Day 1 - Monday, October 22 2018  
Location: Marriott Cambridge, 2nd Floor

8:30 am  
Welcome and J-WEL Updates  
Vice President for Open Learning Prof. Sanjay Sarma, J-WEL Executive Director Dr. Vijay Kumar and J-WEL Faculty Directors

9:45 am  
Work of the Future - joint session with Workplace Learning Collaborative  
Elisabeth Reynolds, Executive Director, Work of The Future Project, MIT

MIT is known for defining the course of technological progress. However, current total productivity gains do not seem to reflect the technological gains of the often-called second machine age. We will discuss how education has become a global bottleneck for progress and how dialogue between pK-12 educators and industry can lay down new pathways for education and employment.

11:00 am  
Welcome to pK-12 @ J-WEL Week!  
Prof. Angela Belcher, Prof. Eric Klopfer, and Dr. Claudia Urrea

Welcome from the pK-12 Collaborative @ J-WEL and participant introductions.

11:45 am  
J-WEL Grants  
Updates from the myriad of departments, labs, and centers on campus working in the pK-12 space. These include recipients of the latest cycle of J-WEL grants from the pK-12 Collaborative. The panel of grantees will include:

“The Compassionate Systems Framework & Community Development”  
Dr. Mette Böll and Dr. Peter Senge

Beginning in 2016, we have been working with the International Baccalaureate (IB) network to develop and prototype a “Compassionate Systems Framework” connecting systems thinking with social-emotional learning (SEL) and mindfulness practices across the pK-12 spectrum. In this
project, we will assess impact and identify best practices that can be extended within and beyond the IB.

“MIT BLOSSOMS Comprehensive Teaching Plans for Project-Based Learning (PBL)”
Prof. Richard Larson, Elizabeth Murray

The MIT BLOSSOMS program is an international education initiative that creates math, science and engineering video lessons for high school classes around the world. As a result of the J-WEL grant we received, we are currently moving in a new direction -- to provide high school teachers with the resources they will need to feel comfortable and confident in giving Project-Based Learning (PBL) a try. BLOSSOMS will develop ready-made packages that provide teachers with all the lesson materials and guidance they will need to work on a 3-4 week project with their students. These projects will allow students to explore the academic content more deeply while tackling real-world problems in a learning environment that encourages sustained inquiry, group collaboration, and self-management. Teachers and students using these PBL lessons will also have access to a Global Education platform, allowing them to share project activities and results with classes in other countries.

“The BioBits Pilot Program: Implementing Our Low-Cost Molecular Biology Educational Kits in Local Classrooms”
Prof. Jim Collins, Ally Huang

Hands-on activities illustrate molecular biology concepts to enrich learning and understanding for students. Currently, however, such activities are prohibitively costly and complicated for many schools because laboratory expertise and expensive equipment are required to handle the live biological components involved. Using low-cost protein expression technology, we developed BioBits, low-cost and easy-to-use kits that teach molecular biology lessons, allowing access to hands-on biology activities previously not accessible to low-resource classrooms. We are launching a pilot program to produce and distribute 100 of these kits in Cambridge/Boston classrooms to inspire student interest in biology and to gather user feedback to improve future kits.

“Tailoring STEM for Girls with Social Impact”
Prof. David Wallace, Dr. Larissa Nietner

Hands-on learning offers unique opportunities to engage girls in science class. Middle schoolers use tech every day. By empowering students to create sensing technology in a few simple steps, we can turn teens into passionate scientists and inventors. We’ll share NGSS-compatible lesson plans and research findings.

“Teacher Practice Spaces for Equity Teaching Practices”
Prof. Justin Reich

Great teachers know that learning requires practice; ironically, teachers themselves have limited opportunities to practice in low-stakes settings. The Equity Teaching Practices project creates a variety of practice spaces, inspired by games and simulations, that lets teachers rehearse for and reflect on important decisions in teaching. Our focus is on classroom practices that can support equitable student experiences and outcomes, including disrupting preparatory privilege, honoring intersectional identity, and asset framing.

