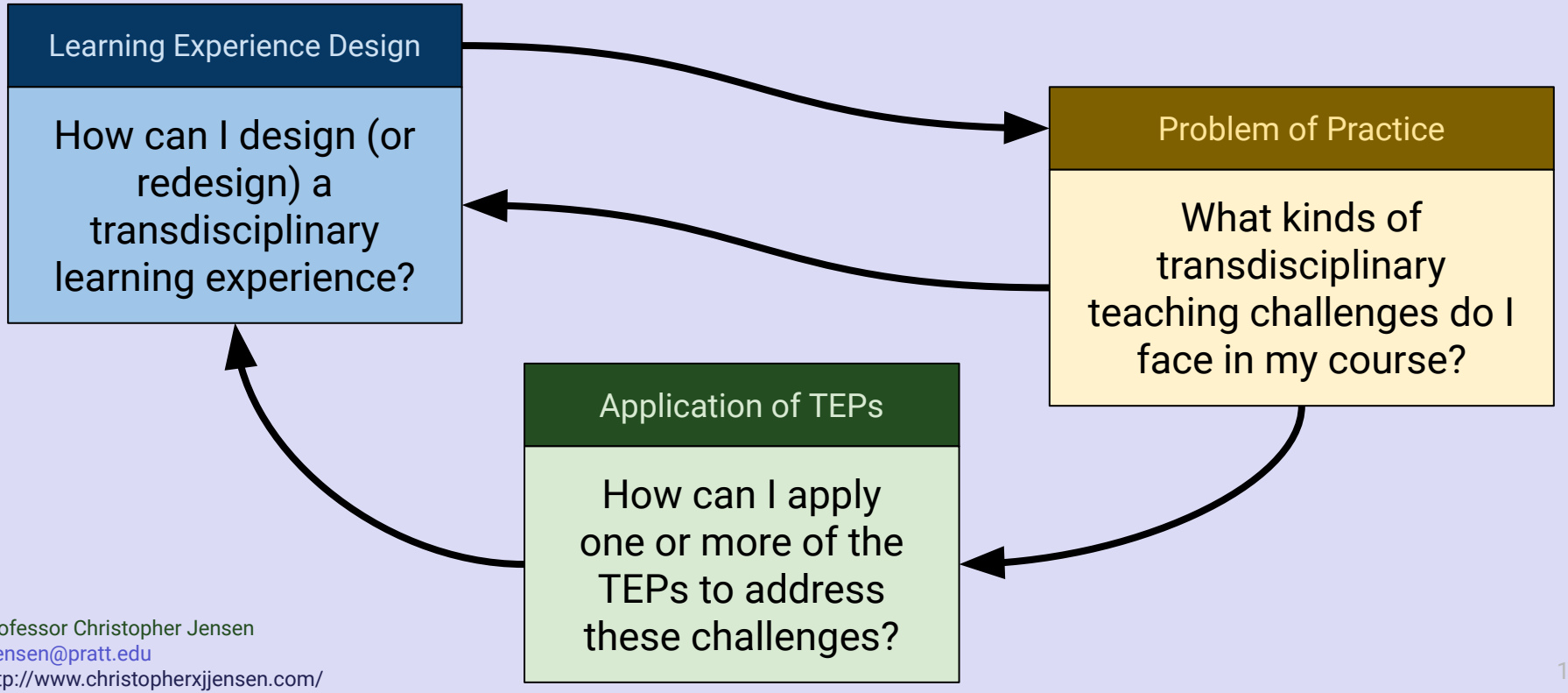

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Sharing SoTL work through a gallery exhibition

