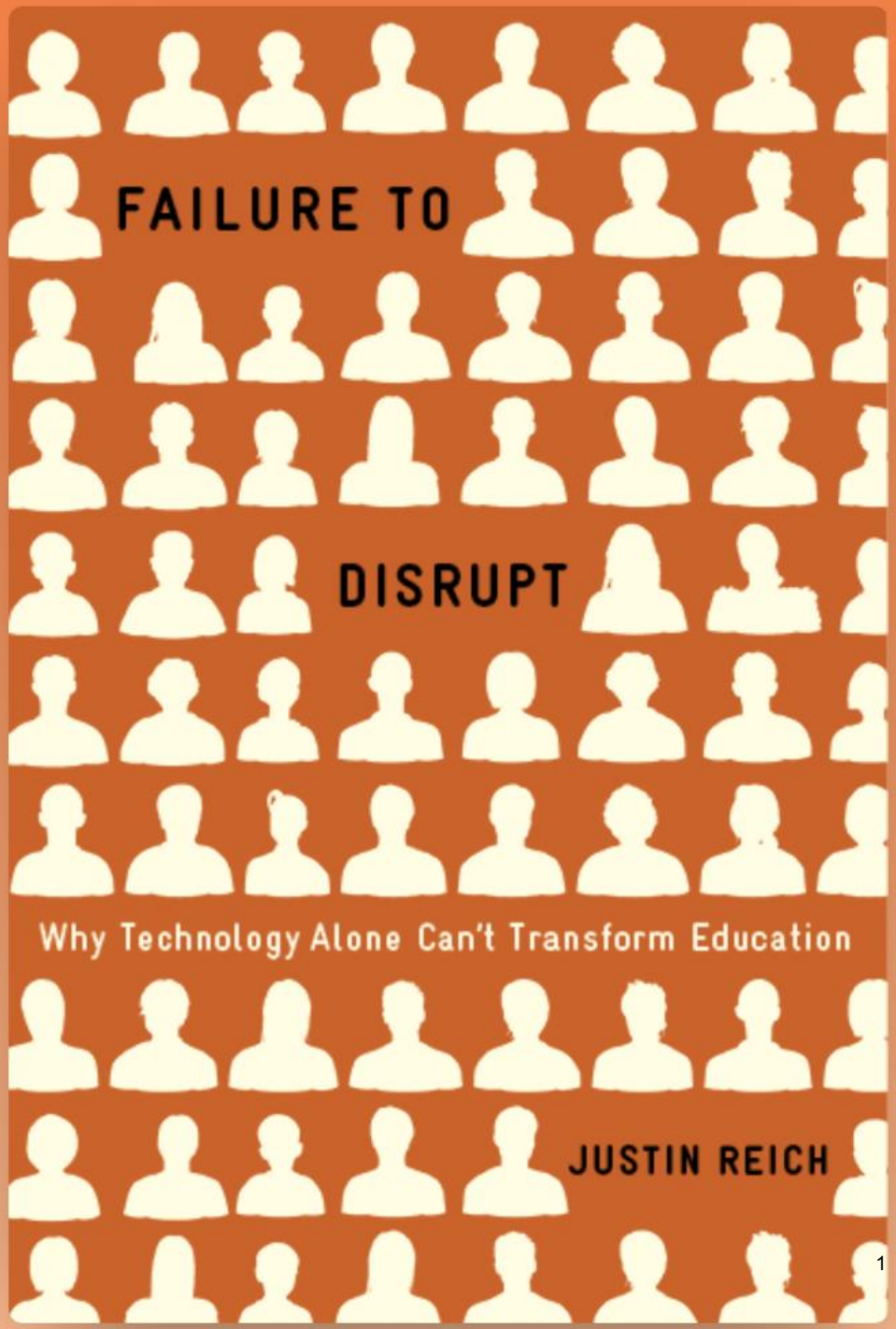
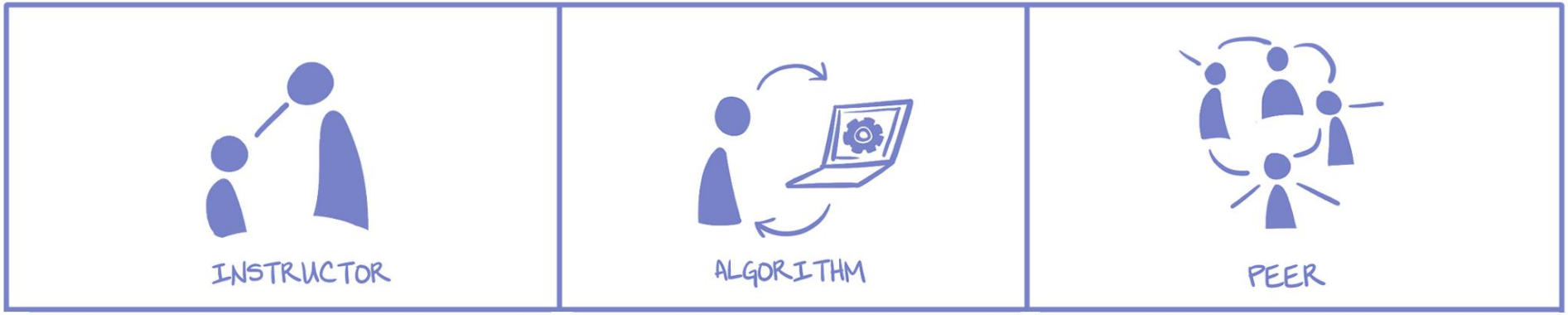


Justin Reich

Mitsui Career Development Professor
Massachusetts Institute of Technology
tsl.mit.edu

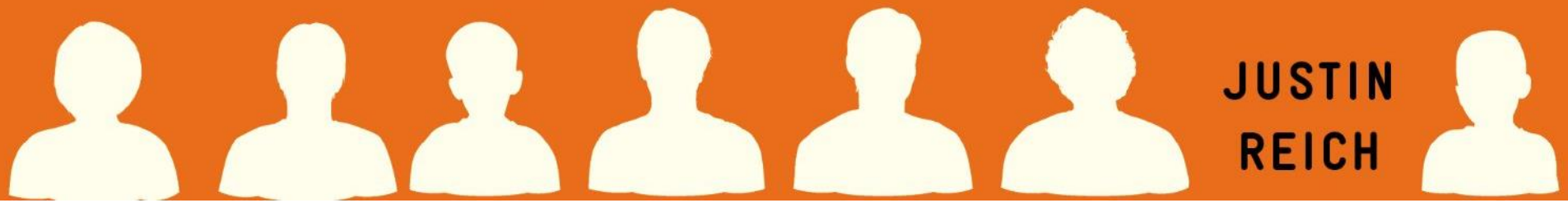
Three Genres



Who guides the sequence of learning activities?

