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19-22 September, Barcelona, Spain

Towards a new future in engineering education, new scenarios
that European alliances of tech universities open up



PROCEEDINGS



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IMPLEMENTING AGILE CONTINUOUS EDUCATION (ACE) AT MIT AND BEYOND: THE MIT REFUGEE ACTION HUB (REACT) CASE

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ABSTRACT

The rapid pace of change in technology, business models, and work practices is causing ever-increasing strain on the global workforce. Companies in every industry need to train professionals with updated skill-sets in a rapid and continuous manner. However, traditional educational models — university classes and in-person degrees— are increasingly incompatible with the needs of professionals, the market, and society as a whole. New models of education require more flexible, granular and affordable alternatives. MIT is currently developing a new educational framework called Agile Continuous Education (ACE). ACE describes workforce level education offered in a flexible, cost-effective and time-efficient manner by combining individual, group, and real-life mentored learning through multiple traditional and emerging learning modalities.

This paper introduces the ACE framework along with its different learning approaches and modalities (e.g. asynchronous and synchronous online courses, virtual synchronous bootcamps, and real-life mentored apprenticeships and internships) and presents the MIT Refugee Action Hub (ReACT) as an illustrative example. MIT ReACT is an institute-wide effort to develop global education programs for underserved communities, including refugees, displaced persons, migrants and economically disadvantaged populations, with the goal of promoting the learner's social integration and formal inclusion into the job market. MIT ReACT's core programs are the Certificate in Computer and Data Science (CDS) and the MicroMasters in Data, Economics and Development Policy, which consist of a combination of online courses, bootcamps, and global apprenticeships. Currently, MIT ReACT has regional presence in the Middle East and North Africa, East Africa, South America, Asia, Europe and North America.

1 INTRODUCTION

Emerging global challenges are adding to already intensifying demands for national and international competitiveness, and across the world many point to the urgent need to speed up innovation and modernize organizations [1]. STEM is a key pillar in the modern innovation-based economy, though by no means the only [2]. Rapid innovation requires an innovative workforce, and yet there is a global shortage of skilled workers [3] in the STEM field and beyond. All this while thousands of already highly skilled professionals get forcibly displaced every year, without knowing a formal carefully designed mechanism to support them in being able to demonstrate their skills, continuing their education, and actively getting back to work.



Traditionally the main avenue towards expertise building has been graduate-level programs. These are usually based on traditional practices – classes and in-person degrees, for example – which are increasingly incompatible with the learner, societal, and market needs. They are monolithic and often inconvenient for full-time employees balancing personal, professional, and financial obligations.

As companies in every industry feel the need to train professionals with updated skill-sets in a rapid and continuous manner, the industry is working on adjusting their corporate training programs to meet current market needs, including university-industry collaborations [4,5]. However, the vast majority of these programs are developed with the company's needs, rather than employees' professional goals, in mind. Furthermore, corporate training is an extremely heterogeneous field without clear quality standards, skills accreditation or standardized assessment.

Workforce education today needs a new model to complement traditional graduate education: one that is more agile, continuous, granular, incremental, convenient and affordable while still ensuring and assuring high quality. Additionally, this new agile model needs to be attuned to the needs of employers and learners, apply the latest developments from the science of learning, use modern educational technology and pedagogy, and present content in a fluid, flexible and digestible way to ensure student success. We introduce a model that we refer to as Agile Continuous Education (ACE), a philosophy and framework to standardize this new and emerging –though fluid– paradigm of upskilling.

