Designing a Sustainable and Impactful Digital Literacy Ecosystem in Maryland through Learning Engineering: A Case Study of Pratt Adventure & Beyond

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conjecture map digital literacy digital navigator learning engineering Participatory Design train-the-trainer model

This paper presents the design and development of a hybrid train-the-trainer curriculum grounded in learning engineering principles to advance digital literacy across Maryland. Developed through a collaboration between the University of Maryland Extension, the College of Information Studies, and the Enoch Pratt Free Library in Baltimore City, the curriculum combines self-paced online modules with interactive, in-person workshops tailored to community needs. The initiative followed an

iterative, data-informed process that included needs assessment, prototyping, implementation, and continuous refinement based on learner feedback. Drawing on tools such as learner personas, conjecture maps, and participatory design practices, the project models how learning engineering can be applied to create scalable, sustainable digital equity programs through trusted public institutions like libraries. This work was originally presented at the 2024 ICICLE Learning Engineering Conference in Phoenix, Arizona.

Introduction

What does it look like to apply learning engineering principles and tools to design a sustainable and impactful learning experience? How can resources like conjecture maps, design journals, and learner personas—and practices such as human-centered design and iterative development—be meaningfully leveraged to support digital literacy training? This proceeding reflects on a yearlong effort by the Marylanders Online team[1] at University of Maryland Extension (UME) to design and pilot a training program for digital navigators at the Enoch Pratt Free Library (EPFL)[2] in Baltimore, Maryland. Now being scaled and prepared for national rollout, this program is under the evaluation process using both quantitative and qualitative methods. Grounded in iterative feedback, community engagement, and a strong commitment to inclusive learning engineering (LE) principles, this case study offers a practical example of how LE can shape hybrid learning experiences and train-the-trainer models in the digital literacy landscape.

Learning engineering (LE) is a powerful framework that integrates learning sciences, instructional design, data analytics, and iterative refinement to ensure that educational experiences are both responsive to learners' needs and scalable for broader impact (Dede, 2018). Developed in collaboration with University of Maryland Extension (UME) and the College of Information Studies (INFO), and funded by the American Rescue Plan, this curriculum design initiative—originally titled Pratt Adventure & Beyond (PAB)—was created to advance digital literacy, equity, and inclusion across the state of Maryland by leveraging the trusted infrastructure of public libraries and other anchor institutions. As the instructional designer leading this effort, I applied LE principles throughout the curriculum development process, ensuring that the training remained learner-centered, adaptable, and continuously refined through ongoing feedback. The result was a 10-module hybrid curriculum piloted at EPFL between March and December 2024. Recognizing its scalability and relevance, the

program has since been rebranded as the Marylanders Online Navigator Education Toolkit (MONET), with the addition of two new modules focused on AI literacy to reflect the evolving nature of digital competency. MONET with 12 modules in total is now expected to serve as a sustainable, flexible model for digital literacy training that can be implemented across diverse communities both within and beyond Maryland. With ten full-time digital navigators trained through this curriculum, the program is expected to support approximately 400 inquiries and serves an estimated 1,200 community members per month.

The original Pratt Adventure & Beyond (PAB) curriculum was developed using a participatory design process to actively engage digital navigators and library staff, ensuring alignment with their instructional challenges and the diverse needs of the communities they serve (Subramaniam, 2016). The iterative development cycle, guided by formative assessment data, usability testing, and direct learner feedback, enabled continuous refinement of the training modules to maximize engagement and effectiveness. Digital literacy topics were curated based on a comprehensive learner needs assessment conducted by the Marylanders Online team (Harding et al., 2024), as well as internal evaluations conducted at the EPFL. Delivered in a hybrid format, the curriculum comprises ten self-paced online modules, each reinforced through interactive in-person workshops. This blended learning environment promotes flexibility, active learning, and practical skill application. The modules target core digital literacy competencies, outlined below:

Table 1

All 10 Modules of the PAB Curriculum

Module Title	Description	Module Title	Description
Computers and Operating Systems	Basic computer functions, hardware, software, file management, and OS literacy	Mobile Devices	Navigation, settings, apps, and accessibility on smartphones and tablets
Internet and Web Browsing	Safe and effective internet use, search strategies, and browser navigation	Email and Communication	Creating and managing email accounts, digital etiquette, and communication tools
Productivity & Collaboration Tools	Using platforms like Google Workspace and Microsoft 365 for tasks and teamwork	Online Security and Privacy	Cybersecurity basics, password hygiene, scams, and protecting personal data
Telehealth	Accessing healthcare online, using portals, and preparing for virtual visits	Soft Employability Skills	Patron support skills such as active listening, empathy, and troubleshooting

Everyday Digital Skills	Practical digital tasks including online banking, bill pay, and tax filing	Remote Working and Learning	Tools and strategies for remote engagement, virtual collaboration, and time management

This paper further explores the concrete methodologies and tools from learning engineering practices that shaped the development of the PAB curriculum—now rebranded as the MONET curriculum. It positions this effort as a replicable model for libraries and anchor institutions seeking to bridge the digital divide through inclusive, data-driven, learner-centered interventions.

Methods and Discussions

Applying Learning Sciences

The initial phase of developing this program was rooted in the learning sciences, which form the foundation of learning engineering by offering insight into how people learn and how the human mind processes information. These principles provide the theoretical and practical blueprint for designing effective learning experiences (Goodell & Kolodner, 2022, p. 76). Given that this initiative is designed for digital navigators and librarians who face real-world challenges in their daily work, I adopted a blended constructivist approach that integrates key principles from situated learning (Clancey, 1995) and problem-based learning (Barrows, 1986). This approach positions learners as active agents who construct knowledge through meaningful engagement with their environments—particularly through concrete, problem-solving scenarios. These scenarios are tailored to reflect the specific digital literacy and patron support issues encountered in library settings. This pedagogical framework is especially well-suited for adult learners pursuing professional development, meeting the needs of both newly hired digital navigators and seasoned librarians as they navigate the evolving demands of technology support in today's libraries.

To achieve this, we identified the creation of immersive learning experiences as a pivotal element of the curriculum. These experiences enable librarians and digital navigators to engage with and explore pertinent 'problems' and scenarios that they are likely to encounter in their roles. Throughout the development process, we systematically gathered feedback from librarians to ensure that the workshop scenarios were as authentic and realistic as possible. This feedback harnessed a rich dataset derived from the diverse experiences of librarians who frequently interact with a variety of patrons and their respective support issues. As a result, we designed a series of scenario-solving and discussion-oriented in-person workshops that often feature demonstrations and engaging dialogues centered around real-world scenarios. For instance, one common scenario presented involves: "Mike, a 65-year-old Baltimore resident who recently retired, comes to the library seeking guidance on how to use Instagram to connect with his grandson. He has just received a Chromebook from the government, but this is his first experience using such a device." In this scenario, learners are expected to engage in group discussions that address both the hard skills required for using devices like Chromebooks and the differences between using them and

laptops or mobile devices. They also delve into how to navigate applications such as Instagram while incorporating essential soft skills for effective patron support. Conversations might include suggestions such as, “First, you should inform him about the basic Chromebook training workshop happening at EPFL,” or “Encourage him to complete a basic Instagram course module,” or “Sit alongside him to navigate Instagram together with patience.” Such dialogues foster active learning, allowing participants to apply their knowledge as digital navigators in real-world situations, thus enhancing their capacity to provide meaningful support to patrons.

Furthermore, recognizing that this initiative trains future trainers, the curriculum includes essential instructor-focused components, offering facilitation strategies and techniques called ‘digital navigator tips and tricks’ embedded in learning materials, designed to empower participants to lead their own training sessions effectively. By equipping digital navigators and librarians with the tools and confidence needed to facilitate these discussions, we aimed to foster a supportive community of practice that enhances digital literacy and navigation skills across diverse patron demographics.