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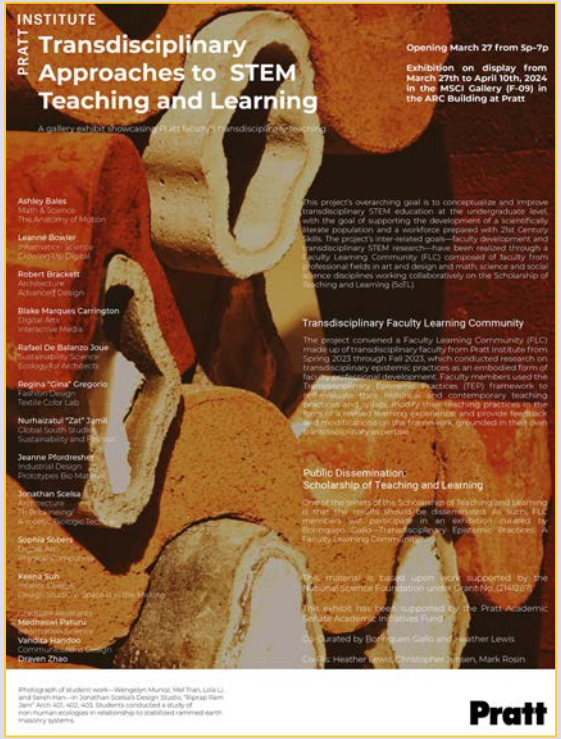
Our 11 FLC members each mapped their use of the *Transdisciplinary Epistemic Practices* onto their pedagogical inquiry projects



Gallery exhibition poster by Vandita Handoo

Gallery opening photo by Chris Jensen

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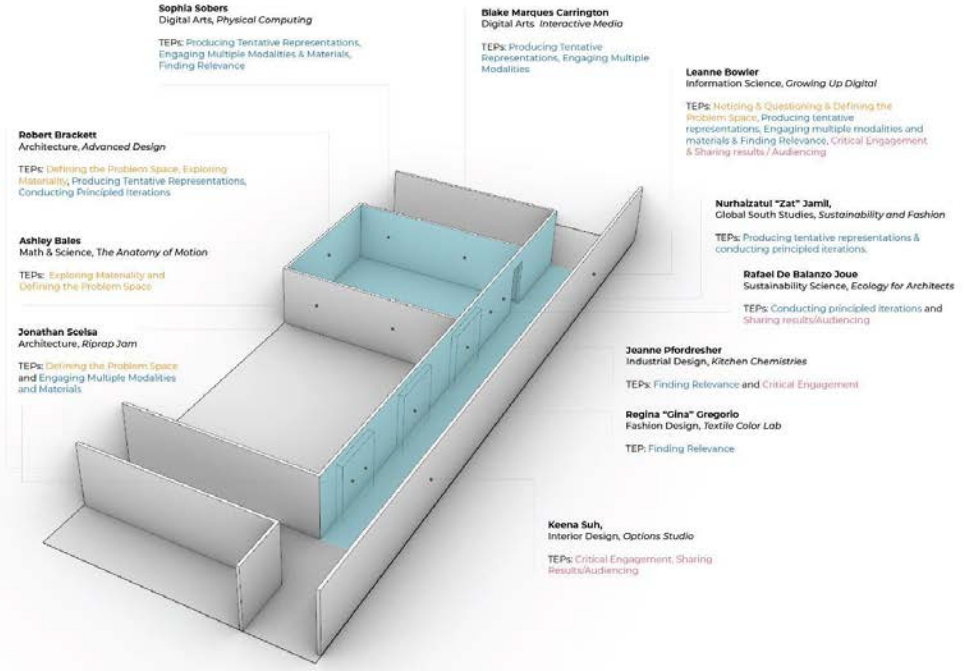
Applied Transdisciplinary Epistemic Practices:
Wrestling with Problems of Practice

The eleven members of the Transdisciplinary Epistemic Practices Faculty Learning Community modified existing courses through a dynamic curriculum redesign process that integrated one or more of the following Transdisciplinary Epistemic Practices (TEPs).



MSCI Gallery (F-09), ARC Building, Pratt

This material is based upon work supported by the National Science Foundation under Grant No. (2141287).

Meaning Making

Producing tentative representations	Visualize and understand phenomena conceptually, and from there, to extrapolate to new situations
Conducting Principles Iterations	Construct and compare the results of multiple varied solutions to a task or problem, using well defined variational criteria
Engaging multiple modalities and materials	Develop capacity to engage with, and make informed connections among multiple modalities and materials
Finding Relevance	Contextualize work within the frames o sacal values (historical and contemporary) and personal values

Critiquing

Sharing results/ "Audiencing"	Sharing findings/ work through verbal, visual, or textual discourse
Holding commitments to standards of the field	Adhering to the standards and practices of the field
Critical Engagement	Providing feedback and promoting dialogic communication based on evidence, and leveraging a diversity of perspectives