FAILURE TO DISRUPT

Why Technology Alone Can't Transform Education



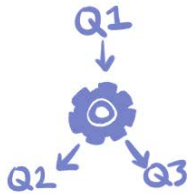
JUSTIN REICH

INSTRUCTOR

ALGORITHM

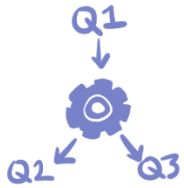
PEER

LEARNING MANAGEMENT SYSTEMS



AUTOGRADERS

ITEM RESPONSE THEORY



AUTOGRADER

WORLD WIDE WEB

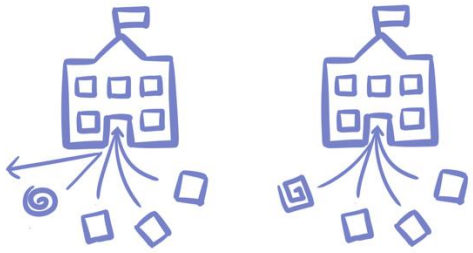
#AGGREGATOR

THORNDIKE

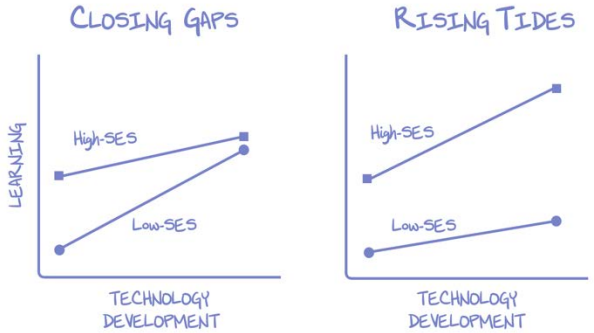
THORNDIKE

DEWEY

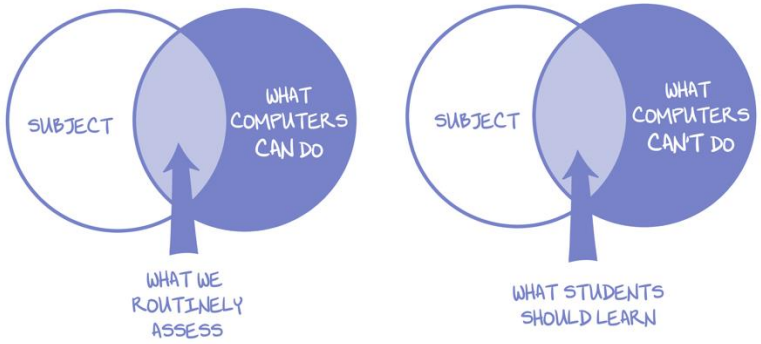
Four "As-Yet Intractable Dilemmas"



