CMS.S61/S97 - STEAM Learning Architecture:
A Framework for Educational Innovation
M-W - 10:30 to noon

Instructors: Dr. Claudia Urrea, Emily Glass, Joe Diaz, Kirky Delong

"The atmosphere at MIT is really what allowed me to
explore other fields of science, which has been key to the advances I've been able to make,"
Professor Moungi Bawendi

Course Description (short)

This course explores the creation of new learning environments and experiences through the lens of the STEAM Learning Architecture, a framework developed by pk-12 @ Open Learning to guide approaches to teaching and learning for educational innovation. The framework prioritizes student-centered, hands-on learning, rooted in the Constructionist theory that the most powerful learning occurs through discovery, exploration, and creation. Guest speakers and site visits will provide context for final projects that produce innovative learning experiences for k-12 audiences.

Course Goals

- Gain a broad understanding of educational innovation, including pedagogies, methods, and physical spaces
- Visit innovative spaces for learning and engage with guest speakers (K-12 and higher education)
- Apply theoretical and practical design principles to co-design an innovative learning experience and/or environment

Why This Course

This course provides a high level view of educational innovation with an eye towards hands-on learning, real-world application, and constructionism. It aims to address education of the whole person, taking into account social-emotional learning, learning beyond the four walls of the classroom, and big questions being asked in the world today. Students will synthesize what they learn from site visits, guest speakers, and design workshops to develop an innovative educational project of their own.

The course connects but does not directly overlap with others currently being offered in education at MIT, including in Comparative Media Studies and the Media Lab. There is a growing interest among MIT students for experiences in education and teaching so that they are better prepared for teaching opportunities that arise. The way this course is designed allows students new to the study of education to gain foundational knowledge, while creating opportunities for those already knowledgeable to deepen their understanding.

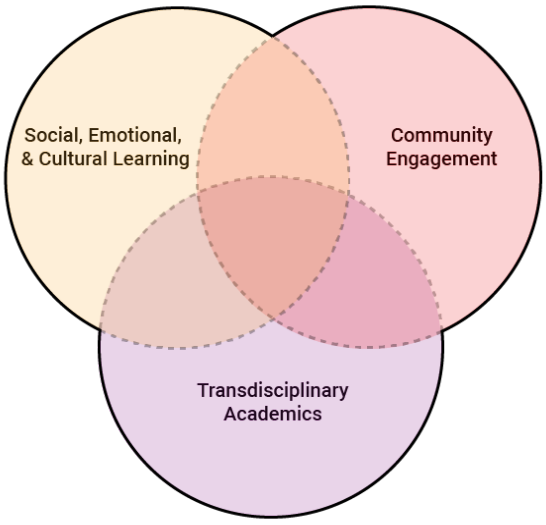
Learning Architecture Background

The original version of the Learning Architecture was developed as part of a collaborative effort between MIT, the Inter-American Development Bank (IDB), and the Belizean Ministry of Education, Culture, Science and Technology (MoECST) to open Itz'at STEAM Academy (ISA), a new high school in Belize City. The school is designed to be an innovative model for the country of Belize and the wider Caribbean region, with an explicit focus on STEAM and hands-on learning. The iteration produced for ISA (previously known as the Curriculum Architecture: Approaches to Teaching and Learning) was written as a foundational framework intended to guide the subsequent development of the school's program and curriculum.

The co-design process undertaken in the initial development of this document included visiting and studying a number of innovative schools and consulting with expert practitioners, primarily in the US. In generalizing the Learning Architecture for a wider audience, additional resources and programs were studied to expand the points of reference to include undergraduate learners. The resulting document is a broader framework intended to be used by any educational innovator who wants to design new, STEAM-focused learning environments and experiences.

Course Structure *(13 weeks)*

The STEAM Learning Architecture is built on three pillars: 1) Social, Emotional, and Cultural Learning, 2) Transdisciplinary Academics, and 3) Community Engagement, which provide the structure for the first half of this course.



At the beginning of the course, we will analyze the pillars individually through readings, guest speakers, and site visits that illustrate the pedagogies and program elements possible in each one. Next, we will explore how competency-based learning and assessment support the pillars by providing appropriate methods of evaluation and reflection. Finally, students will go through a design thinking process to brainstorm and conceptualize project ideas that they will carry through to the end of the course. *All project ideas must have a testable component.* Students will have the opportunity to playtest their project ideas with local students in their target age group, receive feedback, and refine their deliverables before a final presentation.