1 THE ACE FRAMEWORK

The ACE framework that the Massachusetts Institute of Technology (MIT) is proposing focuses on providing education in a flexible, cost- and time-efficient manner by combining a broader range of modalities: online, on-site on campus, and at-work. As presented in Figure 1, the ACE framework is built on 3 pillars: *individual* learning, *group* learning, and *real-life mentored* learning. A complete learning path should include experiences combining all 3 modalities. As an example, based on current MIT offerings and opportunities, a learner can start with individual coursework online or in-person and build a digital academic portfolio of credentials at their own pace. However social aspects of learning are equally important, particularly considering that most workers will need to work in teams. For this reason, the second pillar of the framework is a group learning component. We cite the example of MIT Bootcamps, which are “guided hackathons” – intense, facilitated, hands-on, project-based, online or on-site activities – as an example of a group activity in which learners can firm up their skills in a team setting. Working with others has the additional benefit of identifying and rectifying possible blind spots from individual activities; coaching in MIT Bootcamps further brings about the exercise of deliberate practice [6]. The third pillar in the ACE framework, we argue, must be a mentored,

real-life learning experience (e.g. through apprenticeships, or a collaborative university/industry project), where learners set specific skills development goals at the beginning of at-work engagements. This third phase, we argue, gives the learner the opportunity to apply their new skills and to firm them up in the context of the real world by participating in carefully structured and mentored experiences.

ACE provides new degrees of freedom to workforce learners by:

- Encouraging them to try new courses and content, and earn credentials along the way;
- Offering them the possibility to use credentials and to be subsequently accredited in a full-time academic program (e.g. the [MIT Micromasters](#) programs);
- Making content and certification available in smaller bite-sized chunks when and where it fits best to work and personal-life;
- Allowing them to customize their path based on personal preferences, rapidly-evolving industry needs, or personal future career goals;
- Allowing them to apply learned skills and knowledge in more rapid cycles (in a more agile way) in real-world projects;
- Enabling these benefits to be delivered in a more cost-efficient manner;
- Facilitating exposure to the real work environment so they better understand work and culture in potentially unfamiliar fields and roles; and
- Exposing them to career choices via smaller engagements designed for both learning and experience, allowing their career decisions to follow a discovery driven path. Learners are consequently equipped to make informed decisions about the role and industry that will best fit.



Fig. 1. The 3 pillars of ACE

The ACE framework combines known educational approaches that have been developed and tested at MIT and elsewhere; it does so in a way that systematizes what is otherwise unstructured, in keeping with the discipline of the three pillars we have described: *individual* learning, *group* learning, and *real-life mentored* learning.



To ensure speed and relevance in ACE delivery, we sought a use case that would put the ideas to the test amid an urgent need: the MIT Refugee Action Hub (ReACT). We present ReACT below as a “case study” to illustrate the potential for ACE to revolutionize lifelong learning.

2 MIT REFUGEE ACTION HUB (REACT)

The MIT Refugee Action Hub (ReACT) is an institute-wide effort to develop global education programs that target the needs of underserved communities, including refugees, displaced people, migrants and economically disadvantaged populations. MIT believes that education is a critical tool to help underserved learners achieve their personal and professional goals, by giving them a platform to recognize and leverage their talents, access a professional career, and create positive change in their lives and communities.

ReACT launched in May 2017 as a response to the [MIT SOLVE](#) call to find creative solutions to the problem of refugee education. It focused on the creation of a center at MIT to design and deploy new learning opportunities for displaced populations around the world. Driven by his own experience as a refugee, Prof Admir Masic has since led a collaborative effort with internal partners including [MIT Bootcamps](#), MITx, MISTI, the [MIT Enterprise Forum Pan-Arab Region](#), and external partners around the world to address the complex problems of this growing crisis and offer programs with the potential to change the narrative of the refugee experience.

With 79.5 million forcibly displaced people around the world, and only 3% of them able to access higher education, there has never been a greater need for the kind of globally focused educational innovation offered by MIT [7,8].

2.1 ReACT cohorts, learners and hubs

ReACT’s global cohorts connect to a worldwide network of universities, nonprofits, organizations and companies committed to serving underserved communities and connecting them with relevant learning resources, professional development opportunities, and meaningful employment.

The first ReACT cohort was established in 2018 to support mostly Syrian refugees resettled in Jordan (the first ReACT hub) and refugees from Palestine and other nearby regions. Their learning path focused on skills development in computer programming, entrepreneurship and innovation, using curriculum drawn from MIT courses, MIT Bootcamp workshops and maker activities. After the two week in-person Immersion and Acceleration workshop, learners completed two MITx MOOCs on basic Python programming and computational thinking as well as a third elective course of their choosing. Since then two more cohorts have completed the Certificate in Computer and Data Science program, and a fourth one is currently

undergoing activities. In all, 90 individuals have completed ReACT training, and 65% found employment in the field within 6 months.