Curse of the Familiar



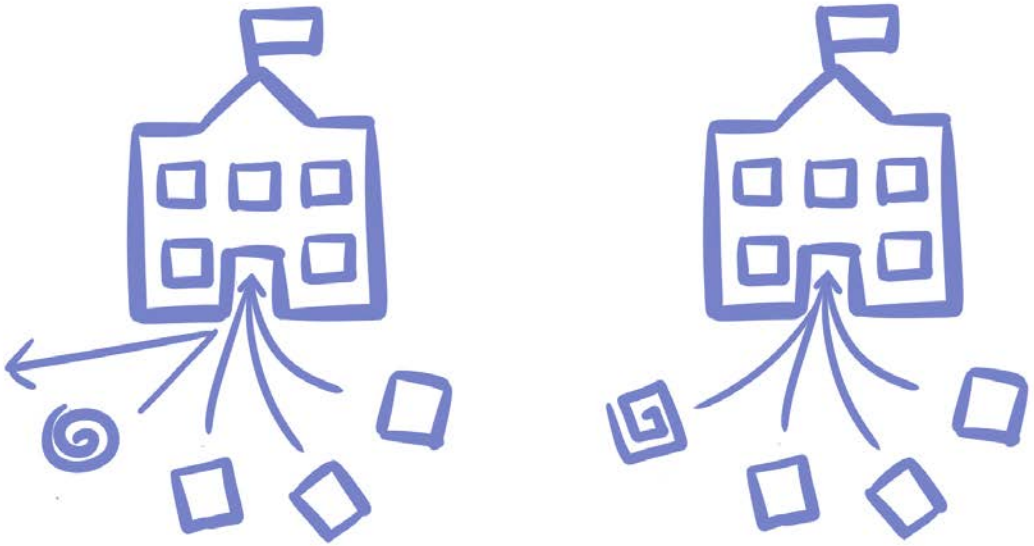
EdTech Matthew Effect



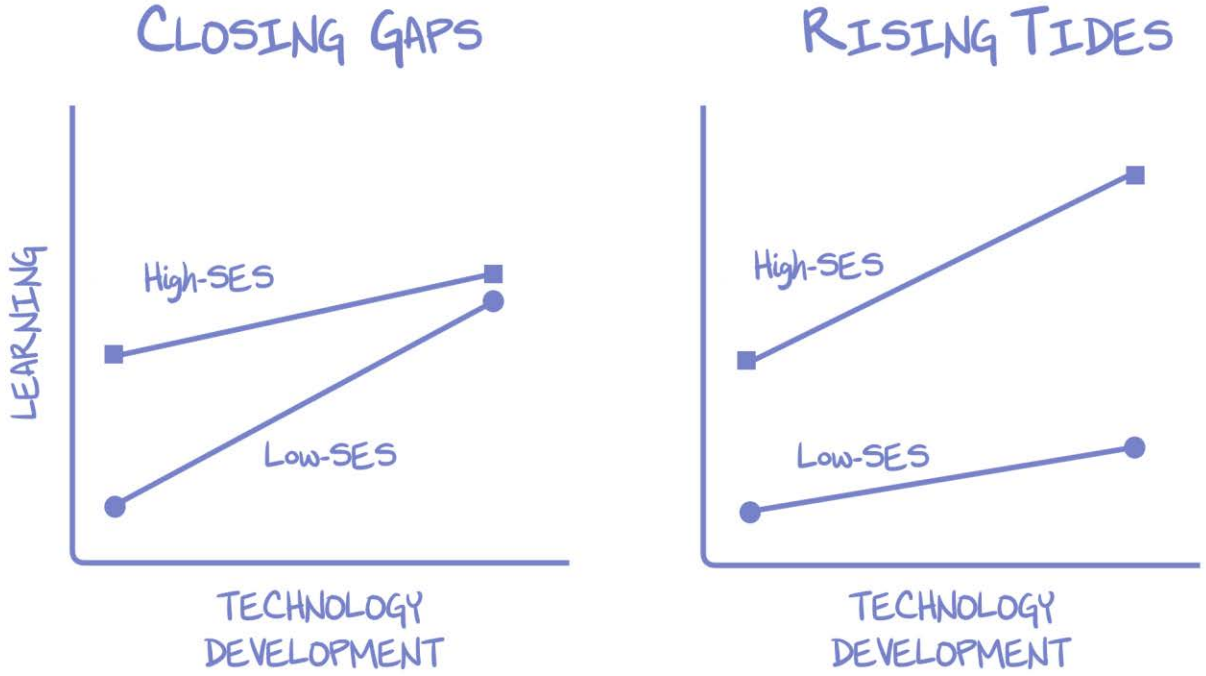
Trap of Routine Assessment

Toxic Power of Data and Experiments

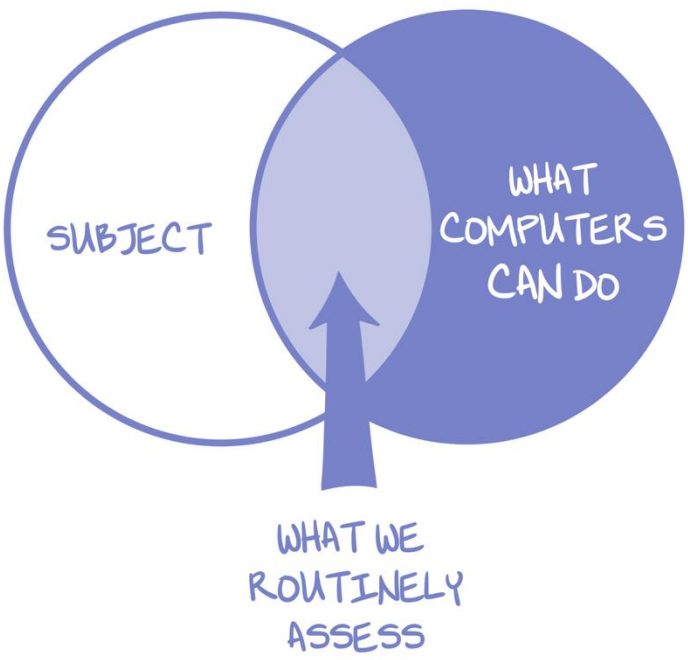
Curse of the Familiar

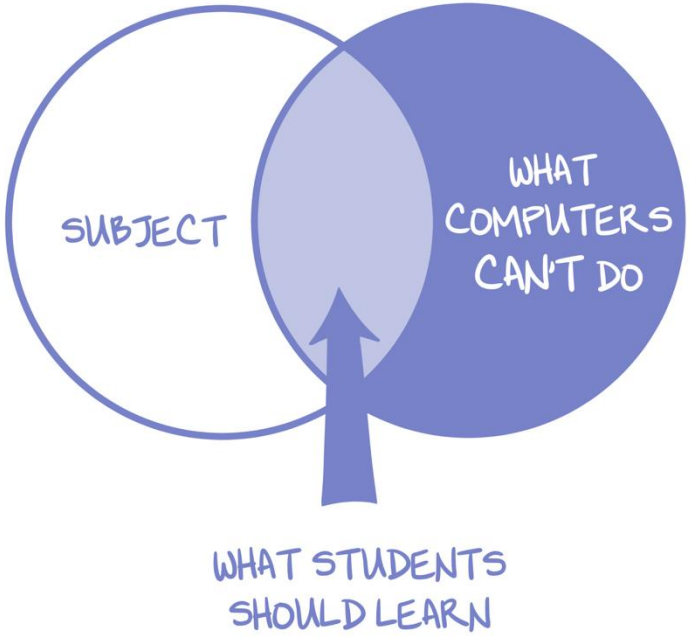


EdTech Matthew Effect



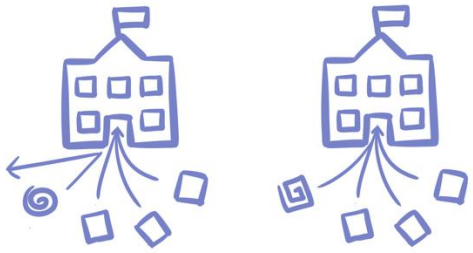
Trap of Routine Assessment



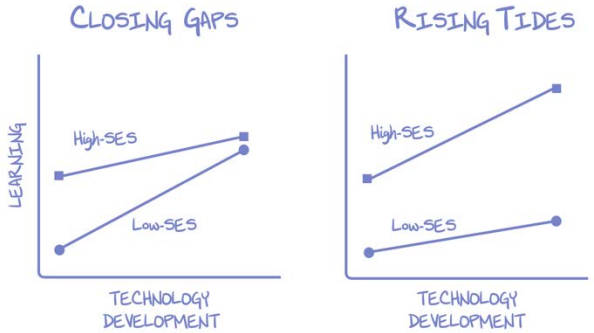


Toxic Power of Data and Experiments

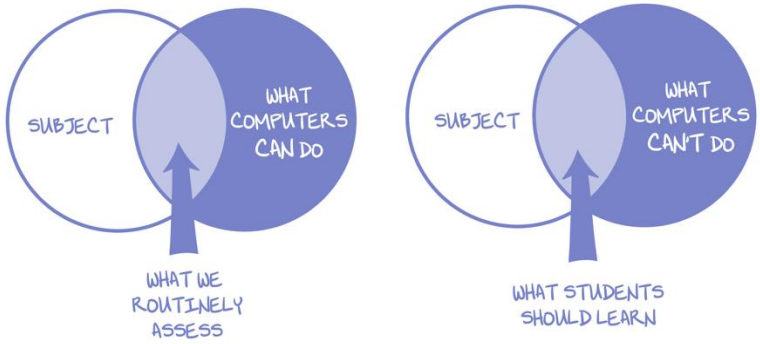
Four "As-Yet Intractable Dilemmas"



