**From MOOCs to MOOIs:**

**Attrition as Law in Online Learning** *and* **Online Therapy**

**Elias Aboujaoude, MD, MA (corresponding author)**

Department of Psychiatry and Behavioral Sciences

Stanford University School of Medicine

401 Quarry Road, Room 2301

Stanford, CA 94305

Phone: 650.498.5035

Email: eaboujaoude@stanford.edu

**Lina Gega, PhD**

Department of Health Sciences and Hull York Medical School

University of York

York, United Kingdom

**Andy J. Saltarelli, PhD**

Office of Learning Technologies & Spaces

Stanford University

Stanford, CA 94305

**Introduction**

Like every other field, education and mental health treatment have been upended by the coronavirus pandemic. The United Nations Educational, Scientific and Cultural Organization (UNESCO) estimated that over 91% of the worldwide student population—nearly 1.5 billion learners—have been impacted,1 and a March 2020 Kaiser Family Foundation survey suggested a national psychological trauma affecting 45% of the US population.2 Accordingly, and seemingly overnight, long established methodologies had to be abandoned to continue teaching students suddenly uprooted from their classrooms, and to meet the mental health needs of a population rocked by a severe stressor. Online platforms offered easily scalable solutions that may have made the difference between students graduating on time or not, and patients suffering alone or finding support. Studies will ultimately determine how successful this transition has been and how well the remote backup has worked compared with the conventional “gold standard.” Meanwhile, pre-COVID-19 research into MOOCs and digital therapy platforms offers important insights into the newly indispensable worlds of online education and therapy.

Overall, that body of research suggests great promise but highlights, rather consistently, a dramatic attrition problem; one that has parallels and roots in broader online psychology, where inattention and weak ties to content and relationships are characteristic. A better understanding of attrition in that context is crucial to the successful adoption of online learning and treatment during, and beyond, the pandemic, and should stimulate collaborations between two suddenly central fields that have much more in common than has been acknowledged.

**MOOCs**

Much hope rode on Massive Open Online Courses (MOOCs) when they became available in the early 2010s, including the possibility of making education globally accessible.3 Bringing together star educators, user-friendly platforms, and no to low participation cost, they offered the possibility of democratizing education like never before. The “seal of approval” implied by partnerships between nascent MOOC startups and prominent universities—Stanford with Udacity and Coursera; Harvard, MIT and UC Berkeley with EdX4—further contributed to the notion of a pedagogical revolution in the making.

***Theoretical Background***

MOOCs came about at a time of questioning of existing educational models and a realization that old methods may no longer be well suited to today’s learners, information repositories and modes of communication.5 The 2007 “Kronberg Declaration on the Future of Knowledge Acquisition and Sharing” issued by the UNESCO advocated a more learner-centric philosophy that focused on learners interacting directly with educational material as the instructor receded to a less directive role.6 Similarly, “connectivist” theory encouraged plugged-in learners to engage directly with online information as opposed to traditional teacher-to-student transmission. By leveraging technology to translate nascent education theories, MOOCs—whose very name emerged from a 2008 conference on connectivist learning7—seemed to embody the move toward learners taking charge of the learning process.

***Components and Topics***

Specific MOOC components vary, but features include a combination of recorded and live video lectures; online readings; forums for student-to-student and student-to-instructor interaction; assessment modules (typically, peer-to-peer or auto-graded); and social media links for discussion.8 No topic seemed off limits to the format, from computer science to social sciences, arts and humanities, business and accounting, mathematics, agriculture, biological sciences, engineering, environmental science—and education itself.9

***Attrition***

Seemingly independent of components and across subject areas, however, MOOCs have suffered from dramatically high attrition rates, a fact that has compromised the ambitious goals that propelled their initial deployment and growth. In one study of 155,000 learners who registered for “Circuits and Electronics,” the prototype 2012 MIT MOOC, only 4.6% completed the course.10 A comprehensive 2018 study of *all* courses taught on edX by MIT and Harvard since then revealed how little had changed despite six years of research and investment in course development and user engagement.11 The study covered 565 course iterations with a combined 12.67 million course enrollments and 5.63 million learners. Completion rates ranged from 3.13% and 5.91% across all academic years. Among learners who reported an intention to complete, completion rates varied between 11.51% and 17.74%. Further, the vast majority (88%) never returned to enroll in another MOOC, suggesting possible dissatisfaction with the learning format or process. Finally, the growth in MOOC participation was concentrated almost entirely in the world's most affluent countries, a finding encountered in other research12 and that challenges the notion that MOOCs would bring education to the deprived margins of global higher education.

