STEAM at the Library:
Supporting Youth and Lifelong Learning

American public libraries promote equality and opportunity by fostering literacy and skill acquisition throughout an individual's entire lifespan. Libraries have traditionally provided free, confidential assistance as patrons develop reading, writing, language, information and computer literacy. Libraries also foster the acquisition of skills necessary for a lifetime of satisfying employment. In 2018, a critical component of literacy is digital and STEM-related.

STEAM learning integrates any combination of STEM areas of study: Science, Technology, Engineering, and Mathematics as access points for inquiry, dialogue, and critical thinking. Additionally, it integrates STEM principles in and through Art (the "A" in "STEAM") and Design. Creativity and innovation, central processes in Art and Design, foster the creation and ingenuity that are also critical to STEM and to our economy and future.

The Cambridge Public Libraries (CPL) already offers some STEAM learning programs. We are expanding our offerings to build a robust **STEAM at the Library** program. Past programs for youth include building with robotic Legos, coding with Raspberry Pis, and in a collaboration with Akamai, students took part in a dramatic game, enacting network components to viscerally understand how the internet works. The Library also partners with Girls Who Code, a club offering computer science education and tech industry field trips to girls in grades 6-12 throughout the academic year. Additionally, Book Shop is an ongoing hybrid book group and makerspace workshop for youth.

The Library partners with Innovators*for*Purpose to teach various courses to middle schoolers, including 3D modeling technology, modeling concepts, and robotics. In the course last summer, students scanned physical models with the 3D scanner, printed these models with the 3D printer, and examined them in virtual reality. We are also participating in a PLIX Space Initiative with MIT and Harvard to help adapt curriculum materials for a public library setting to bring concepts and learning about satellites and space to our Cambridge youth. A recent library survey and feedback revealed that all ages (and genders) are interested in learning to code, so we are thinking of ways the CPL can expand its coding offerings.

In an innovation economy where the very nature of work is shifting, and a significant percentage of job sector growth is in STEM-related fields, guided experimentation with emerging technologies has become an essential bridge across opportunity chasms in our society. The CPL, which is open to the public 65+ hours per week across seven locations, is well suited to meet that need. The role of the Library to create learning opportunities for all residents from birth to end of life in a rapidly evolving creative, scientific, and technological landscape aligns naturally with the goals of Cambridge STEAM Initiative, a joint initiative of City of Cambridge's Department of Human Service Programs (DHSP) and Cambridge Public School Department (CPSD). It's important for public libraries to support innovators of all ages as they do their work. The Library can provide staff with the professional expertise to make these creative services available in a free and accessible manner.

To fulfill our mission of being a doorway to opportunity and learning, the Cambridge Public Library is committed to devoting resources in the form of space, expertise, networking, and learning opportunities for patrons of all ages to acquire and expand their STEM literacy skills. We will transform space at the Main Library to augment existing public service areas, build staff capacity by hiring and training, and build upon current STEAM programs at all library branches to create new opportunities for Cambridge youth and adults. The addition of these creative services, with staff expertise to help all residents take advantage of them, positions the Cambridge Public Library to support the City's and CPSD's commitment to STEAM for youth and lifelong learners.

STEAM at the Library Goals:

1. To introduce, expose, build awareness, and deepen* an understanding of what scientists, mathematicians, engineers, technologists, designers, writers, and artists do and how they work, especially STEAM professionals from diverse backgrounds (*following the Cambridge STEAM Initiative's introduction to immersion model)
2. To connect youth, emerging adults, and career changers to mentors, role models, and STEAM professionals
3. To provide seamless access to STEAM tools and learning opportunities for children and teens during out of school time
4. To teach coding, 3D modeling, robotics, and audio/video production to any resident who wants to learn regardless of socio-economic barriers
5. To focus outreach efforts to segments of the population who are underrepresented in STEM careers
6. To collaborate with community partners and build on existing relationships with schools and universities, City departments, businesses, and nonprofits.