Curse of the Familiar



EdTech Matthew Effect



Trap of Routine Assessment

Toxic Power of Data and Experiments

Three Big Bets of MOOCs

1)Provide new pathways into higher education for people with limited access
2) Reorganize (disrupt, unbundle, etc.) higher education
3) Create a new data-driven science of learning

New Pathways?

nature

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nature › correspondence › article

Published: 20 November 2013

Online education

MOOCs taken by educated few

Ezekiel J. Emanuel ✉

Nature **503**, 342(2013) | Cite this article

2833 Accesses | **93** Citations | **139** Altmetric | Metrics

FAILURE TO DISRUPT

Why Technology Alone Can't Transform Education

JUSTIN REICH

New Pathways?

INSIGHTS

POLICY FORUM

SCIENCE EDUCATION

The MOOC pivot

What happened to disruptive transformation of education?

By **Justin Reich** *and* **José A. Ruipérez-Valiente**

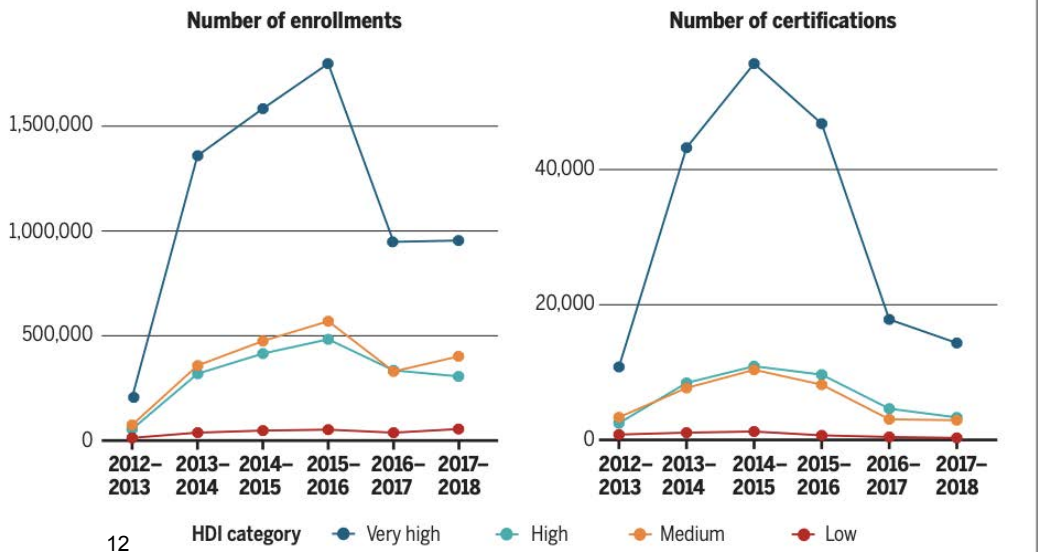
When massive open online courses (MOOCs) first captured global attention in 2012, advocates imagined a disruptive transformation in postsecondary education. Video lectures from the world's best professors could be broadcast to the farthest reaches of the networked world, and students could demonstrate proficiency using innovative computer-graded assessments, even in places with limited access to traditional education. But after promising a reordering of higher education, we see the field instead coalescing around a different, much older business model: helping universities outsource their online master's degrees for professionals (*1*). To better understand the reasons for this shift, we highlight three patterns emerging from data on MOOCs provided by Harvard University and Massachusetts Institute of Technology (MIT) via the edX platform: The vast ma-

We analyzed data from all MOOCs taught on edX by its founding partners MIT and Harvard University, from the start of the initiative in October 2012 to May 2018 (organized into annual cohorts starting in June). The dataset includes 565 course iterations from 261 different courses, with a combined 12.67 million course registrations from 5.63 million learners. Data from other edX partners or MOOC providers might reveal different dynamics, but we have a detailed view of two of the largest course providers.

MOOC researchers realized early on that most MOOC registrants leave soon after enrollment. Of those who register for a course, 52% never enter the courseware (table S4), and attrition typically remains high in the first 2 weeks of a course (*2*). We see similar patterns when looking at engagement over multiple years. New individual learners increased from 2012 to 2016 but have declined since (see the first figure). The largest initial cohort was in 2015 to 2016, but only 12% of those 1.1 million individual learners took an

