INTRODUCING AGILE CONTINUOUS EDUCATION (ACE): OPPORTUNITIES AND CHALLENGES

A.F. Salazar-Gómez[1]
Massachusetts Institute of Technology
Cambridge, USA

A. Bagiati
Massachusetts Institute of Technology
Cambridge, USA

E. Beshimov
Massachusetts Institute of Technology
Cambridge, USA

S. Sarma
Massachusetts Institute of Technology
Cambridge, USA

Conference Key Areas: *Future engineering skills, E-learning, blended learning, virtual reality*
Keywords: *agile education, blended learning, skills, professional education*

ABSTRACT

The rapid pace of innovation is challenging industries to train professionals with updated skill-sets in a continuous and rapid manner. Current academic systems enable expertise acquisition primarily through graduate-level programs. While such programs are valuable, they can also be somewhat monolithic for full-time employees balancing personal, professional, and financial obligations.

MIT Open Learning is currently developing what we refer to as an agile continuous education (ACE) model, which will provide education in a flexible, cost- and time-efficient manner, by combining modalities: online (such as MITx micro-credentials), on-site (such as MIT Bootcamps), and at-work-site (through apprenticeships and professionally mentored project-work).

This more granular approach affords a degree of freedom to students in their professional lives by: (a) letting them try new content before pursuing full-time academic programs; (b) acquiring content and credentials in smaller bite-sized chunks; (c) allowing them to customize their path based on personal preferences and rapidly-evolving industry needs; (d) applying learned skills and knowledge in more rapid cycles; (e) enabling these benefits in a more cost-effective manner.

[1] *Corresponding Author*
A.F. Salazar-Gomez
salacho@mit.edu

This ACE model is promising but also challenging. First, designed programs must faithfully apply the science of learning. Second, these new building blocks must be standardized. Third, a new paradigm for unified transcripts is needed to accredit and record achievements. Finally, we are concerned utilitarian approaches to designing this system might lead us to neglect foundational aspects of education (i.e. humanities, field that must be preserved in any change). This paper introduces the ACE model and discusses unique advantages and challenges.

1 INTRODUCTION

1.1 Rethinking the Education Model

There is a constant interplay between innovation and education [1]. Technology innovation increases academic and workplace problem-solving but, in the process, changes the tools that professionals use. Business model innovation also transforms industries, merging some and disaggregating others. The combined dynamic redefines what activities are core [2] and influences what skills and job functions performed by professionals increase in importance, stay similarly relevant or become obsolete. Despite its complex and often varied effects, we need innovation. We face many challenges as a global society, and they will not be solved by conventional means [3].

So how do we promote innovation? It starts with recognizing that innovation is a people business and that to promote innovation, we need to update education [2]. Specifically, we need to find a mechanism for professionals to access rapidly advancing knowledge about the state of the art and then develop new skills. This is not an easy task, and remains a central challenge for education today.

Current academic systems enable expertise acquisition primarily through graduate-level programs. The spirit of the current system is to offer programs that are substantial enough to prepare learners for the needs of tomorrow. While this is valuable, this strategy is also risky in a rapidly-changing world. How can higher education institutions be sure they know what professionals might need tomorrow? Moreover, wouldn't it be better also to have professionals offering insights on what they need so that higher education institutions take that into consideration and respond accordingly, but also with research rigor, to best help them?

Traditional programs often have further limits including (a) program cost and time requirements, (b) the availability of certification only at the end of the program; and usually, for full-time graduate students, (c) the opportunity to apply the new knowledge and skills only after graduation [4,5]. So, the current design can be somewhat monolithic and thus exclude full-time employees balancing personal, professional, and financial obligations. Responsibly adapting to this dynamic creates a need for education that is both rapid and continuous. Importantly, this education needs to be highly practical but following a model based on rigorous educational research, and conveyed in a fluid, flexible, digestible way.

