Employment Pathways For Emerging Talent: Evaluating The Certificate In Computer And Data Science (CDS)

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EMPLOYMENT PATHWAYS FOR EMERGING TALENT: EVALUATING THE CERTIFICATE IN COMPUTER AND DATA SCIENCE (CDS)

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ABSTRACT

This research paper presents the results of the first evaluation of the learning experience, challenges and opportunities of the Certificate in Computer and Data Science (CDS). Specifically, it evaluates two different real-life experiential learning opportunities (ELOs): supervised internships and self-guided projects.

MIT Emerging Talent, an initiative that expands upon the efforts of the MIT ReACT (Refugee Action Hub), provides talented learners a platform to advance their skills, leverage their expertise, access a professional career, and become leading change agents in their communities. The CDS is a 12 month-long online learning program that opens education to employment pathways for emerging talent, including refugees, displaced populations, and underserved communities worldwide. The program combines rigorous academic curriculum, immersive skills workshops, networking events, mentor support, and experiential learning opportunities to provide learners with the knowledge, hands-on skills and experiences needed to accelerate their learning and professional journeys.

Quality education, work readiness, networking, and local support are critical for emerging talent to overcome the challenges they currently face and grow personally and professionally. Programs offering such opportunities and their impact are still poorly studied. In this paper we present the complete CDS learning journey and results from surveys and interviews to learners and program staff regarding the supervised internships and the self-guided projects. The paper concludes with recommendations and future steps.

1 INTRODUCTION

1.1 Opportunities for Emerging Talent

The world is at a pivotal moment. Current environmental, socioeconomic, and technological challenges are requiring humanity to be more sustainable and adaptable [1]. At the centre stage, to make it possible, is high-quality and opportune education [2,3]. However, neither the conditions nor the resources necessary to promote learning are evenly distributed in the world. In 2021, only 50% of children at scholar age attended upper secondary school or higher education [4]. This percentage drops to 40% for tertiary education enrolment [5], and is lower in low income, underrepresented communities [6]. Evidence suggests causality between education and socioeconomic empowerment, and sustainable development [7].

All around the world, people from historically excluded or underrepresented backgrounds, including refugees, displaced, underserved and conflict-impacted communities, have several of their basic needs unmet, including education [1,6]. Nevertheless, their resilience and unwavering spirit allow them to overcome such struggles and forge a promising future, if properly nurtured, to become agents of positive change. We refer to these stars as *emerging talent*. To nurture this talent, programs offering high-quality training, socioemotional support and connections with the job market are necessary.

1.2 MIT Emerging Talent

MIT Emerging Talent is an initiative at the Massachusetts Institute of Technology (MIT) that develops global education programs targeting talented individuals from the most challenging circumstances. This initiative expands upon the efforts of the MIT Refugee Action Hub (ReACT), which has offered the Certificate in Computer and Data Science (CDS) to more than 200 learners in the last 5 years [8].

Globally, there are several programs offering training and support to emerging talent. Programs focused on high-tech technical skills, usually cover coding and data science but lack mentoring and human skills training [9-10]. Conversely, programs with a strong community building and human skills component usually cover vocational training [11,12]. In general, these programs are evaluated via their mid- to long-term impact, but few include deep programmatic assessment nor combine technical and human skills training. In this research paper we present the first evaluation of the learning experience, challenges, and opportunities of the CDS.