Disproportionate participation from affluent countries

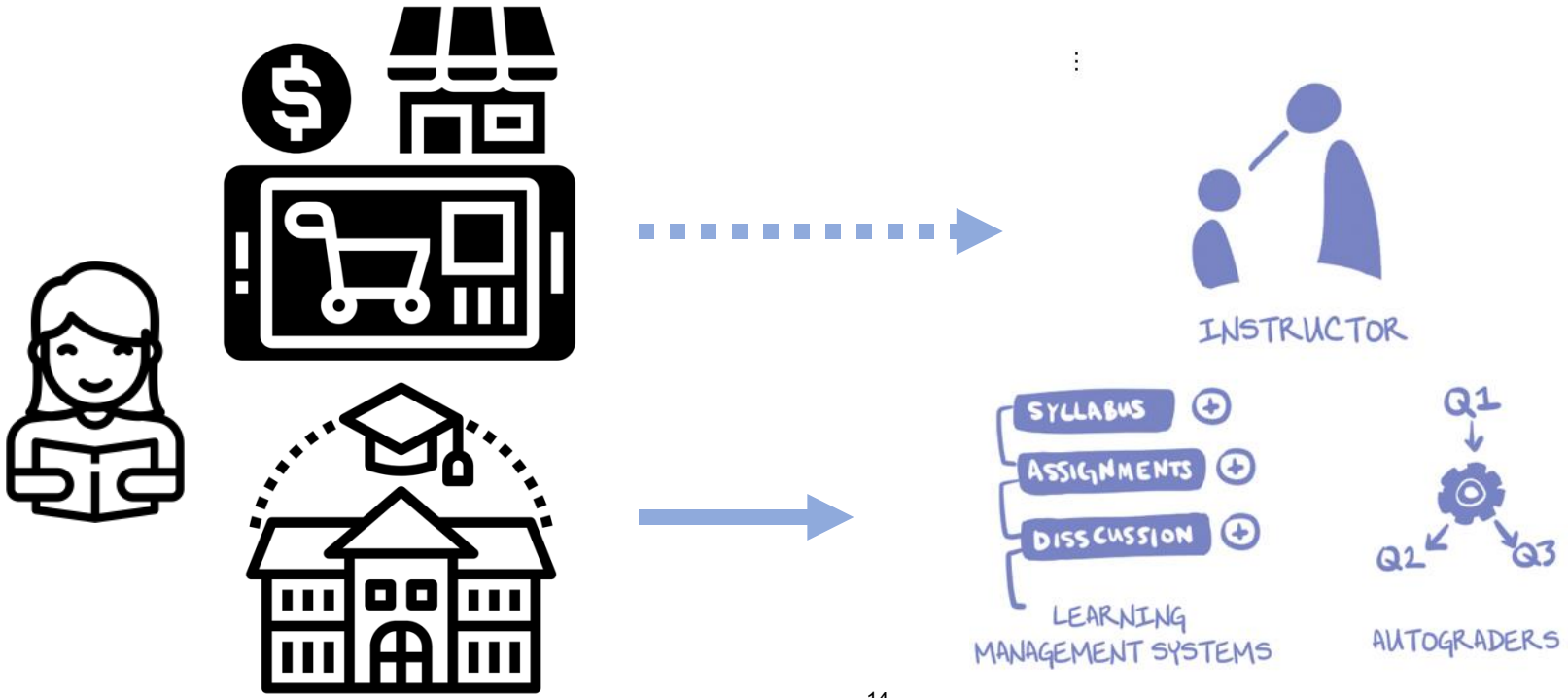
Number of enrollments and certifications per year divided into quartiles based on the UN Human Development Index (HDI) rating of each registrant's home country.



New Pathways?

1) MOOCs reduce costs by digitizing faculty labor
2) No faculty + many peers = minimal human contact
3) Individual, self-paced learning, requires high self-regulated learning
4) Most people are not good at self-regulated learning
5) The best preparation for independent, self-regulated learning is an apprenticeship in formal education systems

Disrupt Higher Ed?



Disrupt Higher Ed?

1) People tried out storefronts, but paying customers wanted legitimacy
2) Traditional registrar arrangements confer legitimacy
3) MOOC providers move towards the space occupied by Online Program Managers
4) Rather than disrupting higher education, MOOCs have been domesticated by existing systems

In light of these trends, financial sustainability for MOOC platforms may depend on reaching smaller numbers of people with greater financial means that are already embedded in higher-education systems rather than bringing in new nonconsumers from the margins.

In October 2018, edX became the last of the major MOOC providers to announce partnerships with universities to offer fully online professional master's degrees (*10*), 5 years after Udacity made the first such partnership with Georgia Tech. EdX's move into fully online master programs was followed by their December 2018 decision—mirroring earlier decisions by Coursera and Udacity—to begin building paywalls around their previously freely available content (*11*).

In these initiatives, MOOC providers will compete with well-established, for-profit companies in helping universities to outsource their online degrees. For two decades, a class of companies called "online program managers" or "school-as-a-service" companies—Pearson Embanet, 2U, and Wiley Education Services—have supported colleges in creating online degrees (*1*). Universities choose how much of the total student experience to outsource to these providers, who offer services that include marketing and recruitment, admissions, online course management, curriculum design, and course instruction and assessment. School-as-a-service providers typically earn revenue by taking a fraction of the tuition of each student enrolled.

MOOC providers are reorienting to compete directly with these companies in one market segment: professional master's degrees, credentialed by near-top universities, in fields with well-established return on investment, such as data science, computer programming, business, and related fields. The primary competitive advantage of MOOCs relative to established school-as-a-service providers involves cutting labor costs through automation. Many "traditional" online programs include small class sizes, synchronous sessions with instructors, and human-graded assignments. Many degrees offered by universities with the technology and support of Coursera and edX will be one-half or one-quarter as expensive as typical U.S. professional online credentials, with the bulk of savings coming from a combination of larger class sizes, fewer or no synchronous sessions, reduced contact with instructors, and more autograded assignments (*12*).

Because MOOC platforms support programs that look more like "traditional" online higher education, the literature on online learning can provide guidance. By most indications, students typically do worse in online courses than in on-campus courses, and the challenges of online learning are particularly acute for the most vulnerable populations of first-generation college students, students from low-income families, and underrepresented minorities (*13*). If low-cost, MOOC-based degrees end up recruiting the kinds of students who have historically been poorly served by online degree programs, student support programs will be vital. Some recent research has explored online and text-message–based interventions for supporting these students, but most research suggests that human connections through advisers, tutors, and peer groups provide the most important student supports (*14*). These human supports will push against lower tuition costs. MOOC-based degree providers may find that highly

GRAPHIC: N. CARY/SCIENCE

10.1126/science.aav7958

11 JANUARY 2019 • VOL 363 ISSUE 6423 131

January 19– jeez, these MOOC things are sure looking like OPMs

HIGHER EDUCATION

With purchase of edX, this company is betting big on a prestige brand in online higher education

2U, based in Maryland, finishes $800 million deal to acquire platform created by MIT and Harvard