To address the above goals, **STEAM at the Library** will include four components:

1) Physical renovations at the Main Library to support STEAM learning and access to technology and equipment;
2) Staffing to provide expertise and coverage of points of service;
3) Curriculum and programs designed to ensure that we are meeting patron learning goals and supporting the Cambridge STEAM Initiative's goals; and
4) Outreach to provide access to underrepresented populations.

IMPROVEMENTS TO SUPPORT STEAM

Innovation Lab ("The Garage")
A large, open space for collaboration and learning, multimedia work and for tinkering and training. There will also be separate, soundproof rooms providing flexible space for:
- Audio, video, and recording studios
- Mixing and editing work
- Virtual Reality (VR) and Augmented Reality (AR)
- 3D printing and other technologies

Technology Bar
The Information Commons (IC) was conceived more than ten years ago to meet basic public computing needs at fixed stations. Today, equitable access means offering mobile devices so patrons are free to sit anywhere in the Library, like their neighbors who own their own laptops. We will bring a new level of support and activity to this area at the Main Library by replacing a small service desk with a Technology Bar offering tech advice and device checkout, as well as seats for the public on one side and staff to assist patrons with questions on the other.

- Large screens will provide real-time inventory of an array of devices to check out, from mobile hotspots to Chromebooks
- Replace some existing seating with open tables or comfortable seats with laptop trays
- New sight-lines will allow for an array of printers, scanners and accessibility equipment
- Seating overall will increase in the area devoted to assisting the public with computing

Computer Classroom
The Computer Classroom is predominantly used as overflow space for the IC. By reducing the number of fixed computer stations, increasing the number of laptops, and adding seating in the IC, we can transform the classroom into a flexible space for STEAM programming. With the new lab space, we will significantly increase the amount and type of learning experiences we provide.

Specialized Creative Workstations at Main and Branches
Creation of moderated, flexible workstations in support of homework and out-of-school learning

- Specialized computers supporting advanced tools, such as CAD, multimedia editing, and Adobe Creative Suite software

Youth and Teen Spaces
STEAM programming, demos, classes, and workshops for children through age 13 will take place on the third floor of the Main Library, where there is ample space, and during scheduled times in the Garage and InfoCommons Lab, as well as in the youth space or program space at branch libraries. Teen programming will take place in the Teen Room, during scheduled times in the Garage and InfoCommons Lab, and in youth and program space at the branch libraries. Mobile hotspots will be available for families to borrow and publicized in both the teen spaces and children's areas. Additionally, all STEAM spaces will be available to youth at various times and for specific programs through coordination between managers.

Branches
Mobile STEAM equipment such as 3D technologies, robotics, and learning kits will be transported to the branches to support branch programming. Laptops and hotspots for lending will also be made available at the branches. Providing circulating laptops at the branches with less restrictive time limits will help to meet demand (desktop workstations have a two-hour time limit) and provide freedom for patrons without computers at home to sit anywhere in the library.

Replacing desktops with circulating laptops will also free up valuable space at the branches:

- Central Square: The Tech Center could be repurposed as flexible space to host activities such as STEAM programming, classes, or workshops.
- Central Square: One or two robust workstations featuring creative software and/or a 3D printer could replace basic desktops in the Children's Room.

- O'Neill: Laptops, specialized software and technology, and a large screen could be added to the Conference Room.
- O'Connell: One or two robust creative workstations could be added.

STAFFING

To design the curriculum, oversee programs, form partnerships, and fulfill outreach goals, we will add STEAM staff at the Library.

CURRICULUM/STEAM PROGRAMMING

The Library will develop curriculum and perform outreach, working closely with the Cambridge STEAM Initiative team to ensure our programs help the City and school district achieve its STEAM-related strategic goals. Working with the Community Engagement Team (CET) and community partners to perform outreach, we can do even more to ensure free and equitable access to STEAM learning opportunities to underrepresented and underserved populations across Cambridge. We are committed to offering an array of STEAM programs, from introductory to immersive, for learners of all ages.