1.3 The Certificate in Computer and Data Science (CDS)

The CDS is a one year long online learning program (offered in English) that bridges education and employment for emerging talent following the Agile Continuous Education (ACE) model; namely it combines individual learning, group learning, and a real-life mentored experience [8]. The program has four core offerings: Academics, Human Skills, Experiential Learning, and Networking. These offerings are achieved via synchronous and asynchronous academic activities, synchronous networking events, mentor support, and experiential learning opportunities (Figure 1). The program is open to refugees, internally displaced persons, and low income, historically marginalised learners over the age of 18 years old.
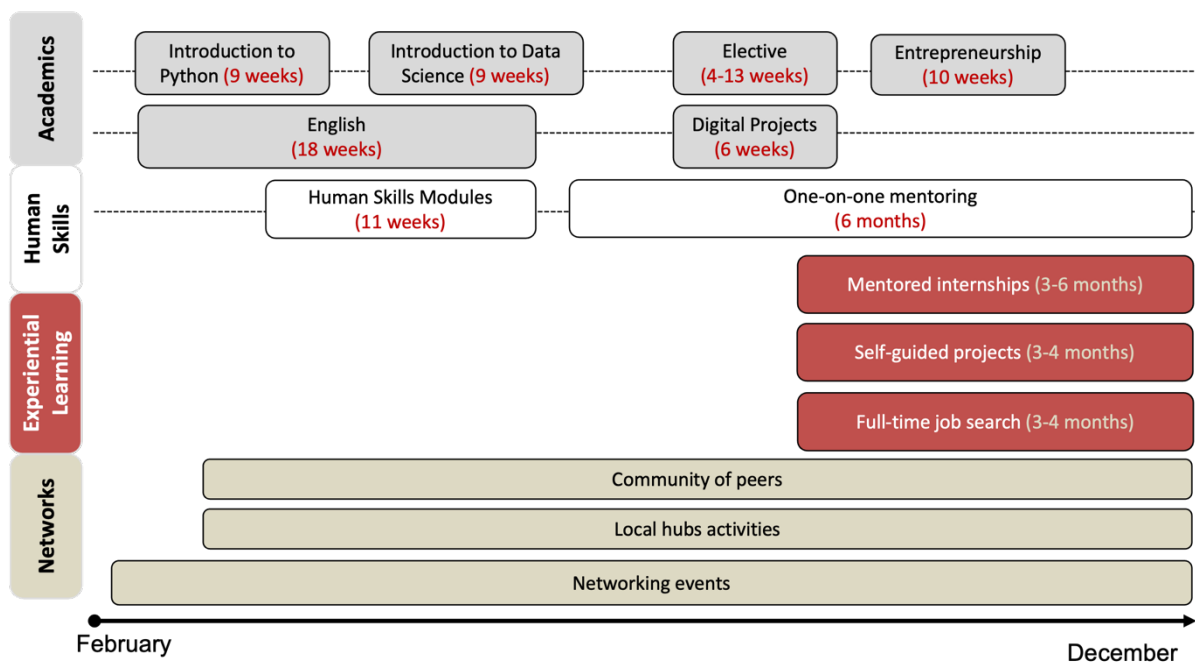

Fig. 1. The CDS Certificate core pillars – academics, human skills, experiential learning, and networks – and main program activities.

● Academics

Table 1 presents a detailed description of the core academic activities.

Table 1. Core academic activities for the CDS

Online, asynchronous, instructor-paced courses (2 courses)	*MITx Introduction to Computer Science and Programming Using Python* and *MITx Introduction to Computational Thinking and Data Science* courses (each requiring 15 hours/week, for 9 weeks).
Elective online course (1 course)	Learners were required to choose one elective from *MITx digital course library* to upskill in a field of their interest
English support	Learners were offered optional *English language lessons* and *one-on-one tutoring* through the NGO Paper Airplanes. Activities lasted 18 weeks, with a commitment of 5 hours per week.
Digital projects workshop (6 sessions)	Learners were invited to a *data science workshop* (six, two hours-long sessions) on web scraping, data cleaning and analysis; results presentation, and project management and collaboration.
Entrepreneurship	A subgroup of learners (10) participated in the *MIT Innovation Leadership Bootcamp*, an online, synchronous, 10-weeks long program focused on identifying an innovation opportunity, a solution, and selecting a business model.

● Human Skills

Training in human skills and mentoring was supported by Na'amal (Table 2).