Throughout these four cohorts, the ReACT learning path has evolved to better respond to the learners’ professional, socio-academic and personal needs as well as external factors, including the COVID pandemic. COVID forced the ReACT programs to be completely virtual but created opportunities for the program to extend and accept more learners globally. From one hub in Jordan in 2018, ReACT programs currently take place in 6 different Hub locations, supporting learners from more than 29 countries. Table 1 presents a summary of the ReACT cohorts, its number of learners per cohort, their location and overall completion rates. The location of the currently active ReACT hubs all over the world is summarized in Fig. 2.

Table 1. Summary of ReACT cohort data (dates, learners, locations and completion rates)

Cohort number	Learning journey dates	Number of locations	Total # learners enrolled
1	May 2017- Oct 2017	1 (Jordan)	17
2	January 2018 - January 2019	1 (Jordan)	22
3	September 2020 - Sept 2021	3 (Jordan, Colombia, Uganda)	50
4	Jan 2022 - present (currently ongoing)	6 (Jordan, Colombia, Uganda, Uruguay, Afghanistan, Greece, USA)	136

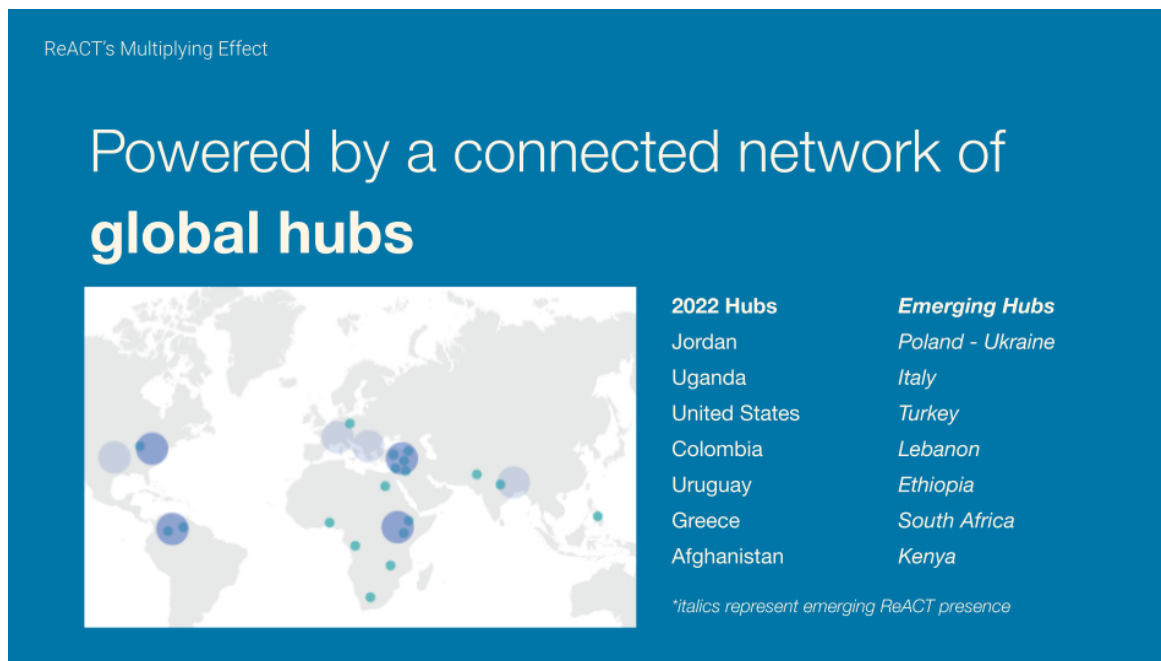


Fig. 2. Location of MIT ReACT hubs around the globe (updated April 2022)



2.2 Implementing ACE through the MIT ReACT Computer and Data Science (CDS) Certificate Program

ReACT's cornerstone program is its Certificate in Computer and Data Science (CDS), a yearlong online program in which participants hone the skills needed for success in the 21st-century economy. The CDS is a high-touch ACE program, consisting of online courses, bootcamps, and learning through internships. In CDS learners study computer programming and data analysis, while also focusing on cross-cultural collaborations and work readiness, innovation thinking and entrepreneurship.