The engineering education community has already started to acknowledge and promote a shift from content-based to content-and-skills-based education [6]. While content delivery has been a common practice in higher education institutions, the

current paradigm needs to be updated to include development of such valuable professional skills as problem-discovery and problem-solving, ethical reasoning, team work, communication, creativity, and critical thinking. It is the command of these skills that allows the professional to bring to bear the value of content expertise.

1.2 Agile Education is a Current Need

MIT Open Learning (OL) aims to transform teaching and learning at MIT and around the globe through the use of digital technologies, in an open, collaborative and innovative way, guided by the latest evidence from the science of learning. MIT OL is currently developing what we refer to as a model of agile continuous education (ACE). The ACE model will provide education in a flexible, cost- and time-efficient manner, by combining a broader range of modalities: online (e.g leading to credentials), on-site (e.g. leading to MIT Bootcamps credentials), or at-work-site (through apprenticeships and professionally coached project-work). These modalities on their part consist of a meaningful range of sub-modalities (such as online synchronous and online asynchronous) that further expand our design space.

To fully realize this mission, MIT OL has already created a great number of online courses and programs [7,8] as well as supplemental digital resources, responding to the continuous demand from professionals to upgrade their skills and content knowledge. It has also spearheaded the use of digital credentials to certify content and skills acquisition [9]. Specifically, for over 7 years, MIT has offered more than 200 MITx online courses at the undergrad and graduate level; created 4 MicroMasters pathways (highly intense, graduate-level courses with credentials accepted by some MIT residential graduate programs upon admission and by more than 34 different universities from 21 countries); developed the xPRO courses and 5 program series (courses focusing on training professionals in state-of-the-art topics ranging from leadership and negotiation to machine learning and data science); created MIT Bootcamps (a blended program that combines online preparation with on-campus, intensive, week-long workshop for select learners to advance their knowledge); and, along with other leading universities, co-founded the Digital Credentials Consortium (DCC) to design an infrastructure for digital credentials of academic achievement. With all these resources at hand, MIT OL is now seeking to offer a new educational model to enhance the 21st century education.

2 THE ACE MODEL STRUCTURE

The ACE model offers every professional an opportunity but we expect that ACE would be a particularly effective solution for young professionals. This is because for young professionals the gap between increasingly-steep requirements of early-career jobs and concomitant preparation achieved through traditional education is high.

ACE learners would explore, follow, and ultimately craft for themselves, with guidance, a granular professional path that better suits their needs and interests. They would select from a range of courses and activities that are **online, on-site**, or **at-work**, or combine any of them together. To upgrade their knowledge and skills they would (a) take online courses available in the edX platform from the MITx and xPro portfolios; (b) participate in intense hands-on on-site and at-work MIT bootcamps; and (c) apply the new content and skills at-work, either through apprenticeship programs or by

participating in carefully structured and mentored activities designed to be directly implemented at the workplace. The online, on-site, and at-work activities are articulated; and this process is cyclical: learners can return to advance their knowledge and skills continuously. Figure 1 presents an example of how three different learners could follow three different paths, each one specifically tailored to their needs, and structured with support from mentors. Before completion of each one of the academic modules the students can choose whether they want to obtain a digital credential certifying the content and skills acquired at an additional price. These credentials are also accepted by other higher education institutions, a fact that further enhances flexibility in education.