Table 2. Human skills activities

Online synchronous human skills modules	Learners had access to 11 optional *online synchronous workshops* (1.5 hours each, offered 3 times to align with 3 different time zones) on planning, teamwork, communication, remote work, self-management, conflict resolution, and work in culturally diverse settings. The workshop videos were also available later, asynchronously.
One-on-one mentoring	Learners were paired with a mentor with similar cultural and personal background, to provide professional and personal mentoring.

● Experiential Learning Opportunities

The last 3-4 months of the program, once the technical training was completed, learners applied their skills and knowledge via an experiential learning opportunity (ELO). There were three different ELO modalities: paid mentored internships, self-guided projects, and full-time job search (more details in Table 3):

Table 3. Experiential Learning Opportunities (ELOs)

Paid mentored internship	Learners applied their skills at the workplace, built up their resume, and created connections with the local job market to, ultimately, get a full-time job. MIT Emerging Talent provided access to company databases, some internship opportunities, and connections with local partners, but learners were in charge of finding the internships (of minimum 20 work hours/week, for 3 months). Most host companies and interns were in different locations. Eighteen (18) learners from the cohort participated in the Global

	Apprenticeship Program (GAP), an initiative led by [The Intern Group](#) (TIG), that connects learners and companies with remote paid internships. For more details on the GAP initiative refer to Salazar-Gomez et al [13].
Self-guided projects	Learners with previous job experience, a full-time job, or without the time availability for an internship, proposed an individual or collaborative project. These projects allowed learners to improve their portfolio and confidence using the knowledge and tools learned in the program.
Full-time job search	Some learners needed to immediately find a full-time job, so MIT Emerging Talent offered this ELO to facilitate their employment search.

- **Networking**

Table 4 describes the networking activities, including local and remote events.

Table 4. Networking activities

Facilitated synchronous events	The program team organized synchronous online events throughout the program to promote engagement and community building, and to assess challenges and opportunities experienced by learners.
Community of Peers	Beyond the facilitated events, program participants were encouraged to build a network of support and friends to keep everyone engaged via Slack and LinkedIn channels.
Local Hubs	Where available, learners living nearby (same city) were connected with local partners (NGOs, employers, and higher education institutions) that provided spaces to meet in person, and plan community building activities.

2   RESEARCH METHODOLOGY

2.1 Program evaluation and assessment

All research activities were approved by MIT's IRB office. All participants (learners, industry mentors, supervisors, and program staff) were invited via email communications. Informed consent was provided to all research subjects.

- **Questionnaires and interview prompts**

Surveys and interviews were used to collect data regarding content, pedagogies, technology, and socioemotional support with emphasis on the supervised internships and self-guided projects. Pre- and post-questionnaires were deployed via Qualtrics; and interviews were done via Zoom. Surveys were deployed for learners, industry mentors, supervisors, and staff while only program staff were interviewed.

Pre-questionnaire: Learners were asked about their prior knowledge and mastery of technical and human skills (pre- and post-CDS), work/internship experience, what worked and did not work with the different CDS academic activities (pre-questionnaire was deployed right before the ELO), what their chosen ELO was and what were their ELO expectations prior to it. Internship mentors and supervisors were asked about their experience as a manager, their mastery leading teams and individuals from culturally diverse backgrounds, and the expected skills and content knowledge from interns. Program staff were inquired about the foreseen program

challenges and opportunities, the elements of technical preparedness offered by the program, and factors supporting or affecting a successful ELO.

Post-questionnaire: <u>Learners</u> were asked about their mastery of technical and human skills, those that were key in their ELO, and the usefulness of the CDS activities and courses. They were also inquired about the ELO challenges and opportunities, their relationship with the supervisor, and satisfaction with the ELO. <u>Mentors and supervisors</u> were asked about their mastery level of coaching skills, the skills and knowledge considered important for the ELO, how support and feedback were provided, and how the ELO goals were set and met.