Assignments

- Weekly readings and short in-class assignments throughout the semester (20%)
- Site Visits with observation logs/ reports (20%)
- Positioning paper (20%)
- Final project (40%)
    - Presentation
    - Artifacts of learning
    - Final paper

Site Visits

Students are expected to participate in two or three site visits. The dates of those visits will overlap with one of the classes and will be communicated in advance for students to coordinate with their schedules. Possible visits in the Boston area include (during scheduled class time): Dearborn STEM Academy (Boston), Possible Zone (Boston), Christa McAucliffe Charter School (Framingham), The MET (Rhode Island). Possible international visits (to be scheduled during IAP, Spring break or summer) include schools in Belize and Colombia.

Calendar

- Mon/ Wed 10:30-12
- 2x 1.5 hr sessions/ wk can include speakers, workshops, design charrettes, site visits, etc.)

D	Weeks	Description	Assignments and Readings *(to be confirmed)*	Guest speaker/visits/ activities *(potential)*
M 2/5	1. Course Intro	• Intro to the course (and students) • Background (country, team, approach to the work, pedagogies, etc.) • Form groups for Wed workshop	• STEAM Learning Architecture: A Framework for Educational Innovation (executive summary, preface, and introduction) • Day in the life of the student at the school in Belize (vignette)	Teaching team. Potential guest speaker.
W 2/7	2. Ways of Learning	• Hands-on workshop • Teach the class to do something new • Reflection	• https://www.youtube.com/channel/UCY1kMZp36IQSyNx_9h4mpCg • Reading TBD • *Introduce first positioning paper assignment*	Workshop: Teaching team
M 2/12	3. Pillar 1: Social, Emotional, and Cultural Learning (SECL), part 1	• Applying SECL in a high school context • SECL at MIT	• STEAM Learning Architecture: A Framework for Educational Innovation (Chapter 1: Foundational Pillars and Core Practices: Student-centered learning and SECL) • Compassionate systems in schools Additional resources: • Supporting Social, Emotional, & Academic Development: Research Implications for Educators. • Teaching Adolescents to Become Learners, The Role of Noncognitive Factors.	Guest speakers: • Dr. Peter Senge, MIT • Prof. Pawan Sinha, MIT • Nadine Zaza, MIT
W/14	4. Pillar 1: Social, Emotional, and Cultural	Workshop led by members of the Center for Systems Awareness.	Resource: • California Impact: Compassionate Systems Leadership in Expanded	Workshop: • Dr. Lana Cook, MIT

	Learning (SECL), part 2		Learning	
T 2/20?	5. Pillar 2: Transdisciplinary Academics	Transdisciplinarity, inherent in STEAM education, requires stretching beyond the confines of traditional disciplines and encouraging students to engage with complex questions in a convergent way. A transdisciplinary approach is ideal for tackling the most pressing issues of our time, including climate change, biotechnology, design for the future, healthcare, global politics, etc. This session will pull from readings, case studies, and guest speakers to understand how schools can (and do) design a transdisciplinary approach to academics.	• STEAM Learning Architecture: A Framework for Educational Innovation (Core Practices: Transdisciplinary Academics) • Convergence Education: A Guide to Transdisciplinary STEM Learning and Teaching • Mindstorms—Children, Computers and Powerful Ideas. https://dl.acm.org/doi/pdf/10.5555/1095592. Additional Readings: • Ackermann, E. (2011) Piaget's Constructivism, Papert's Constructionism: What's the difference?	*Guest speakers: To be confirmed.*
W 2/21	6. Pillar 2: Transdisciplinary Academics, part 2	Hands-on workshop to explore different types of transdisciplinary learning, including Sustainable Development Projects (Belize), Studio-based learning	• STEAM by Design. Design & Technology Education • Big picture thinking: How to educate the whole person for an interconnected world. Additional readings: • Education for Sustainable Development: A roadmap.	Workshop: Emily Glass (Sustainable development projects)
M 2/26	7. Pillar 3: Community Engagement, part 2	A focus on community engagement provides students with real-world experiences that create relevance for learning and create opportunities for meaningful personal and academic growth by working on projects that generate tangible, positive outcomes for those around them.	• Postsecondary Outcomes of Innovative High Schools: The Big Picture Longitudinal Study	Guest speakers: • Rosa Weinberg, MIT • Kristy Chable, ISA • David Birnbach, MIT