“XRoads: Building Educator Capacity in XR”
Dr. Scott Greenwald, Prof. Eric Klopfer, Prof. Pattie Maes, Dr. Meredith Thompson

As technology becomes more affordable and available, virtual reality (VR) is poised to become a useful educational tool. The Xroads talk will feature applications of VR in educational contexts from two directions: game-based learning about cellular biology and project-based learning about co-creation of design projects

1:30 pm - 3:00 pm
Hands-On Learning at MIT

In the spirit of MIT’s “mens et manus” motto, join different labs, projects, and initiatives from all across campus for a hands-on experience of learning at MIT.

Cellverse – Learning Biology through Virtual Reality in K12
Dr. Meredith Thompson
Session held in building 26-153

The Education Arcade and MIT Game Lab have joined forces to create the Collaborative Learning Environments in Virtual Reality (CLEVR) project. During the session, we will describe our work in VR in K12 settings. Additionally, attendees will play a collaborative cross-platform game to explore a biological cell from the inside out using virtual reality (VR) and a tablet.

pSims: Inquiry-Based Science Education through Participatory Simulation Technology
Prof. Eric Klopfer
Session held in NE48-328

The notion of complex systems is central to many of today’s most pressing societal challenges, from tackling climate change to developing new pharmaceutical drugs to understanding the spread of diseases. Yet these complex systems are often hard for science educators because they are difficult for teachers to represent and for learners to access and explore. To address this challenge, the MIT STEP Lab has developed a suite of mobile-device enabled activities called pSims, short for Participatory Simulations. These pSims leverage networked mobile devices (mostly smartphones) to enable participants to engage in active, inquiry-based learning through
their interactions with the simulation, and coordination and discourse with one another. Using simple interfaces and player actions, the gameplay experience is relatively straightforward for individual players. Yet the collective parsing of the experience provides information about the larger underlying systems. This hands-on session will feature a new version of The Virus Game, and a discussion of this genre and its potential to impact learning new things in new ways.

BLOSSOMS
Prof. Richard Larson, Elizabeth Murray
Marriott Cambridge - Concept

Today’s students must learn science not through rote memorization but in a way that encourages engagement and discovery. MIT BLOSSOMS is developing a Blended Teacher Professional Learning program that will guide teachers in moving towards a pedagogy that can achieve this goal. In this workshop, participants will experience a physics lesson that is taught in a student-centered, active-learning style that encourages students to think and behave like scientists. To that end, participants will be encouraged to make predictions, develop hypotheses, ask questions, use models, carry out investigations, construct explanations, and engage in argument from evidence. Information will also be provided about the new MIT BLOSSOMS Blended Teacher Professional Learning initiative and the four other lessons under development as part of it in biology, chemistry, earth sciences, and engineering.

Promoting Experiential Learning and STEM skills with Makerspaces in K-12
Diane Brancazio
Session held in building 4-409 - Edgerton Center Student Project Lab

In this session, we will review Edgerton Center programs in Maker Education for grades K-12, specifically Maker Education. We will present the takeaways from our year-long effort (“Learning Supported by Making,” completed in August 2018) and share goals and activities from a new course we are piloting: “Master Making in the Classroom.”

Participants will engage in the process of designing a Maker project for a K-12 academic topic of their choice. Activities include browsing our IdeaBank of adaptable projects, reviewing physical samples of student-made projects, and trying out our methodology to design and plan a Maker project for a core academic class.

We will share resources that illustrate the many forms that a Makerspace/Innovation Lab can take in a K-12 environment and guides for setting up and operating a successful school Makerspace.

3:30 pm - 5:00 pm
Showcase
The Innovation Showcase will take place on Monday, October 22, at the Boston Marriott Cambridge in Kendall Square. The showcase is an open house for J-WEL members and guests to learn about the variety of educational initiatives and projects that take place at MIT as well as a select group of high-potential startups innovating in the field of education. Each organization will give a one-minute spoken pitch to the audience introducing their service or product, with Q&A, demonstrations, and discussion taking place at individual tables.