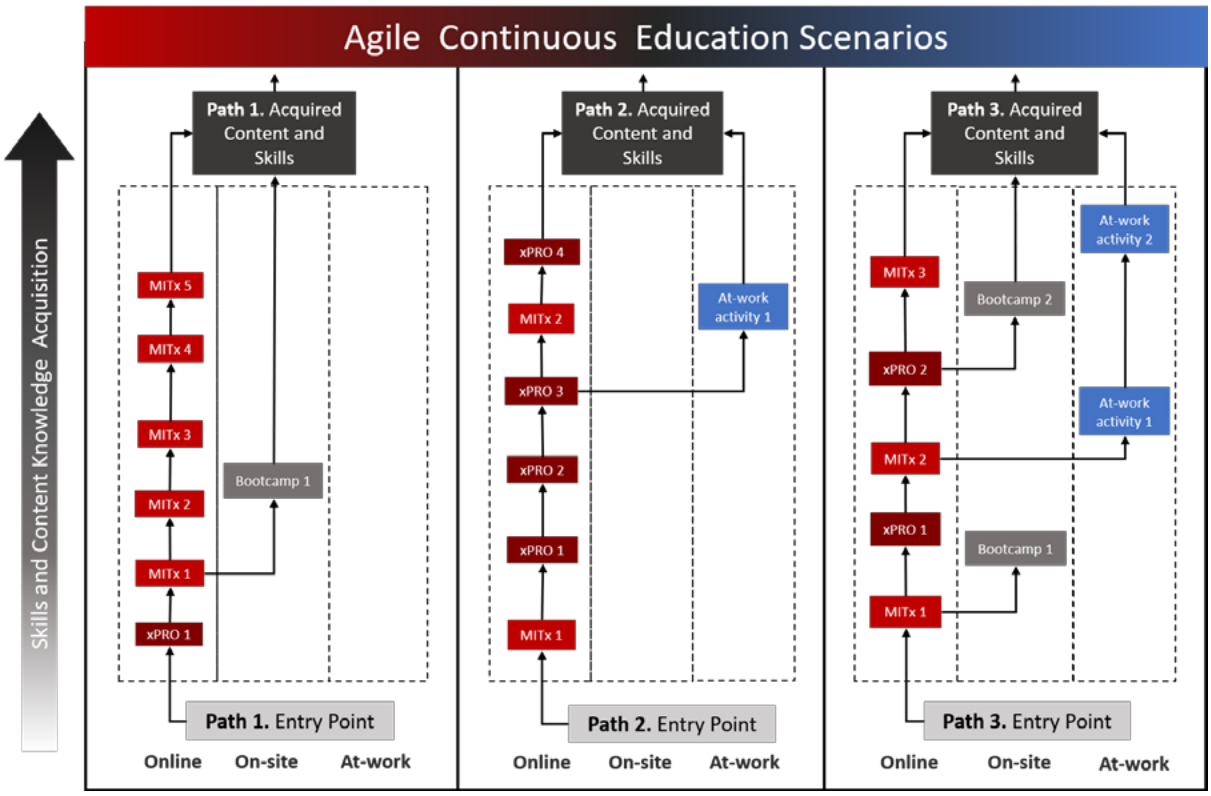

Fig. 1. Three different scenarios taken by different learners following the proposed ACE model

3 IMPORTANT CONSIDERATIONS

3.1 Opportunities and Challenges

The proposed ACE model presents promising opportunities. It offers a more granular approach and valuable degrees of freedom to professionals seeking to improve their skills and content knowledge by:

a) allowing them to try new content before pursuing a full-time academic program;
b) providing content and credentials in smaller size modules in shorter time periods;
c) allowing the students to customize their path based on personal preferences and the rapidly-evolving industry and society needs;
d) giving the students the opportunity to instantly apply the learned skills and knowledge at work;

e) and enabling all these benefits in a more cost-effective manner.

Now it is important to state that the development of the ACE model does not come without considerations and challenges, both in regards to the content and articulation of the different modules, the pedagogy selected for implementation, as well as the path logistics and course credentials.

With respect to the pedagogy selected to present the courses or bootcamps, MIT OL aims to develop and deliver new courses guided by the latest evidence from the science of learning, an effort currently underway [10].

About the content, although most of the existing online courses developed in MIT OL so far belong to the STEM and Business fields, both MIT and the global Engineering Education community acknowledges the need for the development of ways of thinking that are better rooted in the humanities [6, 11-12]. The development of ethical thinking, critical thinking, humanitarian thinking, as well as a better understanding of local and global contexts and cultures should be integrated with the technical, scientific, or entrepreneurial topics presented in every course.