Human-centered, Iterative Design Process

A human-centered approach is foundational to learning engineering, requiring a series of deliberate, iterative activities to deeply understand end users and their environments. These activities include observing users in context, consulting relevant literature, and conducting interviews to gain insights into user needs and challenges. Based on these insights, ideation involves generating design solutions grounded in the real-world experiences of users. These solutions are then translated into rapid prototypes that can be evaluated through user testing, with the goal of gathering preference and usability data from the intended audience. Feedback from these tests informs redesigns, progressively refining the prototype through iterative cycles involving increasingly realistic settings and a broader range of stakeholders, until a satisfactory, effective solution is achieved (Goodell & Kolodner, 2022, pp. 85–86).

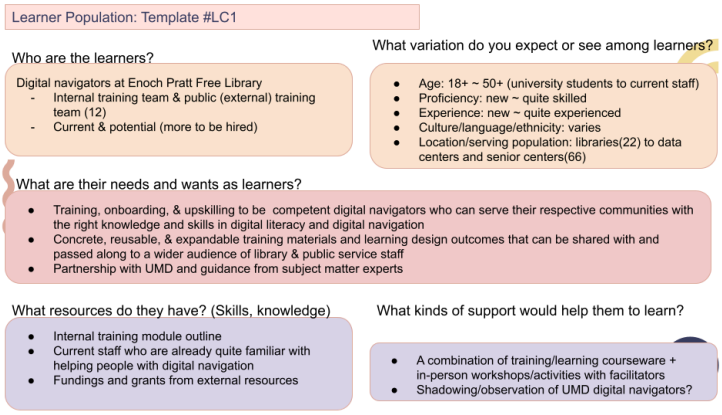
This methodology was a core component of the PAB curriculum design. We actively engaged practitioners and stakeholders at the EPFL, including newly hired digital navigators and seasoned internal training managers—both end users and those responsible for training them. For example, feedback collected during each session of the pilot phase was immediately integrated into the next iteration of the curriculum. One participant from the initial face-to-face workshop on Chromebooks recommended adding direct pop-up notifications to indicate correct or incorrect answers in the online modules. This suggestion was implemented in the third online module. Similarly, feedback on the realism of scenario-based activities led to adjustments that better reflected the authentic interactions digital navigators have with patrons. This iterative, learner-centered design approach remains central to the ongoing refinement and scaling of the curriculum at UME and beyond.

Additionally, the PAB design process was deeply informed by participatory design (also known as co-design), a key concept that aligns closely with human-centered design in learning engineering. Participatory design emphasizes the involvement of a diverse set of stakeholders throughout the development process—from early exploration and discovery to prototyping and testing (Goodell & Kolodner, 2022, p. 91). I adopted this approach to ensure that those most affected by the curriculum—digital navigators and support staff—had an

active voice in shaping it. This method is grounded in the belief that users bring essential expertise and lived experience, which enhances the relevance, usability, and effectiveness of the final product. As Subramaniam et al. (2016) note, participatory design fosters a sense of ownership among stakeholders and ensures that training tools are tailored to actual needs. This learner-centered, participatory methodology reflects a central tenet of the learning engineering community: that the design of learning experiences should be both evidence-based and co-constructed with those who will benefit from them.

Figure 1

Learner Population Needs Analysis.