Another study analyzed 36 MOOCs offered by Stanford University in collaboration with Coursera between 2011 and 2013, and covering computer science, mathematics, politics, science and health.13 Among the 120,861 learners tracked, 46% were “non-starters”, i.e., did not explore the MOOC in any way after enrolling. Activity decayed rapidly initially, then more slowly, with only 17% of enrollees watching the last video and 8% taking the last quiz. The number of students participating in any way at the midpoint of the course was approximately 25% of the original cohort. “Auditors” who only watched videos and “engagers” who watched videos and took quizzes, showed similar attrition patterns, leading the study researchers to conclude that attrition is a “deterministic” feature of the medium.

**Digital Therapy**

A similar story is told by the technology-enabled platforms that have been explored in mental health treatment. Many features have made them particularly appealing to patients, providers, public health authorities, insurance programs, and investors: scalability in the face of severe provider shortages; reduced need for physical examinations and laboratory tests in mental health treatment; the stigma that still complicates visits to mental health clinics; and diagnosis-specific obstacles to visiting treatment settings, such as OCD-related contamination fear or social anxiety disorder.14

Technology-enabled platforms used in mental health vary greatly and encompass self-help digital therapy platforms with minimal or no support from a therapist; video-based therapy via webcam; virtual reality therapy, which reproduces feared environments to desensitize patients, including to height, flying or other phobias; “serious games”, or video games with a therapeutic goal, such as “brain training” to protect memory; and artificial intelligence therapy, which uses machine learning to simulate an in-person therapist.14 These interventions differ in the degree of support offered to the user; the technology platform used; the theoretical framework behind them (“cognitive behavioral”, “exposure”-based, “psychodynamic”, or other); and whether they target individuals, couples, families or groups.15

***MOOIs***

Among technology-enabled mental health treatment interventions, digital therapy platforms are the oldest and best studied. These programs are also the platform that resembles most closely the MOOC experience insofar as they tend to be self-paced, with or without brief interactions with a therapist or facilitator, and are easily scalable. The concept is so aligned with MOOCs that it has been termed Massive Open Online Interventions, or MOOIs.16 Like MOOCs, digital therapy platforms were heralded as a way to “democratize” care and solve once and for all stubborn shortages and inequalities in mental health treatment access.

***Attrition***

As with MOOCs, attrition has helped deflate the dream of universal access to mental health care via digital therapy platforms. Defined as termination at any point between registering for online treatment and completing post-treatment questionnaires,17 attrition was already so well documented by 2005, that it warranted its own “law”—the “Law of Attrition.18 This was in part inspired by two studies, one involving a 12-session online digital platform to treat panic disorder (“Panic Center”),19 and one involving a five-module online intervention for depression (“MoodGym”).20 In the Panic Center study, the use patterns of 99,695 visitors to the portal were analyzed. Among the 1,161 who registered, only 12 (1.03%) completed the program. Among all the challenges encountered in introducing and testing this new treatment, the researchers described attrition as “the most notable problem”. Similarly, among the 19,607 registrants who sought out MoodGym to treat depression, only 97 (0.5%) completed the intervention.

**The Larger Context**

The retention challenge encountered in MOOCs and digital therapy platforms mirrors online behaviors far from these fields. A look at broader online psychology helps contextualize this and shows that distractibility from an online task may be a feature of the medium itself, rather than specific to online learning or clinical care.