Exploring

Defining the Problem Space	Asking well formulated questions that can be addressed either empirically, non-empirically, or through a well defined combination of both
Exploring Materiality	Explore models of the world and its structure, to explain and/or inspire further inquiry
Noticing and Questioning	Careful observation and looking more closely at the world, and thereby identifying (well defined) questions that need to he explored or features that otherwise might not be seen

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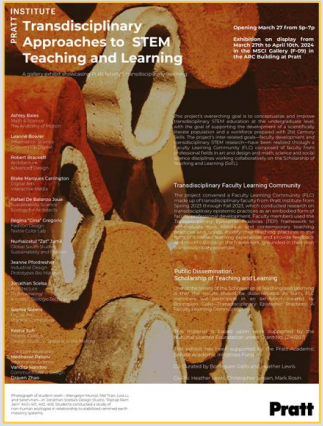

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Gallery schematic by Vandita Handoo

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Gallery opening photo by Draven Zhao

Problem of Practice:
Developing a "visual hypothesis" research method connecting knowledge from many disciplines

Exploring the implementation of visual hypotheses

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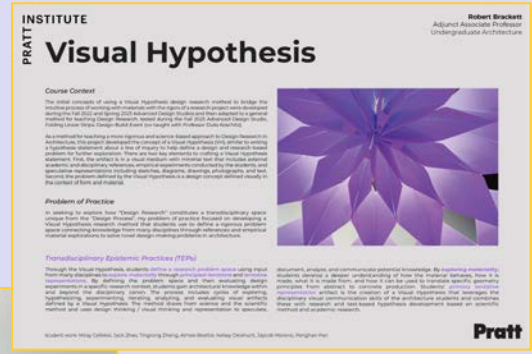
Exploring materiality

Defining the problem space



Producing tentative representations

Conducting principled iterations

FLC member Robert Brackett

Gallery exhibition photos by Draven Zhao

Problem of Practice:
Conducting materials science research that can lead to actionable results in sustainable design

Thinking critically about what matters in materials research

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Finding relevance

Critical engagement

FLC member Jeanne Pfordresher

Gallery exhibition photos by Draven Zhao

Problem of Practice:
Integrating functional understanding of anatomy into the design of novel anatomical structures and configurations

Creating a believable make-believe creature

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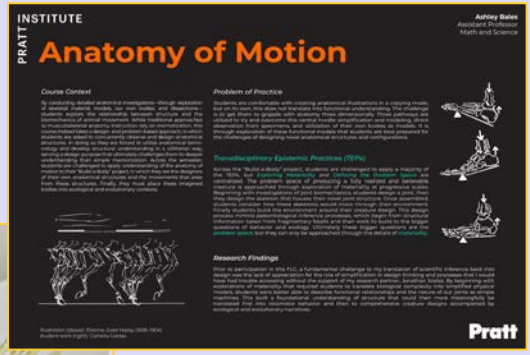
Exploring materiality