Interviews: <u>Program staff</u> were asked about the overall program perception, what worked and did not work, and how the relationship with mentors was. Staff were also asked about the ELO challenges and opportunities, the role of the local support mechanisms (if available), and the process of finding internships, defining projects, and supporting the job search.

3 RESULTS AND RESEARCH FINDINGS

A total of 94 learners, 21 supervisors (some oversaw several interns), and 7 program staff were invited to the surveys. A total of 11 (11.7%) and 10 (10.6%) learners, and 4 (19%) and 2 (9.5%) supervisors responded to the pre- and post- questionnaires, respectively. Two (2) program staff (28.6%) answered the pre-questionnaires and four were part of a deep exit interview. Given the low survey response rate, the following findings derive from the learners' enrolment and completion data as well as from the interviews and mixed method surveys.

3.1 Learner participation and program completion

The 2022 CDS cohort program took place in 2022. From a total of 1000 complete applications (3000 incomplete), 135 (13.5%) learners were accepted (by a committee of experts) and enrolled in the program. The admission criteria for the open call for applications included English fluency, interest in computer and data science, openness to collaboration across cultures, inclination towards social impact, problem-solving mindset, and math and statistics knowledge.

After two months of core academic activities, 94 (69.1%) from those enrolled continued participating. The program was completed by 65 (47.8%) learners. Completion required finishing the core academic courses and the ELO. Program attrition is an issue that reflects the pressing conditions some of this emerging talent is exposed to: no access to a computer, electricity service, or internet connection; time constraints due to other obligations including caring for family members and working several shifts; housing instability and more.

3.2 A global community of talent

The CDS is a global program: Figure 2 presents the locations for enrolled learners (135 in 31 countries), those that completed the program (65 in 28 countries), and the offices of the 20 companies (13 countries) hosting remote internships. Learners come from Africa, Asia, North, Central and South America, and Europe, with

program local hubs in Afghanistan, Colombia, Greece, Jordan, Uganda, Uruguay, and USA.

*Fig. 2. Location of Learners **enrolled** and **graduated**, and **internship host companies.***

3.3 Program opportunities and challenges

Opportunities: Learners and staff highlighted upskilling in time management, communication and autonomy, teamwork, and digital literacy. The digital projects workshop was very useful for learners working on self-guided projects. The GAP experience proved successful to support CDS in finding paid internships. Active local hubs provided support and engaged with learners in their context and program staff highlighted the need of more local partners. The program provided means to promote community building and peer-to-peer learning.

Challenges: The learners' local socioemotional and economic conditions (limited access to technology, mental and physical health, displacement, lack of spaces for studying) make program participation challenging. Engagement between the MIT ReACT and Emerging Talent community and learners needs to be improved (for support and technical advice related to courses and projects). Producing content and activities engaging to learners in all ends of the professional spectrum is an unsolved issue (especially for learners seeking more challenging, in-depth, data science knowledge). Internships were the preferred ELO for most learners but finding them is one of the biggest challenges for the program, due to the program's small staff size. Engaging supervisors to be proper mentors was also challenging. Staff further highlighted the need to develop curriculum and learning activities that better link to skills needed for employment opportunities. Finally, high program attrition was correlated with low engagement throughout the whole program, with some staff mentioning approximately 50% of the enrolled learners not responding to their emails nor participating in the synchronous activities.

3.4 ELOs: supervised internships, self-guided projects, and job search

In 2022, 30 learners completed internships (18 as part of the GAP [13]), 25 worked on projects, and 10 focused on seeking full-time employment. The ELOs allowed

learners to improve human skills such as communication, teamwork, and remote work. ELOs also helped learners to build a portfolio and improve their technical knowledge in tools and platforms used in the labour market (i.e. Github, Slack). CDS-GAP interns and supervisors were trained by TIG and MIT Bootcamps [13].