***Reading vs. “Surfing”***

Before learning or treatment became realistic online goals, other online activities showed a similar tendency toward limited user commitment. Readers of online content, for example, have long been seen as ﬁckle, easily distracted by better online opportunities, and much Web development has focused on decreasing “bounce rate”, increasing “dwell time”, extending “scroll depth”, and shrinking “time between visits”.21 In an early study of the reading patterns of scholars consulting the British Library’s online stacks, 60% viewed no more than the first three pages of an e-article.22 Rather than committed or in-depth, the researchers’ reading was described as “promiscuous,” “volatile”, “squirrelling” and “bouncing”. Lay readers of popular online content are no different: 38% of *Slate* readers who land on a story spend no time at all engaging with it. Of readers who do engage in some way (such as moving the mouse pointer on the page), 5% never scroll beyond the very top of the page, and most scroll to only about the 50% mark.23 The early adoption of “surfing” to describe engagement with the internet still captures this tendency rather well.

***Inattention and Online Psychopathology***

It is also notable that Attention-Deficit and Hyperactivity Disorder (ADHD) is very commonly diagnosed in individuals with Pathological Internet Use (PIU) (aka “Internet Addiction”), broadly defined, and the video-game-focused Internet Gaming Disorder (IGD). In a review of 20 large studies, 100% of the studies reported a significant correlation between PIU and ADHD.24 Another review explored the association between IGD and co-occurring psychological disorders in 24 studies. A significant correlation with symptoms of ADHD was reported in 85% of the studies.25 This points to inattention as a recurrent finding in individuals with diagnosable internet-related psychopathology. But, while most internet users do not suffer from PIU, IGD or, indeed, ADHD, their behavior, as described by research such as the reading studies, consistently suggests difficulty sustaining attention in the online environment. (The literature on overconfidence in online multi-tasking abilities can be understood to support this point.26) Some degree of attention span compression seems to characterize the spectrum of online experience from the casual “surfer” or multi-tasker to the “problematic” user or “addicted” gamer.

***Loose Online Ties***

The difficulty attending to online content has a parallel in the weakness of the bond in many online relationships. The average number of Facebook “friends” was 338 in 2014, according to a Pew Research Center study marking the social network’s 10th anniversary.27 There is no doubt that, in their brief history, social media have dramatically extended the reach of people’s social circles, including by helping users form new relationships or revive old ones. Indeed, the decades-old “strength of weak ties” sociological theory28 has found new life in the social media age by highlighting the importance of weak ties in bridging together closely knit groups that enjoy strong ties within them but that would otherwise have difficulty connecting with other closely knit groups. But the popularity of functionalities such as “unfriending” and “blocking” or behaviors such as “ghosting” suggests how low the level of investment in many online relationships can be.29,30 Data are scarce, but one study of 1,137 social media users found that Facebook “unfriending” was easily triggered and not necessarily the result of clearly offensive or hurtful behavior:31, 32 64% cited “unimportant” posts as their reason for unfriending someone, compared with 34%, 26%, 13% and 12% who cited “too many posts”, “political posts”, “sexist posts” and “racist posts”, respectively. In other words, a major breach of friendship rules was not required to end many social media friendships. Online friendships are easy to accumulate but seem just as easily terminated.

**Putting It All Together**

The loose ties in online relationships, the attentional problems accompanying online disorders, and the distractibility vis-a-vis online content may not be fundamentally dissimilar from the problem that users have sticking to MOOCs or digital therapy platforms. A difficulty committing to processes online may be a “deterministic” feature of internet-related technologies, one that transcends the specific online activity. Its end result may be to limit the benefit that can be drawn from valuable online offerings, including in education and psychotherapy. The neurobiological underpinnings of this are far from clear, but research into Internet-related psychopathology suggests effects at the level of connectivity between brain areas33, white brain matter integrity,34 cerebral blood flow,35 and dopamine transmission.36

***Enhance Motivation to Encourage Retention***

Attrition in online education and treatment is important to understand and to try to minimize, in part because greater exposure to program content would be expected to increase benefit. Insights from organizational psychology may prove helpful here, especially around enhancing adherence motivation by focusing on factors that influence it, such as collaborative goal-setting between user and educator/therapist; performance monitoring; "social presence” by the educator/therapist; an educator/therapist who is seen as "legitimate"; the nurturing of a bond between the user and educator/therapist; and “psychologically inclusive design” that builds programs representative of a broad audience of users.37,38