Accordingly, I began with a thorough needs analysis of the target learner population to understand who they are, the context in which they work, and what they expect and need from a training experience (see Figure 1). This foundational inquiry involved collecting data through conversations with key stakeholders and examining the challenges faced by digital navigators and librarians, particularly those newly hired or transitioning into technology support roles. This learner-centered analysis shaped the direction of the curriculum, ensuring alignment with the actual tasks and digital literacy issues encountered in public libraries. Following the needs analysis, I reviewed and audited pre-existing training materials used by the EPFL internal training team (see Figure 2). These included onboarding documents, digital device tutorials, and internal cheat sheets. Rather than discarding these materials, I sought to enhance and reframe them based on collaborative feedback from practitioners, especially those already engaged in training or mentoring digital navigators. Once initial prototypes were developed based on the synthesized feedback and content audit, I conducted low-fidelity testing with stakeholders to evaluate usability and instructional clarity (see Figure 3). These sessions—conducted both in-person and virtually with several stakeholders—allowed me to collect direct feedback on everything from instructional flow to visual layout. This stage of the design process naturally aligned with a core principle of learning engineering: iterative development grounded in continuous feedback cycles. Specifically, I employed a design-based research (DBR) approach, which emphasizes iterative cycles of design, enactment, analysis, and redesign aimed at improving educational practice and generating contextually situated knowledge (Brown, 1992; Design-Based Research Collective, 2003).

One illustrative example of this feedback-driven design occurred during the pilot of our first online module. Initially, assessments were embedded without revealing correct answers, under the assumption that delayed feedback might promote deeper reflection. However, participants voiced a clear preference for immediate, in-context feedback with pop-up explanations. In response, I modified subsequent modules to include real-time feedback, making the assessments more interactive and helpful for on-the-job application. Another point of feedback related to the realism of scenario-based learning content; some users found initial drafts too abstract or disconnected from their daily experiences. Revisions were made to ensure scenarios closely mirrored real patron interactions, drawing directly from anecdotes and use cases provided by EPFL staff.

This continuous cycle of review, testing, and revision was not only critical for improving the quality and usability of the learning experience, but also central to honoring and building upon existing institutional knowledge. By consciously setting aside my designer ego, I approached the curriculum development process with humility and collaboration, leveraging what already worked while adapting materials to new needs. Throughout this process, the curriculum remained anchored in a participatory design model, where stakeholders were treated not merely as informants but as co-creators. Their sustained involvement fostered a collaborative and empowering learning design culture. Ultimately, this learner-centered and iterative design process resulted in a curriculum that is both pedagogically sound and deeply attuned to the real-world challenges faced by digital navigators and librarians. It continues to evolve as we expand implementation across the University of Maryland and beyond.

Figure 2

Review of the Pre-existing Training Materials and Drafted Ideas.

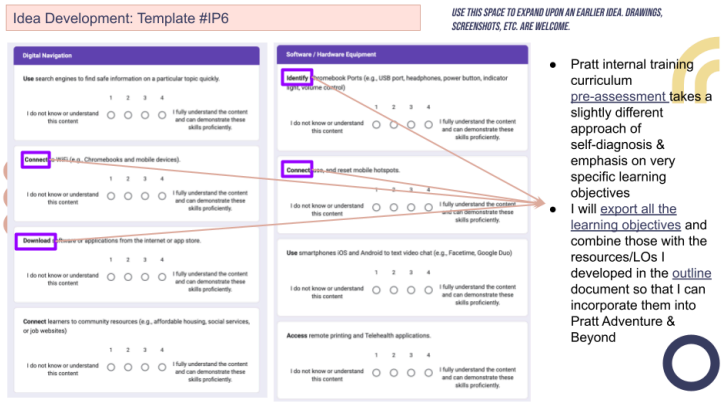
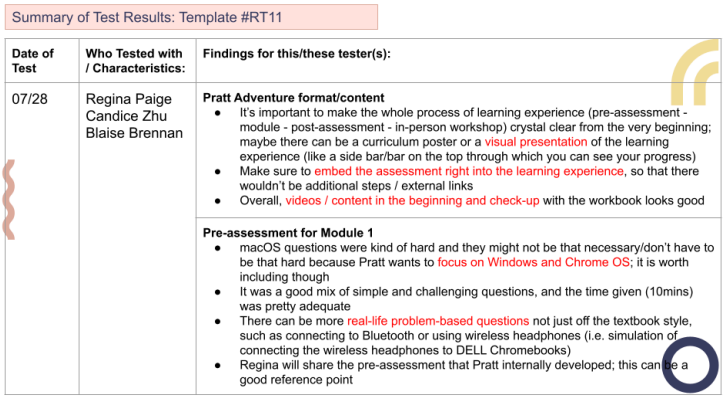


Figure 3

Prototype Testing Notes with Internal Stakeholders.