Defining the problem space

FLC member Ashley Bales

Gallery exhibition photos by Draven Zhao

Geometric cast masonry for ecological restoration

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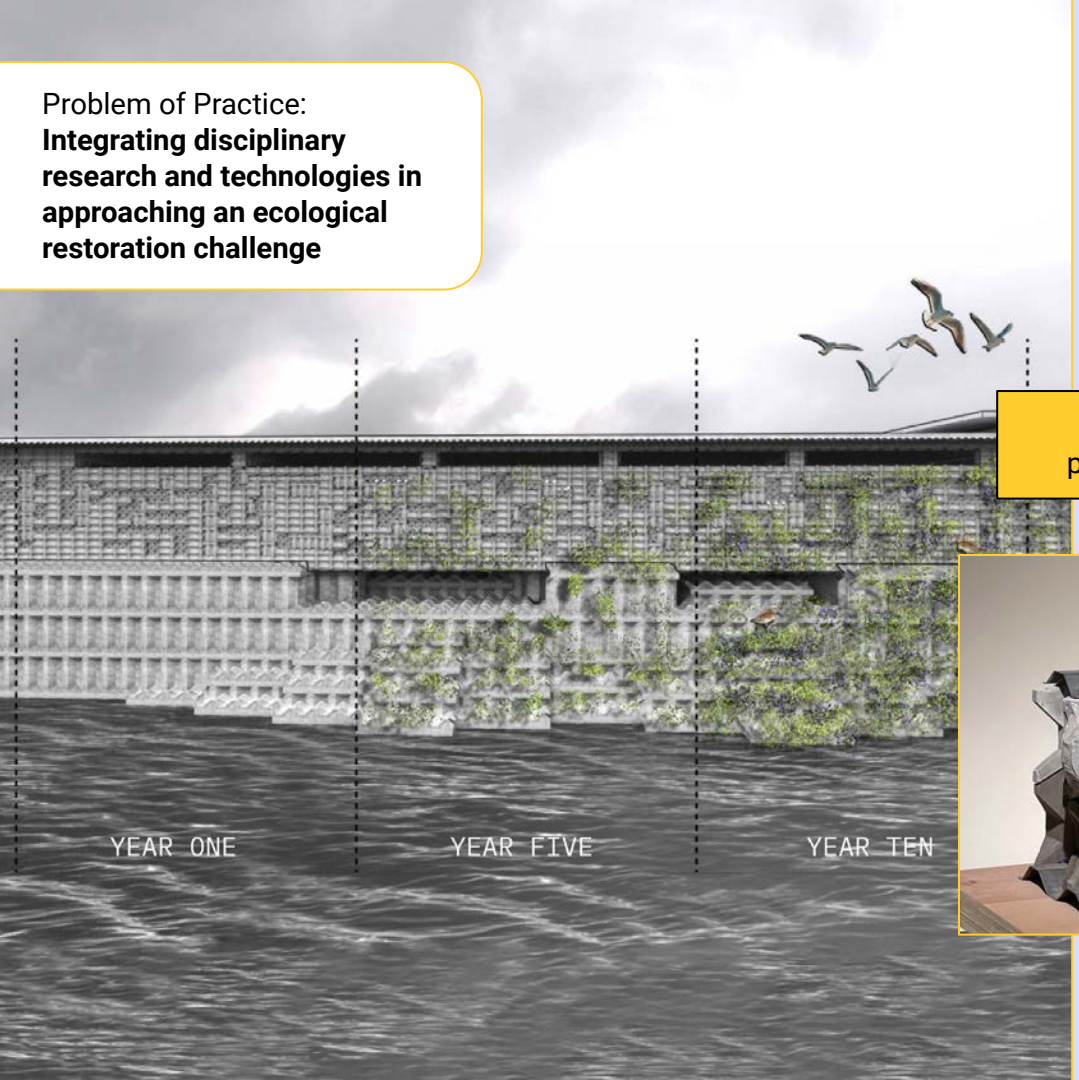
Problem of Practice:
Integrating disciplinary research and technologies in approaching an ecological restoration challenge



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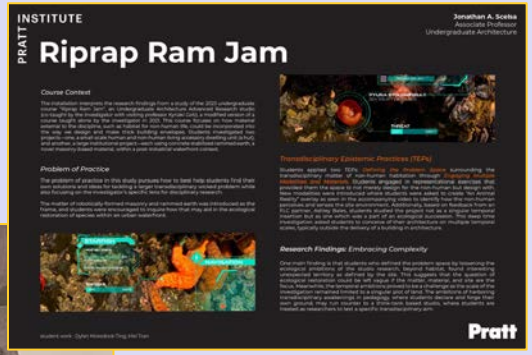
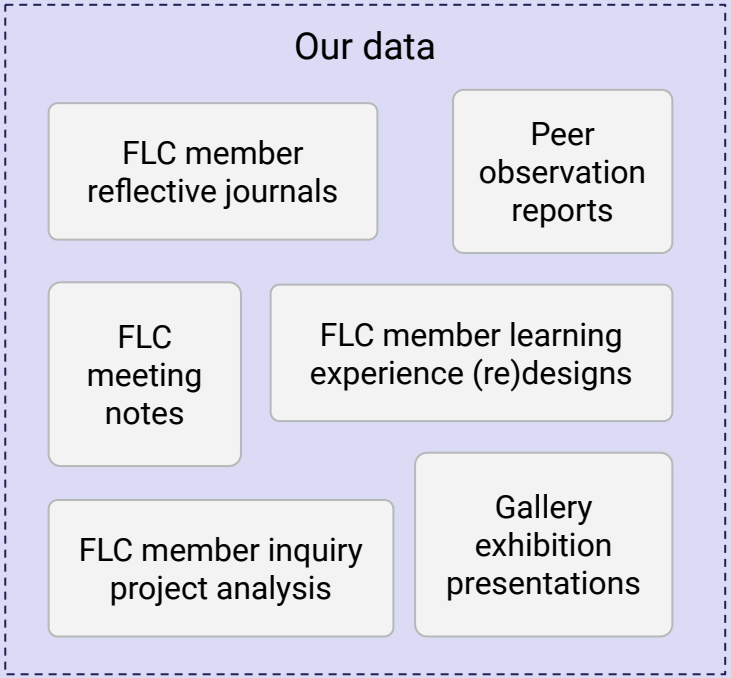