Along these lines, and while there are no established ways to reduce dropout rates in digital therapy platforms, several modifications have been suggested, including allowing more opportunity for even brief contact with therapists. Indeed, evidence suggests that, when it comes to digital mental health interventions, the greater the therapist involvement, the more effective the intervention.39,40 Similarly, “hybrid” or “blended” MOOC models that incorporate in-person contact with educators have been suggested to improve retention.41,42

***The Need to “Bond”***

The absence of a meaningful “therapeutic alliance” or client-therapist “bond” has been hypothesized as a reason for poor adoption and high attrition in technology-enabled treatment interventions overall,43 including the video-enabled psychotherapy platforms now very popular post-COVID.44 It is possible that the absence of a live interlocutor who encourages patients and holds them accountable for missed appointments or incomplete therapy homework, or whom patients do not want to “disappoint” by dropping out of therapy, plays a role in attrition. The same argument can be made regarding the lack of a present and fully engaged educator in the MOOC experience.

***The Paradox of Charging***

The lack of a meaningful financial investment into MOOCs and digital therapy platforms may also play a role in attrition. Many MOOCs started as free offerings and remain free or easily affordable. This is also true of many digital therapy platforms which, even when not free, are much less costly than office-based treatment. Ironically, though, as it “democratizes” education and treatment and as it reaches disadvantaged groups, affordability might also decrease commitment to MOOCs and digital therapy platforms since there is little to lose, financially, from dropping out. Data suggests that MOOC cost correlates with attrition and that charging for online courses may help.45 Relatedly, issuing completion certificates, for which MOOC platforms usually charge, has been described as another promising retention strategy.46

***“Gamification” to the Rescue?***

Finally, a more interactive interface can be seen as more engaging and, therefore, less likely to lead to attrition. This "gamification", however, does not seem to have led to a substantial increase in adherence: For digital therapy platforms, there does not seem to have been a substantial decrease in attrition as programs moved online from the comparatively "boring" CD-ROM progenitors. Similarly, MOOC retention has not improved as internet functionalities expanded and “bells and whistles” were added.47

***Attrition, an Imperfect Measure***

Still, all is not lost. Attrition may not be the right standard by which to judge the success of MOOCs and digital therapy platforms.48,49 For example, in attrition literature, user intent is often ignored.50 Compared to university students who typically enroll in classes with an explicit interest in earning a credential, MOOC registrants may be interested in sampling whether a topic is worth pursuing in depth; may be interested in a single lecture out of a multi-lecture MOOC; or may be curious about online education in general. A similar distinction may operate between users of digital therapy platforms vs. conventional therapy (e.g., out of a comprehensive digital therapy offering, a user might only be interested in one module’s topic). Therefore, it would be too simplistic to approach MOOC and digital therapy attrition percentages as the conceptual equivalents of the drop rate metric of traditional college courses or the “loss to follow-up” criterion of conventional clinical care.

Further, given the low barriers—geographic, financial, technical, etc.—to entry and the easy scalability of these systems, low retention percentages can still, if enough people enroll, translate into robust absolute numbers of completers. For example, at a 1% retention rate of 10 million people, 10 thousand people will complete a course or an intervention using a mass open online format; the same number of people would otherwise take years to educate or treat with conventional methodologies and would require large investments in resources.

***The limits of “reach many, retain a few, benefit some.”***

But the argument of “reach many, retain a few, benefit some” is not without its flaws; mass-targeted courses and interventions with limited benefits due to high attrition may have adverse clinical, social and economic consequences. First, even if those who complete a MOOC/digital therapy platform are more likely to benefit from it, we still do not know what its effects are on those who drop out: did they not need the course/intervention in the first place, did they get inspired to seek alternative ways of education/care, or were they put off altogether from learning or seeking help? Moreover, do public or private organizations that offer MOOCs/digital therapy platforms consider them as a stepping-stone for improving access, or as a way of absolving themselves from responsibility, because learning or health improvement rests with the individuals who take up and adhere to the offered course/intervention?