Summary of Test Results: Template #RT11

Date of Test	Who Tested with / Characteristics:	Findings for this/these tester(s):
07/28	Regina Paige Candice Zhu Blaise Brennan	**Pratt Adventure format/content** • It's important to make the whole process of learning experience (pre-assessment - module - post-assessment - in-person workshop) crystal clear from the very beginning; maybe there can be a curriculum poster or a visual presentation of the learning experience (like a side bar/bar on the top through which you can see your progress) • Make sure to embed the assessment right into the learning experience, so that there wouldn't be additional steps / external links • Overall, videos / content in the beginning and check-up with the workbook looks good
		Pre-assessment for Module 1 • macOS questions were kind of hard and they might not be that necessary/don't have to be that hard because Pratt wants to focus on Windows and Chrome OS; it is worth including though • It was a good mix of simple and challenging questions, and the time given (10mins) was pretty adequate • There can be more real-life problem-based questions not just off the textbook style, such as connecting to Bluetooth or using wireless headphones (i.e. simulation of connecting the wireless headphones to DELL Chromebooks) • Regina will share the pre-assessment that Pratt internally developed; this can be a good reference point

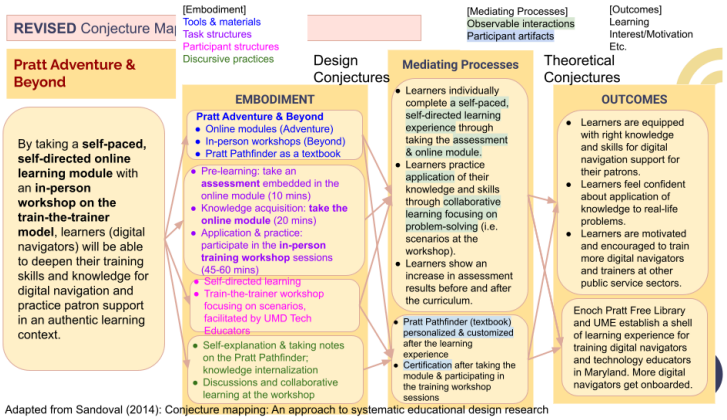
Using LE Tools of the Trade: Conjecture Map and Design Journal

In my work as a learning engineer, structured tools like conjecture maps and design journals have been essential for designing and refining educational interventions in a systematic, theory-informed, and learner-responsive way. Conjecture mapping, as defined by Sandoval (2014), provides a methodological framework that connects learning theory to design practice. It distinguishes between theoretical conjectures—grounded in learning sciences—and design conjectures, which involve the instructional strategies and technological supports embedded in the learning experience. By explicitly linking design elements to anticipated learning outcomes, the conjecture map supports rigorous, evidence-based design decisions that can be tested and revised through iterative cycles.

Conjecture mapping was instrumental in aligning curriculum development with core learning objectives from the outset for PAB. Before any instructional materials were built, I established an initial conjecture map that outlined expected mediating processes—such as peer discussion and hands-on device troubleshooting—and linked them to intended learning outcomes for digital navigators. After each prototype testing phase, I revisited this map to assess which components were functioning as intended and where revisions were necessary. This process helped maintain a continuous focus on learner needs while ensuring fidelity to foundational learning principles. The conjecture map also enabled more granular design planning by identifying key embodiment elements—such as tools (e.g., cheat sheets, device demos), task structures (e.g., scenario-based practice), participant roles (e.g., peer facilitator, observer), and discursive practices (e.g., reflective debriefs). These design features were then tied to observable learning processes and outcomes, creating a roadmap that could guide both design development and implementation evaluation (see Figure 4). Importantly, the conjecture map served not only as a design scaffold but also as a boundary object—a shared, visual representation that facilitated collaborative dialogue with EPFL stakeholders. During regular meetings, we used the map to collectively revisit our assumptions, review evidence from learner interactions, and co-decide on design adjustments. This collaboration ensured that the curriculum remained grounded in our shared goals while adapting to practical realities and feedback from the field.