Engaging multiple modalities & materials

FLC member Jonathan Scelsa

Rendering and photo courtesy of Jonathan Scelsa

Qualitative analysis of our FLC data



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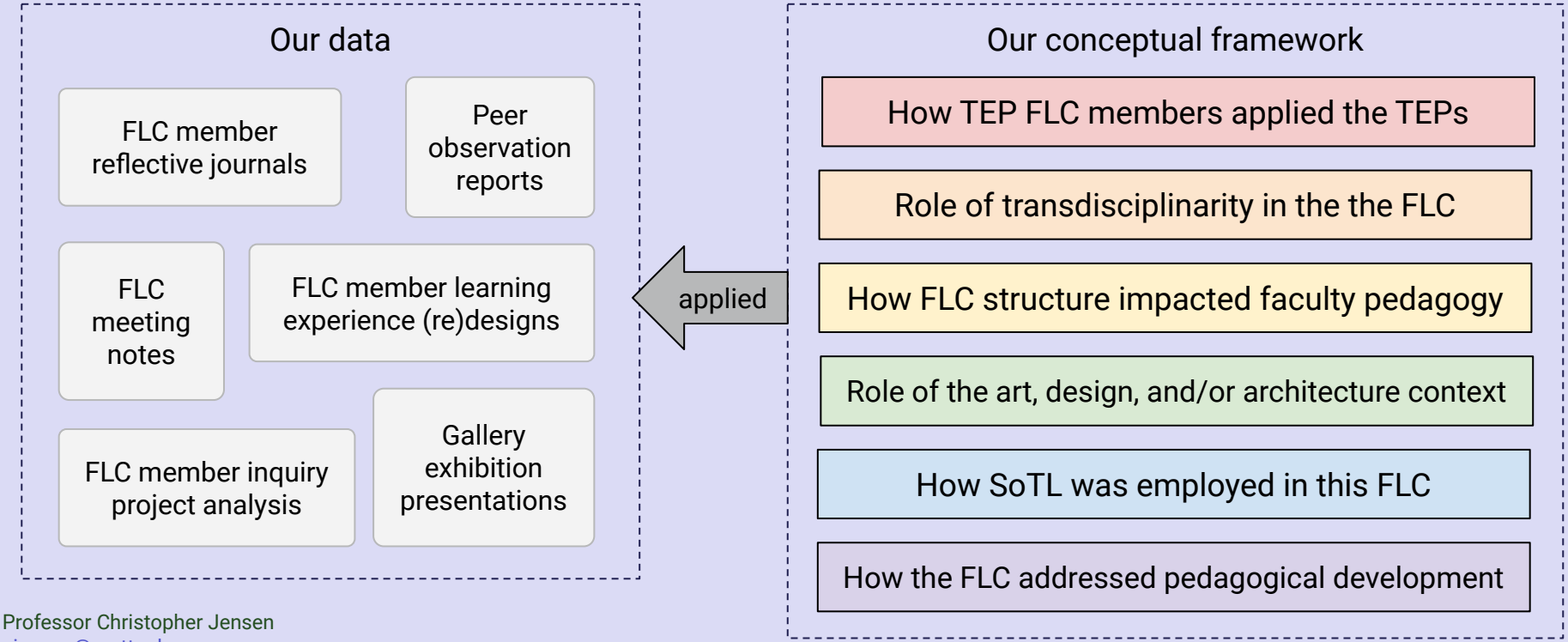

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Some emerging themes in our early analysis…

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- ★ *Naming practices enables transdisciplinarity* : Having a framework that faculty can build upon enriches the transdisciplinary learning experiences faculty offer in their courses.