Second, the cost of developing, updating and maintaining a MOOC/digital therapy platform may appear small when divided by the number of people it can reach compared to doing so with teachers or therapists; however, value for money should be determined not by the absolute cost of MOOCs/digital therapy platforms, but by comparing their combined costs and outcomes with the combined costs and outcomes of their alternatives. Such outcomes should be measured for everyone who “registers” with the course/intervention rather than only for those who complete it, and the costs should include resources that people may use in addition to the costs of the course/intervention itself. Small benefits for small intervention costs may not confer good value for money compared to more costly but more effective alternatives when the masses of those who drop out end up getting worse over time or use more resources. In this respect, the “smaller-reach, better-retention” person-delivered courses/interventions may offer better value for money than the “mass-reach, high-attrition” of MOOCs/digital therapy platforms.

Third, MOOCs/digital therapy platforms may reinforce the “inverse care law” by reaching those more motivated or more privileged. Milder symptoms, better access to technology, and greater social and professional support can help people make better use of an online course or intervention, whereas more severe symptoms, limited access to technology, and inadequate personal support may contribute to drop out. Introduced by Julius Hart in the 70s as a criticism of market-driven healthcare systems, the inverse care law51 still captures the notion of health inequalities in the provision of care around the world.52 MOOCs/digital therapy platforms may promise greater reach, but at the same time may not reach or benefit those in greatest need. Sadly, there are already indications of this in the provision of education and telehealth services during the COVID-19 pandemic.53,54

On the flipside, MOOCs and digital therapy platforms may be valuable as a population-wide education and health initiative, in spite of their high attrition, on the assumption that they lead to incremental change across populations and over time. This, in turn, can shift the whole population distribution in a more favorable direction. For digital therapy platforms, this is analogous to public health tools meant to prevent heart attacks by encouraging blood pressure-reducing habits like exercise and physical activity in entire populations.55 If digital therapy platforms improve mental wellbeing across the population, they can potentially reduce the number of people with mental health problems. In this case, greater population reach would translate into a positive shift in mental health outcomes.

**Future Directions**

The COVID-19 pandemic has brought online education and online treatment into the lives of many people who may otherwise have ruled them out or not had an opportunity to consider them. While their adoption in many cases may have been abrupt and not entirely voluntary, it is likely that some elements of remote teaching and healing will remain in use after the pandemic passes. To maximize the benefit that can be expected from these platforms, it is important that we learn from the well documented attrition and other challenges associated with MOOCs and digital therapy platforms. Although what is being offered in the COVID age by way of online education or therapy does not typically meet the definition of MOOCs or digital therapy platforms, an understanding of the lessons borne out in research studies into those should help us develop educational and therapeutic content that is more accessible, engaging, supported, inclusive, and cost-effective.

Finally, for two fields that have studied similar platforms and investigated similar problems, there has been little “cross-fertilization” and little benefiting from each other’s experience. It is important that these branches of scholarship that are suddenly so central collaborate around shared challenges, for the benefit of their millions of users.