Figure 4

Revised Conjecture Map for PAB.



Adapted from Sandoval (2014): Conjecture mapping: An approach to systematic educational design research

Complementing the conjecture map, the Design Journal was another critical tool throughout the project. Developed by faculty in the Master of Arts in Learning Engineering program at Boston College's Lynch School of Education and Human Development, the journal templates offered a structured way to document each phase of the design journey. The fill-in-the-blank format prompted me to capture initial design hypotheses, iterative revisions, user feedback, and the rationale behind each change (see Figure 5.1). These journals helped me maintain a clear, traceable record of the curriculum's evolution and supported reflective practice, especially when decisions needed to be revisited or explained to collaborators. They were also useful for ensuring feedback was not only collected but translated into actionable changes—keeping the design process both learner-centered and responsive.

Figure 5.1

Prototype Testing Template from Design Journal.

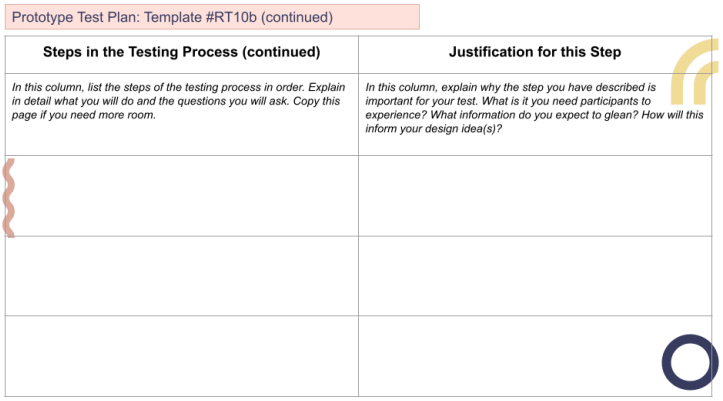
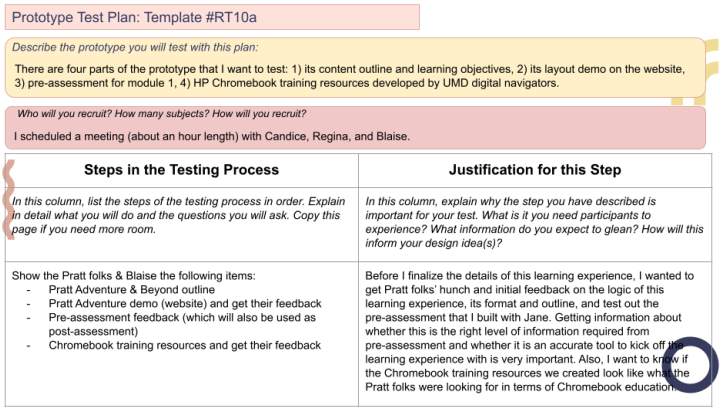


Figure 5.2

Prototype Testing Template Filled In.



Prototype Test Plan: Template #RT10a

Describe the prototype you will test with this plan:

There are four parts of the prototype that I want to test: 1) its content outline and learning objectives, 2) its layout demo on the website, 3) pre-assessment for module 1, 4) HP Chromebook training resources developed by UMD digital navigators.

Who will you recruit? How many subjects? How will you recruit?

I scheduled a meeting (about an hour length) with Candice, Regina, and Blaise.