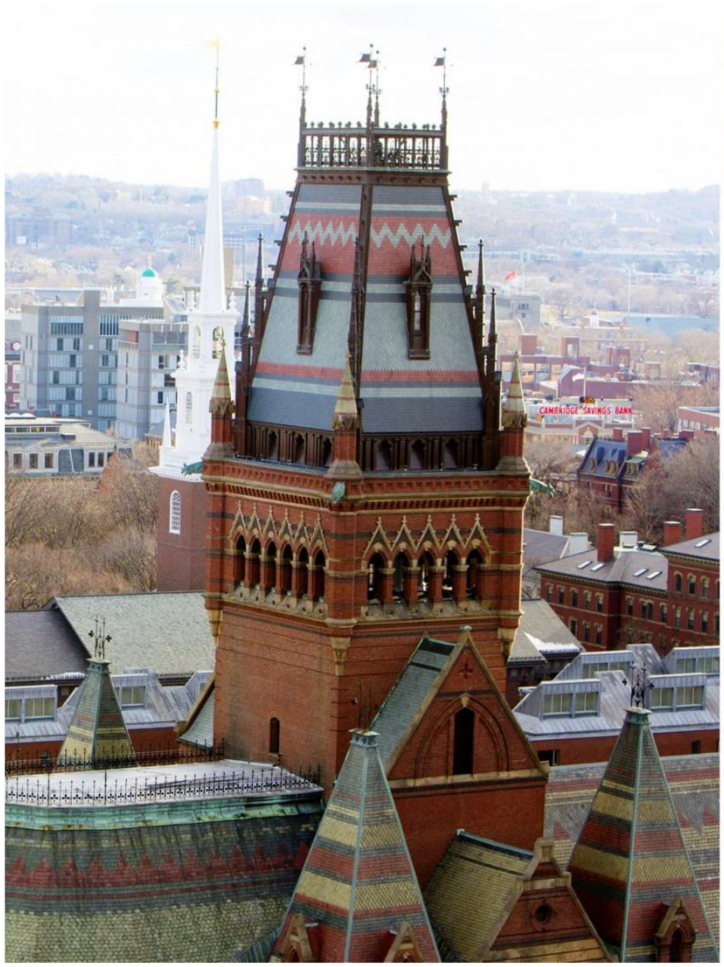
By Nick Anderson

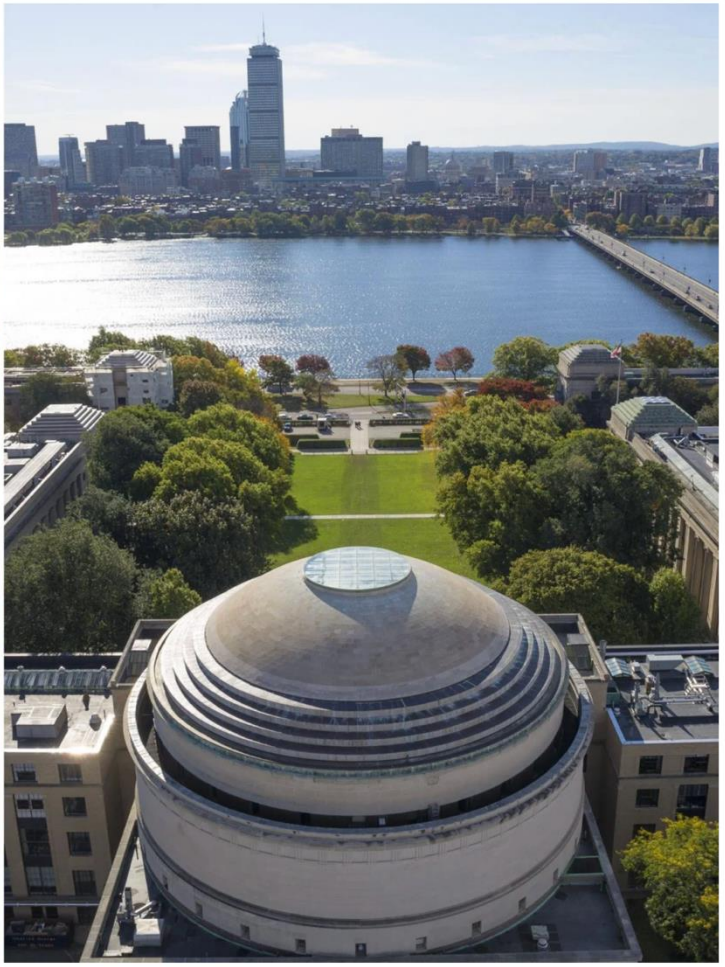
November 26, 2021 at 7:00 a.m. EST

Nov 2021, 2U, largest OPM, buys non-profit edX

CAMPUS

Harvard and MIT-led nonprofit to tackle longstanding inequities in education





File photos by Rose Lincoln/Harvard Staff Photographer; Christopher Harting/MIT

edX acquired by education technology company 2U; proceeds to be invested in nonprofit

2U Inc

NASDAQ: TWOU

Overview | News | Compare | Financials

Market Summary > 2U Inc

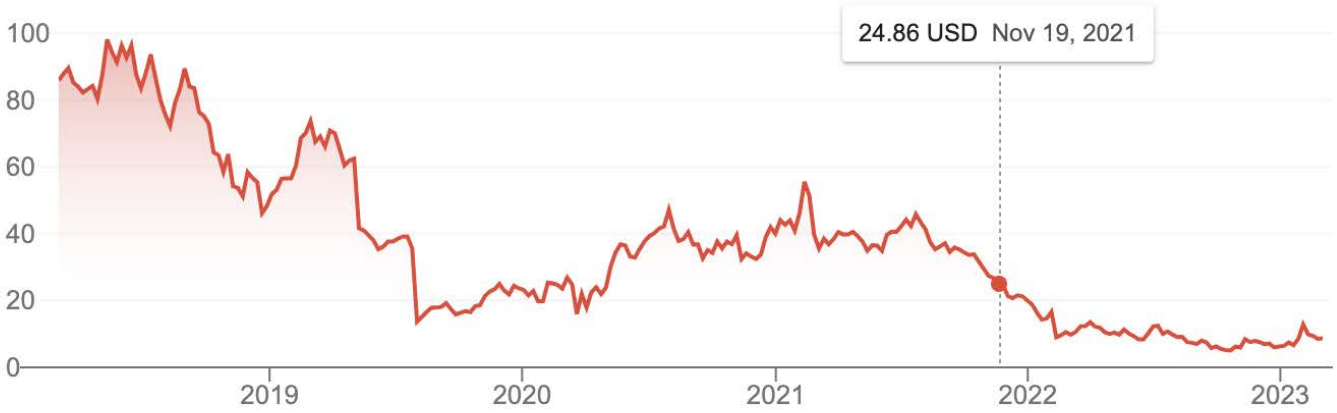
8.68 USD

+ Follow

-77.22 (-89.90%) ↓ past 5 years

Feb 27, 9:50 AM EST • Disclaimer

1D | 5D | 1M | 6M | YTD | 1Y | 5Y | Max



Open	8.83	Mkt cap	688.10M	52-wk high	14.12
High	8.90	P/E ratio	-	52-wk low	4.70
Low	8.59	Div yield	-		

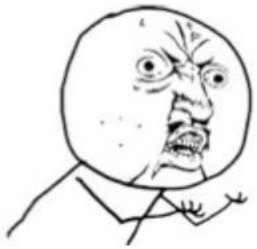
Feedback

More about 2U Inc →

New Science of Learning?