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- ★ *Importance of articulation* : How the TEPs are interpreted and implemented depends heavily on how they are defined.

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- ★ *Transdisciplinary epistemic practices are not universal* : Our TEP framework appears to work well for making-based disciplines, but less well for other disciplines that might also be considered STEM-inclusive transdisciplinary.

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- ★ *Role of pairings in FLC curriculum development* : Transdisciplinary teaching is supported by working with peers from different disciplinary backgrounds, facilitating the cross-departmental collaboration that is crucial to true transdisciplinarity.

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- ★ *Transdisciplinary teaching is part of teaching* : Faculty striving to teach in transdisciplinary contexts must embed this work in their overall pedagogical development, which always includes disciplinary content and standards.

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Thanks!

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Mark Rosin
Heather Lewis
Chris Jensen

FLC Members
Ashley Bales
Leanne Bowler
Robert Brackett
Blake Marques Carrington
Rafael de Balanzo Joue
Regina “Gina” Gregorio
Nurhaizatul “Zat” Jamil
Jeanne Pfordresher
Jonathan Scelsa
Sophia Sobers
Keena Suh

Graduate Assistants
Medhaswi Paturu
Vandita Handoo

Guest Curator
Borinquen Gallo

Gallery exhibition photos by Draven Zhao

This work was supported by the *National Science Foundation* under Grant #2141287

Additional support provided by the Pratt Institute Academic Senate and the Pratt School of Information

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Pratt Institute, Brooklyn, NY

Transdisciplinary Epistemic Practices (TEPs) Framework

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Faculty Learning Community design

Semester 1	Semester 2	Semester 3
Shared reading of the literature	Consultation with the PIs	Reflection on & analysis of learning experience redesigns
TEP Framework exploration	Problem of Practice identification	FLC group gallery exhibition
Discussion of pedagogy	Collaborative groups process learning experience redesigns	Final reflection on FLC work
Extensive peer observation	Implementation of learning experience redesigns	

Applying the TEP Framework to a transdisciplinary problem of practice

Defining the problem space

Riprap Ram Jam

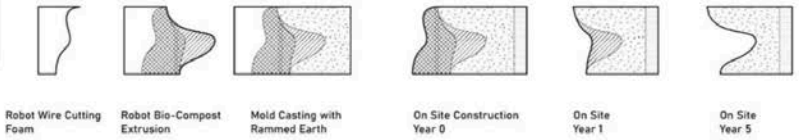
Jonathan A. Scelsa, Associate Professor, Undergraduate Architecture

Engaging multiple modalities & materials

Students considered ways in which emerging technologies could be applied.

How to use available technologies?

Students were asked to use multiple representational means to imagine how a designed space might be perceived and and encountered by other species.

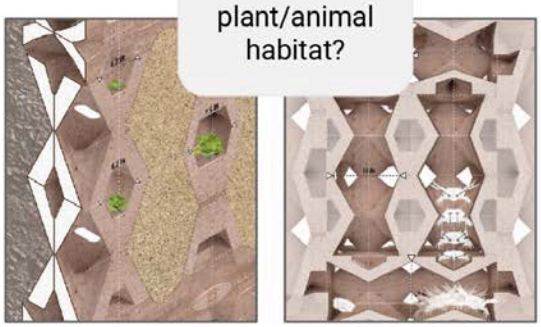


How to use low-impact raw materials?

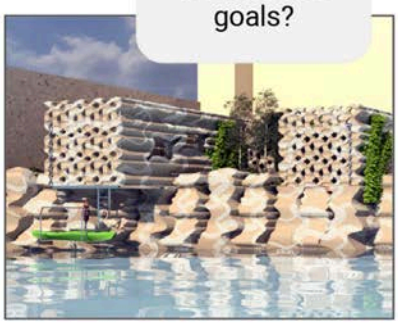
Students had to reconcile material considerations with the goal of fostering biodiversity.

How to create plant/animal habitat?

Students had to reconcile human needs with the needs of other species.



How to address architectural goals?



Contact Us!

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