The CDS learning journey is structured around the 3 main ACE pillars. As learners progress through the program, they advance capacities in academic and technical skills using *individual*, *group* and *real-life mentored* learning:

- *Individual* learning through online MIT courses in computer and data science,
- *Group* learning through participation in the [MIT Innovation Leadership Bootcamp](#), synchronous online workshops focused on human skills development, peer communities through study groups supported by community Teaching Assistants and online social gatherings, and
- *Real-life mentored* learning supported by mentored activities that cover paid internships or mentored learning projects. Learners are also matched 1:1 with a mentor with professional experience in the tech sector.

Individual learning: Learners complete three online instructor-led asynchronous MITx courses in computational thinking, coding, programming using Python, and data science, as well as their choice of electives on the edX catalog to allow specialization in data science for healthcare or economic development policy.

Group learning: The cohort starts with an orientation workshop, where learners participate in visioning and goal-setting activities, strengthen their skills in virtual networking and interactive information and communication technologies, are exposed to opportunities to improve their English, and begin developing an online community.

ReACT partners with [Na'amal](#), which aims “to pave a way for accessible remote employment for refugees and other vulnerable populations” [9] and leads several interactive workshops on planning, success in remote work, communication, data compliance and digital security, and self-management.

Current cohorts also participate in the intensive 10-week online [MIT Innovation Leadership Bootcamp](#), where learners collaborate across cultures and time zones to build new entrepreneurial ventures. The ReACT cohort is integrated within the MIT Bootcamp's larger class of several hundreds of aspiring global entrepreneurs, creating opportunities for ReACT learners to be meaningfully immersed in wider networks while developing their leadership capacities.

Real-life mentored learning: ReACT develops computational thinkers ready to enter high-skill careers as full-stack engineers, software developers, business planning



analysts, and data and information management at various companies. MIT ReACT staff connect learners to local and remote paid internships. Priority is given to high-skill, meaningful internships within the tech sector and with companies that indicate interest in hiring full-time after a successful internship. MIT uses its institutional networks through the MIT Alumni Association, the J-WEL, and MISTI program to connect ReACT learners with internship opportunities in locations where these refugees live. Alternatively, some learners are given the option to pursue real-life mentored learning completing specific projects either within their current place of employment or independently as individuals or small teams. These experiences are especially important for learners who do not have prior work experience but can use what they learn from ReACT to build Github or LinkedIn portfolios or personal websites that showcase their job-ready skills.

Preliminary evaluation research on the implementation and efficiency of the React program is scheduled to begin in August 2022.

3 THE FUTURE OF ACE

Although MIT ACE developed this framework with existing MIT courses, programs, and learning experiences in mind, it is our aspiration that it will be adapted and used by other institutions as well, and possibly at different educational levels. To further shape and promote ACE authors would like to connect with professionals seeking to advance their knowledge and skills in the field of education; learning & development leaders at companies; education policy makers; MIT and other university scholars conducting research in ACE and ACE-like models; and those interested in the current development of education and its future. Together we are aiming to further explore:

- Efficient and scalable coaching and mentorship for learners as they are building their own learning pathways and progress toward career goals.
- Better practices to inform how “human skills” [10] such as critical, creative, and ethical thinking, could be best integrated in the content.
- How the global education community can guide the ACE framework standardization, including discussions about accreditation, digital credentials, unified transcripts, and record achievements.

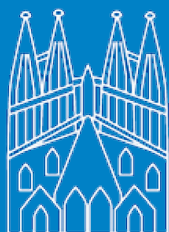
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