Reich's Law

1) Students who do stuff, do more stuff.
2) Students who do stuff,
do better than students who don't do stuff.



Just make student do more stuf!!!!!

Scaling up behavioral science interventions in online education

René F. Kizilcec[a,1,2], Justin Reich[b,1,2], Michael Yeomans[c,1,2], Christoph Dann[d], Emma Brunskill[e], Glenn Lopez[f], Selen Turkay[g], Joseph Jay Williams[h], and Dustin Tingley[f,i]

[a]Department of Information Science, Cornell University, Ithaca, NY 14850; [b]Comparative Media Studies/Writing, Massachusetts Institute of Technology, Cambridge, MA 02139; [c]Harvard Business School, Harvard University, Cambridge, MA 02138; [d]Machine Learning Department, Carnegie Mellon University, New York, NY 10004; [e]Computer Science Department, Stanford University, Stanford, CA 94305; [f]Office of the Vice Provost for Advances in Learning, Harvard University, Cambridge, MA 02138; [g]School of Computer Science, Queensland University of Technology, Brisbane City, QLD 4000, Australia; [h]Department of Computer Science, University of Toronto, Toronto, M5S 1A1 ON, Canada and [i]Department of Government, Harvard University, Cambridge, MA 02138

Edited by Susan T. Fiske, Princeton University, Princeton, NJ, and approved May 12, 2020 (received for review December 5, 2019)

Online education is rapidly expanding in response to rising demand for higher and continuing education, but many online students struggle to achieve their educational goals. Several behavioral science interventions have shown promise in raising student persistence and completion rates in a handful of courses, but evidence of their effectiveness across diverse educational contexts is limited. In this study, we test a set of established interventions over 2.5 y, with one-quarter million students, from nearly every country, across 247 online courses offered by Harvard, the Massachusetts Institute of Technology, and Stanford. We hypothesized that the interventions would produce medium-to-large effects as in prior studies, but this is not supported by our results. Instead, using an iterative scientific process of cyclically preregistering new hypotheses in between waves of data collection, we identified individual, contextual, and temporal conditions under which the interventions benefit students. Self-regulation interventions raised student engagement in the first few weeks but not final completion rates. Value-relevance interventions raised completion rates in developing countries to close the global achievement gap, but only in courses with a global gap. We found minimal evidence that state-of-the-art machine learning methods can forecast the occurrence of a global gap or learn effective individualized intervention policies. Scaling behavioral science interventions across various online learning contexts can reduce their average effectiveness by an order-of-magnitude. However, iterative scientific investigations can uncover what works where for whom.

behavioral interventions | scale | online learning

Behavioral scientists have argued that it is possible to intervene and modify personal habits, decisions, and thought patterns that contribute to social problems (1). Behavioral science interventions have been developed to promote a variety of prosocial behaviors, such as healthy eating habits, physical activity, getting medical check-ups, voting, and achievement in schools and colleges. While these interventions are usually low-cost—to participants and policy-makers—they are still thought to be effective because they target the psychological mechanisms underlying people's behavior (2). The ubiquity of networked devices has made it even easier to implement these interventions at large scale and to run field experiments that reveal their broader impact.

In this study, we conducted one of the largest global field experiments in higher education, with one-quarter million students across nearly every country, to examine the scalability of several behavioral science interventions that improved outcomes for thousands of students in our own prior research. Online education is rapidly expanding to address problems of educational access and meet the rising economic demands for professional development and retraining. For all this growth, many online students struggle to achieve their goals. Course completion rates in massive open online courses (MOOCs) among students who intend to complete (3, 4).

Online learning environments are well-suited to test the scalability of behavioral interventions. They have a well-defined outcome (course completion), requiring sustained effort. Student progress is continuously tracked through a common software platform. Improving outcomes in online learning through targeted support holds great promise for human capital development around the world. National education platforms have started using online courses to supplement college STEM (science, technology, engineering, and math) instruction (5) and students who complete MOOCs report benefits ranging from earning credit toward a degree to enhanced skills in a current job or finding a new job (6, 7). Moreover, there is evidence that students can transfer skills learned from MOOCs into real-world settings: They deploy new programming skills into open-source software projects, participate in scholarly activity following a research methods course, and develop new school initiatives after an education leadership course (8–10).

Following the joint Common Guidelines for Educational Research from the National Science Foundation (NSF) and Institute

Significance

Low persistence in educational programs is a major obstacle to social mobility. Scientists have proposed many scalable interventions to support students learning online. In one of the largest international field experiments in education, we iteratively tested established behavioral science interventions and found small benefits depending on individual and contextual characteristics. Forecasting intervention efficacy using state-of-the-art methods yields limited improvements. Online education provides unprecedented access to learning opportunities, as evidenced by its role during the 2020 coronavirus pandemic, but adequately supporting diverse students will require more than a light-touch intervention. Our findings encourage funding agencies and researchers conducting large-scale field trials to consider dynamic investigations to uncover and design for contextual heterogeneity to complement static investigations of overall effects.

Author contributions: R.F.K., J.R., M.Y., C.D., E.B., S.T., J.J.W., and D.T. designed research; R.F.K., J.R., M.Y., C.D., and G.L. performed research; R.F.K., J.R., M.Y., C.D., and G.L. analyzed data; and R.F.K., J.R., M.Y., and C.D. wrote the paper.

The authors declare no competing interest.

This article is a PNAS Direct Submission.

[1]R.F.K., J.R., and M.Y. contributed equally to this work.