		This session will pull from readings, case studies, and guest speakers to understand how schools can (and do) engage with the wider community.		
W 2/28	8. Pillar 3: Community Engagement, part 1	*Site Visit: Christa McAuliffe Charter School (TBC)*	• STEAM Learning Architecture: A Framework for Educational Innovation (Core Practices: Community Engagement)	
M 3/4	9. Key Learning Areas, part 1	Overview of Key Learning Areas with a guest panel	• STEAM Learning Architecture: A Framework for Educational Innovation (Chapter 2: Key Learning Areas) • Assignment due: School Visit Observation Log	*Guest speakers: To be confirmed.*
W 3/6	10. Key Learning Areas, part 2	In-class charette to design Key Learning Areas and career pathways	• IFTF Future Work Skills 2020 • OECD Dream Jobs Report	Charrette: Teaching team and David Birnbach
M 3/11	11. Key Learning Areas, part 3	*Site Visit: Dearborn STEM (TBC)*	• **Assignment**: Positioning paper due.	
W 3/15	12. Competency-based Learning and Assessment, part 1	Talk on competency-based learning and assessment, addressing how educators use different techniques in the classroom	• STEAM Learning Architecture: A Framework for Educational Innovation (Chapter 3: Competency-based Learning and Assessment) • reDesign. (2016). What IS the difference between competencies and standards? • Casey, K. (2018). Moving toward mastery: Growing, developing and sustaining educators for competency-based education. Vienna, VA: iNACOL. • Casey, K. & C. Sturgis. (2018). Quality Principles for Competency-Based Education.	*Guest speakers: To be confirmed.*

			Vienna, VA: iNACOL.	
M 3/18	13. Competency-based Learning and Assessment, part 2	• Alternate forms of assessment • Rubrics	• https://makered.org/beyondrubrics/overview/ • MIT Playful Journey Lab. (2019). MetaRubric.	*Workshop: To be confirmed.*
W 3/20	14. Innovative Models	Case study: International	• STEAM Learning Architecture: A Framework for Educational Innovation (Chapter 5: Program Design Approach and Conclusion) • **Assignment due**: School Visit Observation Log	*Guest speakers: To be confirmed.*
3/25-29	Spring Break			
M 4/1	15. Innovative Models	Case Study: USA	• Designing An Affordable New Educational Institution Students need to select a target population (local or international)	Guest speakers: • Rob Riordan, Co-Founder of High Tech High • Andrew Frishman, Co-Executive Director, Big Picture Learning
W 4/3	16. Design Process	Introduction to design principles	• Learning Architecture: Program Design Approach	Discussion and preparation for MIT tour
M 4/8	17. Innovative Spaces	*Tour of learning spaces (David Stephen)* • Making the Space for Learning • A space for learning: An analysis of research on active learning spaces		
W 4/10	18. Early Stage Project Ideas	Scenario building with specific user groups in mind– towards designing project ideas.	• On Design Thinking by Maggie Gram • Design Thinking by Tim Brown • Design Without Designers by Anne Burdick • Resource: Bruce Mau | 24 Principles f…	Charrette: teaching team

M 4/15	Holiday			
W 4/17	19. Concept Development	Brainstorming in working teams potential ideas for their projects. Begin to build out these ideas based on scenarios developed in the previous session. Define your framework and what informs the learning (profile of student, opportunities, interest, curriculum frameworks, etc.)	Due: potential scenario based on the target population, answering the questions, what is the opportunity/need? ● What's the Big Idea? Toward a Pedagogy of Idea Power (Seymour Papert)	Charrette: teaching team
M 4/22	20. Project Work/ Intro to PBL	Time to work on projects during class and get feedback from teaching team as well as peers	● Why PBL? Why STEM? Why now? an Introduction to STEM Project-Based Learning | SpringerLink	Teaching team and guests (FSA teachers, ISA teachers, Members of MIT K-12 community)
W 4/24	21. Intro to Playtesting	Learn about playtesting and prepare the team for facilitation, observation & data collection, and roles	● Moving Learning Games Forward	Guest speaker: ● Judy Perry, MIT
M 4/29	22. Project Work/ Intro to Inquiry and equitable practices	Time to work on projects during class and get feedback from teaching team as well as peers	● Teachers as Designers of Learning Environments: The Importance of Innovative Pedagogies, Educational Research and Innovation	Teaching team and guests (FSA teachers, ISA teachers, Members of MIT K-12 community)
W 5/1	23. Playtesting and Feedback / Project Work	*Time at the site (remote possibilities).* Test projects and get feedback from other students and guest participants.		
M 5/6	24. Playtesting and Feedback / Project Work	*Time at the site (remote possibilities).* Test projects and get feedback from other students and guest participants.		
W 5/8	25. Final project work	Reflection on playtesting and refinement of project ideas		Teaching team

M 5/12	26. Final Presentations and Review	Open House for students of the class to share with the larger audience **Final paper submission is due**