**Day 2 - Tuesday, October 23 2018**

**Location: Samberg Conference Center, Dining Room 4**

**9:00 am - 10:30 am and 11:00 am - 12:30 pm**

**Compassionate System Framework (practical session)**
Dr. Mette Böll and Dr. Peter Senge

This hands-on workshop is an introduction to the tools and approaches that have been developed for implementing what we call a “compassionate systems” framework, which integrates systems thinking, social-emotional learning (SEL) and contemplative practices. These tools are being used at both the level of classroom innovations and collective leadership in shaping a more generative school culture. In addition to introducing some of the tools in use, we will share examples from prototypes done with International Baccalaureate (IB) schools with the aim that participants can begin exploring how to shape similar prototypes in their own school and classroom settings. To support this, we recommend people come in teams where they can support one another moving forward.

**1:30 pm - 3:00 pm and 3:30 pm - 5:00 pm**

**Computation Across Subjects**

This session brings the MIT community together to share its work and engage with attendees in hands-on experiences around Computational Thinking. Members of different groups will briefly present the pedagogy and background ideas behind their work before facilitating a practical experience.

The session will begin with a short introduction from each group before moving to different tables to facilitate the hands-on session in smaller groups. They will repeat the hands-on session before bringing the group back together for a final reflection about the experiences and the implications of the different approaches.

**Scratch** - Dr. Natalie Rusk
[scratch.mit.edu](http://scratch.mit.edu)
Scratch helps young people learn to think creatively, reason systematically, and work collaboratively — essential skills for life in the 21st century. With Scratch, you can program your own interactive stories, games, and animations — and share your creations with others in the online community.

**App Inventor** - Josh Sheldon
The MIT App Inventor team enables computational action, giving students the ability to grow their agency, their computational identities, and their digital empowerment, by way of a mobile app building tool and activities that make use of that tool. By giving app builders powerful abstractions, and an easy to learn blocks programming language, we enable anyone, from novice to experienced programmer, to build apps that can impact their lives and the communities around them.

**STEMgem** - Dr. Larissa Nietner
[stemgem.com](http://stemgem.com)
The STEMgem kit consists of a modular smart device, which is connected to an online editor that can be used to create a graphical app, tweet about measurements, or even write new code. The device uses sensors for acceleration, temperature, humidity, pulse, and more to follow. This approach combines science, making, and coding in a new way that fundamentally changes students mindset and boosts learning.

The kit was designed to provide a suitable STEM learning experience to teen girls. Girls' self-efficacy and motivation in STEM subjects drop off in early middle school when they start to be very socially motivated. We extracted design requirements from literature on intrinsic motivation, engagement, and what social purpose means to teen girls today. These include relatedness, autonomy, optimal challenge level, perceived competency, continuous engagement, and meaningful objects. The concept of relatedness is mapped out between communication (social), sports/medical (health), and arts, and it is shown how this balance changes with age.

**Firefly** - Jose Gomez
Firefly was developed at Little Devices Lab for the rapid and affordable automation of biochemical experiments. Eliminating the traditional format of glassware and pipettes for assay work, they transform linear biological protocols (aka “cookbook” labs) into non-linear, parallelized biological exploration experiments. Students use Firefly robots to perform real-world experiments that can answer biological questions without expensive instruments or labs. Programming of the system is done in a multi-plane strategy where biological signaling is the driver of robotic behavior and coding is done first at the cellular and biochemical planes, followed by classical robotic programming and dynamical system design. Our current educational research is exploring ways in which students can create pharmaceuticals, sensors at the nanoscale, and gene libraries using a library of modular parts, robotic behaviors, and programmable biology. Additionally, we explore how robotics and biology can level the playing field and create more meaningful and accessible computational thinking opportunities to students of all socioeconomic backgrounds.

**StarLogo Nova** - Prof. Eric Klopfer and Daniel Wender
[scratch.mit.edu](http://scratch.mit.edu)
StarLogo Nova is an agent-based modeling programming environment that combines an easy-to-use blocks-based programming language with a powerful simulation engine and 3D renderer. StarLogo Nova is used in math and science classes from grades 4-12 to provide students with meaningful experiences of computational modeling in their specific subject areas. In this hands-on experience, participants will investigate two phenomena: disease transmission and natural selection. Starting from basic models, we will determine which aspects of these phenomena we want to investigate, and then will make model modifications, plan experiments, and gather data to draw our conclusions.