We know that families, children, and teens spend a lot of out of school time in the City's public libraries. In support of the CPSD's curriculum, technology, and software that is compatible with the school's offerings will be available. The Library STEAM Program Manager will work closely with the Cambridge STEAM Initiative Director and team to support school-related curricular and strategic goals.

Here are some examples of envisioned **STEAM at the Library** programs and initiatives:

Artists & STEM Professionals in Residence
We will offer residency programs with talented writers, artists, designers, and scientists who will share and workshop their creative and scientific process with youth, families and the public. Perhaps we will inspire the next Lynn Nottage, Lin-Manuel Miranda, or Rainer Weiss to go forth and create.

Leadership Mentorship Program
We may recruit a diverse group of STEAM professionals to help to create and pilot a mentoring program for teens and emerging adults. This program will introduce mentees to various STEAM careers, skills-building workshops and learning opportunities, and will include personalized one-on-one demonstration, discussion, and learning time. The mentoring program will tie in with the Library's commitment to equity, diversity, and inclusion, as well as the Cambridge STEAM Initiative's guiding principle of access and equity. This program will also create a community of practice for both the mentors and mentees.

Designing, Computational Thinking and Robots
CPL will continue to partner with Innovators*for*Purpose to host and teach middle school and high school students design and computational thinking through digital storytelling and robotics programs.

Understanding Satellites
We are partnering with Wolbach Library at Harvard-Smithsonian Center for Astrophysics and MIT Media Lab's Public Innovation Exchange for Cambridge on a project geared toward youth and public development and awareness of CubeSats (small satellites) development. These partners are dedicated to bringing science education and maker culture to public libraries by creating a program where high school students can learn about astrophysics as it applies to CubeSats, small satellites launched by NASA, and contribute to the development of digital architecture for preserving research data collected from these types of small satellites.

Branches
In addition to supporting STEAM at the Main Library, the six neighborhood branch libraries will play an important part of introduction and exposure of STEAM learning for youth and families living nearby. This will include collaborations and strategies developed in partnership with local assistance programs, schools and services including Cambridge Housing Authority (CHA), DHSP's youth-serving programs, Agenda for Children, Center for Families, Baby University, and community-based organizations.

This may comprise of creating STEAM exposure programs at CHA sites or other locations, similar to the programs CPL conducted this summer introducing the library system to residents through welcoming events at the library. STEAM at the Library will also include mobile kits to go to the various branches, for example a 3-D modeling kit, a robotics kit, a coding kit for teaching, demonstrations and learning. Pop-up STEAM demos at branch libraries are also envisioned, such as cloud chambers that simulate how clouds are formed in a box and food "computers" that precisely regulate growing conditions of plants.

OUTREACH

Outreach is a critical element in the library's successful promotion of literacy in the community, and STEM literacy will be no different. In addition to designing and publicizing STEAM learning opportunities across our seven locations, we also plan to take programmatic elements out to other locations. For example, every summer librarians bring story time to the parks; we can build on those connections to bring STEAM experiences to residents through programming, such as exploring Raspberry Pi and engineering a recycled racer. Our Senior Services Librarian visits assisted living facilities every month, we would love to take our 3D printer on a road trip to provide a demonstration and inspire our senior residents to create something of their own design.

We are working closely with the Community Engagement Team (CET) to build stronger connections with new communities and diverse families in Cambridge. We are planning tours and an overview of services and programs (including STEAM) available at the Library for the CET and their clients. We have launched a Conversation Café for Spanish speakers. Each gathering will start with brief presentation about the opportunities at the Library and we plan to incorporate STEAM learning. The Library already partners with many community organizations and City departments to bring services and an awareness of opportunities out into the community. It is a natural part of our work which we believe can be highly effective at raising awareness of and interest in STEAM learning and careers.