**Notes:**

1. United Nations Educational, Scientific and Cultural Organization, “COVID-19 educational disruption and response,” UNESCO, April 14, 2020, <https://en.unesco.org/covid19/educationresponse>.
2. Joel Achenbach, “Coronavirus is harming the mental health of tens of millions of people in U.S., new poll finds,” *Washington Post*, April 2, 2020, <https://www.washingtonpost.com/health/coronavirus-is-harming-the-mental-health-of-tens-of-millions-of-people-in-us-new-poll-finds/2020/04/02/565e6744-74ee-11ea-85cb-8670579b863d_story.html>
3. Anant Agarwal, “Online Universities: It's Time for Teachers to Join the Revolution,” *The Guardian*, June 15, 2013, <https://www.theguardian.com/education/2013/jun/15/university-education-online-mooc>.
4. Steve Cooper and Mehran Sahami, “Reflections on Stanford’s MOOCs,” *Communications of the ACM* 56, no. 2 (2013): 28-30, https://[doi:10.1145/2408776.2408787](https://doi.org/10.1145/2408776.2408787).
5. Richard Arum and Josipa Roksa. *Academically Adrift: Limited Learning on College Campuses* (Chicago: University of Chicago Press, 2011).
6. UNESCO High Level Group of Visionaries on Knowledge Acquisition and Sharing, “Kronberg Declaration on the Future of Knowledge and Sharing, UNESCO, June 22, 2007, <http://www.futureknowledge.org/background/Kronberg-Declaration.pdf>.
7. Dara Cassidy, Nicholas Breakwell and Jemimah Bailey, “Keeping Them Clicking: Promoting Student Engagement in MOOC Design,” 2013, http://icep.ie/wp-content/uploads/2013/12/CassidyBreakwellBailey.pdf.
8. Meltem Huri Baturay, An Overview of the World of MOOCs,” *Procedia – Social and Behavioral Sciences* 174 (2015): 427-433.
9. Waleed Al-Rahmi et al. “Massive Open Online Courses (MOOCs): Data on Higher Education,” *Data in Brief* 22 (2018):118-125, <https://doi.org/10.1016/j.dib.2018.11.139>.
10. Larry Hardesty, “Lessons Learned from MITx’s Prototype Course,” *MIT News* *Office*, July 16, 2012, http://newsoffice.mit.edu/2012/mitx-edx-first-course-recap-0716.
11. Justin Reich and Jose A. Ruiperez-Valiente, “The MOOC Pivot,” *Science* 363, no. 6423 (2019): 130-131,http://dx.doi.org/10.1126/science.aav7958
12. Rene F. Kizilcec et al., “Closing Global Achievement Gaps in MOOCs,” *Science* 355 no. 6322 (2017): 251-252, https://doi. 10.1126/science.aag2063
13. David G. Glance, P. Barrett and R. Hugh, “Attrition Patterns Amongst Participant Groups in Massive Open Online Courses,” ASCILITE Conference, 2014, http://ascilite2014.otago.ac.nz/files/fullpapers/16-Glance.pdf.
14. Elias Aboujaoude et al., “Digital Interventions in Mental Health: Current Status and Future Directions,” *Frontiers in Psychiatry* 11 no. 111 (2020), https://doi:10.3389/fpsyt.2020.00111.
15. Elias Aboujaoude et al., “Telemental health: A status update,” *World Psychiatry* 2 (2015):223-30, https://doi: 10.1002/wps.20218.
16. Ricardo F. Munoz et al., “Massive Open Online Interventions: A Novel Model for Delivering Behavioral Health Services Worldwide,” *Clinical Psychological Science* 4 no. 2 (2016): 194-205.
17. Katherine M. Melville, Leanne M. Casey, David J. Kavanagh, “Dropout from Internet-Based Treatment for Psychological Disorders,” *British Journal of Clinical Psychology* 49 no. 4 (2010):455-71, https://doi: 10.1348/014466509X472138.
18. Gunter Eysenbach, “The Law of Attrition,” *Journal of Medical Internet Research* 7 no.1 (2005):e11.
19. Peter Farvolden et al., “Usage and Longitudinal Effectiveness of a Web-Based Self-Help Cognitive Behavioral Therapy Program for Panic Disorder,” *Journal of Medical Internet Research* 7 no. 1 (2005): e7, https://doi: 10.2196/jmir.7.1.e7.
20. Helen Christensen et al., “A Comparison of Changes in Anxiety and Depression Symptoms of Spontaneous Users and Trial Participants of a Cognitive Behavior Therapy Website,” *Journal of Medical Internet Research* 64 no.4 (2004):e46, https://doi: 10.2196/jmir.6.4.e46