- **Supervised internships**

Opportunities: Most internships were remote 24 (80%), 5 (16.7%) hybrid, 1 (3.6%) in-person. Learners felt welcome in the companies. The internship provided learners with a confidence boost in their skills and capabilities and offered professional and cultural experiences. Interns improved their communication, leadership, teamwork, remote work, and relationships skills. Additionally, most internships were good matches and interns highlighted their overall learning value. Some supervisors highlighted the interns' curiosity and eagerness to learn.
Challenges: Some learners were not proactive and relied on program staff to find internship opportunities. Some companies did not involve supervisors in the hiring process, adding challenges to define the internship goals. Moreover, several supervisors were changed throughout the ELOs, affecting the learning experience. Additionally, it was not clear if interns and supervisors codesigned the internship.

- **Self-guided projects**

There was a total of 9 independent and 5 collaborative (of 4-5 learners per group) projects presenting the following results:

Opportunities: Learners got experience in project management, including problem evaluation, ideation, timeline definition and assigning tasks. They used different programming and data science tools and overall improved their portfolio. Collaborative projects promoted interactions across different cultures and improved collaboration skills. The projects provided flexibility to learners with other obligations, like full-time commitments or other studies (e.g. enrolled in undergrad programs).
Challenges: Program staff highlighted the need to improve the pedagogy around the projects, so it better fosters the desired skills. It was hard for learners to define the right scope of projects for a timeline of 3-months. Moreover, connecting learners with technically experienced mentors was not always possible. In the collaborative projects, learners had issues with team management, distribution of tasks to promote equal learning and effort across team members, and proper communication and conflict resolution. Finally, time management was a challenge, especially for learners that had full-time jobs and other responsibilities.

- **Full-time job search**

These learners were seeking to change jobs and decided to focus on finding other full-time employment. The program provided guidelines to report their job search, application, and interviews. At the end of the ELO, learners reported to the program staff that all of them (10) found better jobs.

3.5 Role of mentoring (Na'amal and ELO mentors)

The results suggest having a mentor, who is an expert in technical content and capable of fostering human skills, successfully promotes learning, either in an internship or project. The absence of specific mentors for the self-guided projects made finding technical solutions and dealing with team-related issues (conflict resolution and communication) more challenging. Mentors proved also fundamental for setting clear expectations and reachable goals for the short timeline of the learning experience. Proactiveness and engagement from the learners were determinants of how much value learners could get from mentors.

3.6 Local hubs

Local hubs proved to be key for the success of the overall learning experience. Learners with access to local facilities, events, mentors, and industry contacts more easily adapted and navigated the personal and professional challenges they were exposed to. Moreover, having a local coordinator proved to be essential in the cohesiveness of the local community of peers; and provided support to learners on navigating the local context and finding useful resources for their needs.

Fostering the local hubs is of great importance for the CDS program success given these spaces offer critical nuances regarding the learners cultural and professional environment (unique to each location) that MIT and its initiative have no control over.

4 CONCLUSIONS

This is the first research evaluation of the learning experience for the CDS. Given the diverse background and challenging living conditions of all learners, the program faces several content, pedagogical and technological issues. Nevertheless, learners, internship mentors and staff acknowledge the value of the training activities as well as the support mechanisms put in place to create a community and provide peer support. The program staff see intentional mentoring (seeking the professional and personal growth of the learner) for all ELOs as a key component for the success of the CDS. They also acknowledge finding the right mentors as one of the biggest challenges. Internships are an important component in the program since it directly leads to full-time jobs. The support of the GAP pilot finding internships proved to be fundamental for the mission of the CDS. Considering the program's global reach, it is crucial to contemplate the local context of the learners: local partners are an important pillar that needs to continue being developed. The next step in this research is reconnecting with CDS alumni after six months of program completion to assess its impact in work readiness and full-time job attainment.

5 SUMMARY AND ACKNOWLEDGMENTS

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