Finally, it should be clearly noted that, despite the appealing benefits, this model is only suggested for people that already followed a formal undergraduate training. ACE, by no means, aims to replace traditional undergraduate education. Moreover, part of the implementation philosophy of ACE can be to support undergraduate education where this would be valuable and needed.

3.2 Future Considerations

Beyond the aforementioned challenges, we pose further questions for the entire higher engineering education community to consider at large when exploring an agile education model for the 21st century:

- How can the ACE model achieve efficient and scalable inclusion of coaching and mentorship in the selection of and progress toward career goals?
- How does the content reflect humanities and social sciences? And in what ways could ethical thinking be integrated with the STEM content?
- How can we as a global education community get ACE standardized? What should the new paradigm be for accreditation, unified transcripts, and record achievements?

Keeping these considerations in mind, the ACE model presents itself as an opportunity to improve graduate and workplace education. This model will make possible new relevant content combinations and, importantly, embed the delivery of that content in the context where it would be best received.
The ACE model should not be seen as a threat to traditional education. It is not and it is not meant to be. In the current environment we are all concerned about the current state and the future of this essential societal institution. We believe that ACE can promote a cycle of education and: the more professionals are able to access education instantly and effectively, the more they would bring knowledge to their community and work; the more they would create economic and social value, the more they would

meet the new frontiers of unsolved problems, thus creating the further and greater need for access to knowledge.

REFERENCES

[1] Etzkowitz, H. (2003), Innovation in Innovation: The Triple Helix of University-Industry-Government relations, Social Science Information No.,42, pp. 293-337.

[2] Tuomi, I. (2005), The Future of Learning in the Knowledge Society: Disruptive Changes for Europe by 2020, Background paper prepared for DG JRC/IPTS and DG EAC.

[3] World Economic Forum. (2019), Schools of the Future Defining New Models of Education for the Fourth Industrial Revolution, World Economic Forum Report.

[4] Schlemper, M.B. (2011), Challenges and Coping in Graduate School Department of Geography and Planning, University of Toledo, The Geographical Bulletin Vol. 52, pp. 67-72

[5] ETS, (2017), New Challenges in Graduate and Professional Education, Inside Higher Ed: ETS Newsletter.

[6] E. Crawley, A. Hosoi and A. Mitra, (2018), Redesigning Undergraduate Engineering Education at MIT – the New Engineering Education Transformation (NEET) initiative. Proceedings of ASEE Annual Conference & Exposition, Salt Lake City, Utah.

[7] MITx courses on edX, (retrieved on April 2020), available at https://openlearning.mit.edu/courses-programs/mitx-courses-edx

[8] MITx MicroMasters Programs, (retrieved on April 2020), available at https://micromasters.mit.edu/

[9] Digital Credential Consortium (DCC), (retrieved on April 2020), available at https://digitalcredentials.mit.edu/

[10] Bagiati, A., Sarma, S. (2018), Merging STEM Education with Brain Science: Breaking the Silo Mentality, Proceedings of the 46th SEFI Conference, 17-21 September, Copenhagen, Denmark.

[11] Klochkova, E.S.,Bolsunovskaya, M.V., Shirokova, S.V. (2018) The Significance of Humanities for Engineering Education. In Proceedings of the 2018 XVII Russian Scientific and Practical Conference on Planning and Teaching Engineering Staff for the Industrial and Economic Complex of the Region (PTES), St. Petersburg,Russia, 14–15 November 2018; IEEE: Piscataway, NJ, USA, pp. 265–268.

[12] Fisher, E., & Mahajan, R. L. (2010). Embedding the humanities in engineering: Art, dialogue, and a laboratory. In M. E. Gorman (Ed.), *Trading zones and interactional expertise: Creating new kinds of collaboration*. Cambridge: MIT Press.