Steps in the Testing Process	Justification for this Step
In this column, list the steps of the testing process in order. Explain in detail what you will do and the questions you will ask. Copy this page if you need more room.	*In this column, explain why the step you have described is important for your test. What is it you need participants to experience? What information do you expect to glean? How will this inform your design idea(s)?*
Show the Pratt folks & Blaise the following items: - Pratt Adventure & Beyond outline - Pratt Adventure demo (website) and get their feedback - Pre-assessment feedback (which will also be used as post-assessment) - Chromebook training resources and get their feedback	Before I finalize the details of this learning experience, I wanted to get Pratt folks' hunch and initial feedback on the logic of this learning experience, its format and outline, and test out the pre-assessment that I built with Jane. Getting information about whether this is the right level of information required from pre-assessment and whether it is an accurate tool to kick off the learning experience with is very important. Also, I want to know if the Chromebook training resources we created look like what the Pratt folks were looking for in terms of Chromebook education.

The value of these tools has extended beyond my own design process. For example, a Ph.D. student at the University of Maryland adopted the design journal template for her own participatory design study, and several professional track faculty at UME have begun incorporating these journals into their course planning workflows. This broader uptake speaks to the utility and adaptability of structured design tools in educational contexts.

In sum, tools like conjecture maps and design journals are more than optional supports—they are foundational instruments for carrying out learning engineering work in a rigorous and responsive manner. Together, they enable a dynamic design process that remains grounded in theory, shaped by data, and continually refined through cycles of testing and learner feedback. These tools helped ensure that the PAB curriculum not only met learning objectives but also adapted meaningfully to the lived experiences of librarians and digital navigators.

Values-Driven Design: Ethics at the Heart of LE

Lastly, it's essential to underscore that the core values at the heart of Learning Engineering—particularly its ethical commitments—were integrated into the PAB curriculum design process from the very beginning. Learning Engineering is inherently a value-laden practice: every design choice reflects assumptions and priorities that affect learners, educators, and the communities they serve. Ethical considerations should never be an afterthought. As Goodell and Kolodner (2022, pp. 209–210) argue, ethical sense-making in Learning Engineering involves recognizing that our work influences real people and systems. Their practical framework outlines key principles such as: acknowledging that design decisions impact communities; understanding that learning engineers are community leaders; and accepting that ethical tensions and conflicts of commitment will inevitably arise and must be surfaced and addressed.

In my role as a learning engineer, I carry a strong commitment to justice, equity, diversity, and inclusion—what I refer to as JEDI values. These ideals were central to the design of the PAB curriculum, which focused specifically on key populations often left behind in digital inclusion efforts, including older adults, residents of rural communities, and individuals from low-income households. Our guiding belief: digital skills should be universally accessible. Echoing the spirit of the beloved line from Ratatouille—"Anyone can cook"—we firmly believe that "Anyone can use technology." The rationale behind developing this flexible, template-

based training model—now being rebranded under the name MONET —is to ensure its sustainability and adaptability for diverse end users. More than a single-use curriculum, I desire MONET to contribute to a larger conversation about building a sustainable and impactful digital literacy ecosystem, one where all learners have the opportunity and the tools to build technology skills on their own terms. Importantly, our vision goes beyond the EPFL community or even Baltimore City. We intend for this curriculum to be adopted and adapted by other libraries, nonprofits, and community organizations across the state—and potentially the nation. By building a framework that is both durable and flexible, we aim to foster a learning ecosystem that can thrive even after initial grant funding ends or the original team moves on. Through this values-driven and community-grounded approach, we hope to leave a lasting legacy that empowers individuals and institutions to continuously expand digital access and literacy, and in doing so, move us closer to a more just and inclusive digital society. The lead author is currently serving as Principal Investigator on a study (pending approval from IRB) to evaluate the effectiveness and impact of the MONET curriculum on digital literacy outcomes. Findings from this research will be shared in future publications and presentations.

[1] https://marylandersonline.umd.edu/home/

[2] https://www.prattlibrary.org/

Acknowledgments

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