**TeachYourMachine** - John Strang
[teachyourmachine.com](http://teachyourmachine.com)

TeachYourMachine is an interactive experience that allows you to explore and participate in the deep learning process. It is intended to be used in middle and high school education to demonstrate the strengths, weaknesses, and quirks of machine learning.

**Day 3 – Wednesday, October 24, 2018**
**Location:** Beaver Works, NE45-201

9:00 am - 10:30 am; 11:00 am - 12:30 pm
Reimagining the Graduate of the Future - Justin Reich

Communities have always wrestled with the multiple purposes of education: to train young people for careers, vocations, and college; to prepare them for their roles as citizens; to develop habits of reflective, ethical adults; and to create a common experience in a pluralistic society while meeting the needs of individual learners. As the world changes and grows more complex, returning to these important questions of purpose can help guide schools in their growth and strategic change. To ensure our schools are effective, we need to routinely reimagine what the high school graduate of the future will need to know and be able to do. The artifact that communicates these ideas is called a graduate profile. Making explicit the capabilities, competencies, knowledge, and attitudes for secondary school graduates, and inviting key stakeholders like students and community members to be engaged in the process, can help you and your school to focus your vision of success and drive school innovation efforts.

MIT Teaching Systems Lab Executive Director Justin Reich will discuss how to guide teachers, administrators, community members, and others passionate about improving secondary school in the process of designing a graduate profile. The group will reflect on the purpose and goals of secondary school, as well as desirable characteristics for graduates. You’ll learn how schools have benefited from a graduate profile development process and begin the process yourself. You’ll learn more about your own context, its values, and beliefs.

*Note: Part I of the Day’s Exploration - “Who is the graduate of the future”?

1:30 pm - 3:00 pm
Reimagining Curriculum

Inquiry learning is a type of active learning where students become the drivers of their learning. Teachers prioritize student questions and ideas and give students the space to explore the topic individually or in small groups. Students are asked to use evidence-based reasoning and creative problem-solving to reach a conclusion or provide a solution to the question that they originally posed. From the teacher perspective, this style of learning helps improve student engagement, and teaches student critical thinking and understanding skills.

Kristina Heavey, Program Manager of the Scheller Teacher Education Program (STEP) and Alex Hargroder, Project Based Learning Coach and Designer (STEP), will lead members through a hands-on, interdisciplinary, inquiry lesson. Throughout the session, we will reflect on our experience in the lesson and use that experience to help design inquiry lessons for our classes. The session will provide tools, methods, and resources to help your students learn to ask critical questions.

Note: Part II of the Day’s Exploration - “how does s/he learn”?

3:30 pm - 5:00 pm

Reimagining Assessment

How do you assess “hard-to-measure” competencies that could be demonstrated in the process of authentic hands-on learning? This is one of the most frequently asked questions by educators who want to reimagine curriculum yet are unsure how to document rich evidence that is deeply embedded in the process of learning. Rubrics and portfolios are useful alternatives, but they are insufficient as they mostly focus on the final products of learning. With the current work with the Beyond Rubrics project at the MIT Teaching Systems Lab, we have been developing simple classroom assessment tools that allow students and teachers to rapidly document crucial moments of learning, growth, or even productive failures related to core maker competencies---agency, social scaffolding, design process, productive risk-taking, and troubleshooting.

YJ Kim (Assessment Scientist at Teaching Systems Lab), Louisa Rosenheck (Assessment Designer at the Scheller Teacher Education Program), and Yumiko Murai (Postdoc at Media Lab) will introduce our playful assessment approach to reimagine how we do assessment in schools—both regarding what and how. Participants will have an opportunity to try out some of the examples from the current NSF-supported research effort to gain a concrete understanding of useful features of assessment for the graduate of the future.

Note: Part III of the Day’s Exploration - “How do we assess learning”?

Day 4 – Thursday, October 25, 2018
Location: Marriott Cambridge

9:00 am - 10:30 am; 11:00 am - 12:30 pm
Strategic conversation around areas of interests

Landscape Reports
- STEAM
- Computational Thinking
- Compassionate Systems Framework and Socio-Emotional Learning
- Teacher professional learning
- Literacy

Day 5 - Friday, October 26, 2018

STEM Week in Massachusetts—selected “field trips” (optional add-on)