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This article contains supporting information online at https://www.pnas.org/lookup/suppl/

Table 1. Comparison of intervention results from prior research and this research for comparable interventions and subgroups of students

Intervention	Subpopulation	Prior result	Present result
Plan-making (long-term)	Committed English-fluent students	$\beta = 3.9$ pp, $\chi^2_{(1)} = 5.2$, $P = 0.023$, $n = 2{,}053$ (3 courses)	Year 1: $\beta = 0.19$ pp, $t = 0.43$, $P = 0.670$, $n = 26{,}586$ Year 2: $\beta = -0.23$ pp, $t = -0.33$, $P = 0.741$, $n = 10{,}372$
Value-relevance	Students in less-developed countries in courses with a global gap	Study 1: $\beta = 3.4$ course activities, $z = 2.82$, $P = 0.005$, $n = 227$ Study 2: $\beta = 24$ pp, $z = 2.26$, $P = 0.024$, $n = 64$	Year 1: $\beta = 2.79$ pp, $t = 3.68$, $P < 0.001$, $n = 5{,}974$ Year 2: $\beta = 2.74$ pp, $t = 2.22$, $P = 0.026$, $n = 2{,}712$
Mental contrasting with implementation intentions	Students in individualistic countries	Study 1: $\beta = 1.8$ pp, $z = 2.35$, $P = 0.019$, $n = 4{,}628$ Study 2: $\beta = 3.9$ pp, $z = 2.41$, $P = 0.016$, $n = 3{,}248$	Year 2: $\beta = 0.25$ pp, $t = 0.44$, $P = 0.662$, $n = 12{,}879$

Note that there are several differences between the prior and present research in terms of the implementation of intervention instructions and sample exclusion criteria. Effects denote percentage point (pp) increases in course completion except where noted.

New Science of Learning

1) The hypothesis was that vast new sources of data would create a new science of learning
2) This data captured many forms of behavior, but not so much about learning
3) Designing online learning to generate new insights about effective instruction or effective learning is much harder and more expensive than just designing new courses

Three Big Bets of MOOCs

1) Provide new pathways into higher education for people with limited access
2) Reorganize (disrupt, unbundle, etc.) higher education
3) Create a new data-driven science of learning

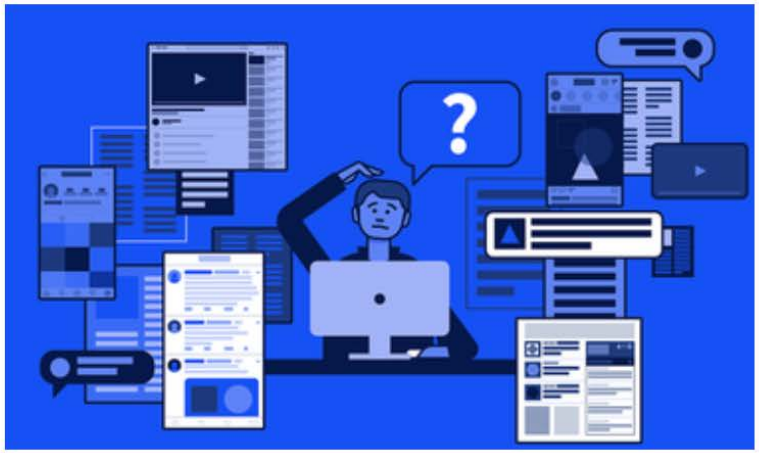
Little Bets of MOOCs?

Catalog › Education & Teacher Training Courses

Sorting Truth From Fiction: Civic Online Reasoning

Learn teaching practices that help students become savvy consumers of digital information.

Massachusetts Institute of Technology



View Course

ELSEVIER

Computers & Education

Volume 180, April 2022, 104426

Large scale analytics of global and regional MOOC providers: Differences in learners' demographics, preferences, and perceptions

José A. Ruipérez-Valiente [a b], Thomas Staubitz [c], Matt Jenner [d], Sherif Halawa [e], Jiayin Zhang [f], Ignacio Despujol [g], Jorge Maldonado-Mahauad [h i], German Montoro [j], Melanie Peffer [k], Tobias Rohloff [c], Jenny Lane [k], Carlos Turro [g], Xitong Li [l], Mar Pérez-Sanagustín [h m n], Justin Reich [b]

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https://doi.org/10.1016/j.compedu.2021.104426

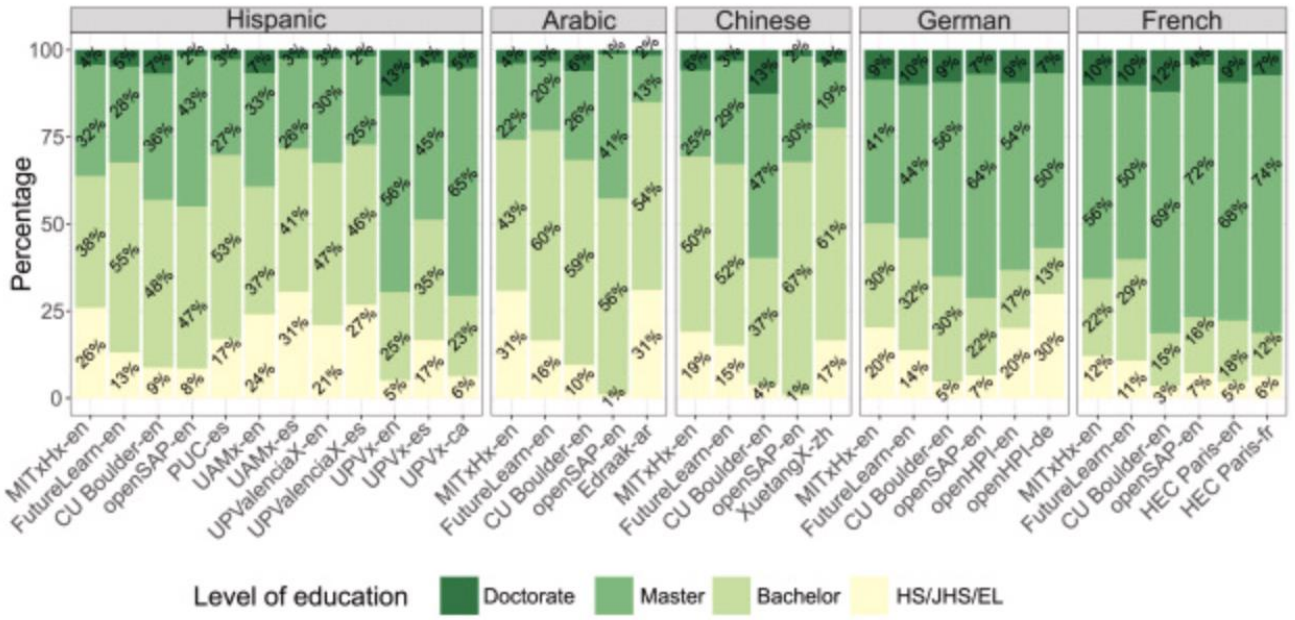

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Fig. 5. Distribution of level of education per MOOC provider and course language for each one of the analyzed sub-populations.

New Bets for MOOCs?