21. Emily Gaudette, “2018’s Content Metric of the Year: Time,” *Contently*, December 19, 2018, https://contently.com/2018/12/19/2018-content-metric-time.
22. Ian Rowlands et al., “The Google Generation: The Information Behaviour of the Researcher of the Future,  
     *Aslib Proceedings* 60 no.4 (2008):290-310, <https://doi:10.1108/00012530810887953>.
23. Farhad Manjoo, “You Won’t Finish This Article,” *Slate*, June 6, 2013, <https://slate.com/technology/2013/06/how-people-read-online-why-you-wont-finish-this-article.html>.
24. Vladimir Carli et al., “The Association between Pathological Internet Use and Comorbid Psychopathology: A Systematic Review, *Psychopathology* 46 (2013):1–13, https://doi: 10.1159/000337971.
25. Vega González-Bueso et al., “Association between Internet Gaming Disorder or Pathological Video-Game Use and Comorbid Psychopathology: A Comprehensive Review,” *International Journal of Environmental Research and Public Health* 15 no.4 (2018): 668, https://doi:10.3390/ijerph15040668.
26. Eyal Ophir, Clifford Nass, and Anthony D. Wagner, “Cognitive Control in Media Multitaskers,” *Proceedings of the National Academy of Sciences* 106 no. 37 (2009):15583-15587, <https://doi.org/10.1073/pnas.0903620106>.
27. Maeve Duggan et al., “Social Media Update 2014,” *The Pew Research Center*, January 9, 2015, https://www.pewresearch.org/internet/2015/01/09/social-media-update-2014.
28. Mark S. Granovetter, “The Strength of Weak Ties,” *American Journal of Sociology*, 78 no.6 (1973):1360-1380.
29. Elias Aboujaoude, *Virtually You: The Dangerous Powers of the e-Personality*, (New York: W.W. Norton, 2011), pp. 163-188.
30. Elias Aboujaoude and Lina Gega, “From Digital Mental Health Interventions to Digital ‘Addiction’: Where the Two Fields Converge,” *Frontiers in Psychiatry* 10 (2020):1017, https://doi: 10.3389/fpsyt.2019.01017.
31. Joseph Stromber, “Here’s Why You Just Got Unfriended on Facebook,” *Vox*, April 27, 2014, https://www.vox.com/2014/4/27/5652578/3-things-research-has-told-us-about-being-unfriended-on-facebook.
32. Pamela Paul, “How to Get Unfriended on Facebook,” *The New York Times*, October 24, 2010, https://www.nytimes.com/2010/10/24/fashion/24Studied.html.
33. Soon-Beom Hong et al., “Decreased Functional Brain Connectivity in Adolescents with Internet Addiction,” *PLoS One* 8 no.2 (2013):e57831, https://doi: 10.1371/journal.pone.0057831.
34. Fuchun Lin et al., “Abnormal White Matter Integrity in Adolescents with Internet Addiction Disorder: A Tract-Based Spatial Statistics Study, *PLoS One* 7 no.1 (2012):e30253, https://doi: 10.1371/journal.pone.0030253.
35. Guobing Liu et al., “Functional Changes in Patients with Internet Addiction Disclosed by Adenosine Stressed Cerebral Blood Flow Perfusion Imaging (99m)Tc-ECD SPET,” Hellenic Journal of Nuclear Medicine 19 no.2 (2016):93-104, https://doi: 10.1967/s002449910361.
36. Haifeng Hou et al., “Reduced Striatal Dopamine Transporters in People with Internet Addiction Disorder,” *Journal of Biomedicine and Biotechnology* 854524 (2012), https://doi: 10.1155/2012/854524.
37. David C. Mohr, Pim Cuijpers, and Kenneth Lehman, “Supportive Accountability: A Model for Providing Human Support to Enhance Adherence to eHealth Interventions,” *Journal of Medical Internet Research* 13 no. 1 (2011):e30, https://doi: 10.2196/jmir.1602.
38. Rene F. Kizilcec, Andrew J. Saltarelli, “Psychologically Inclusive Design Cues Impact Women’s Participation in STEM Education,” *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems*, 2019, <https://dl.acm.org/doi/10.1145/3290605.3300704>.
39. Pim Cuijpers et al., “Computer-Aided Psychotherapy for Anxiety Disorders: A Meta-Analytic Review,” Cognitive Behaviour Therapy 38 no.2 (2009):66-82, https://doi: 10.1080/16506070802694776.
40. Robert Johansson R, Gerhard Andersson, “Internet-Based Psychological Treatments for Depression,” Expert Review of Neurotherapeutics 12 no.7 (2012):861–9, https://doi: 10.1586/ern.12.63.
41. Helen Walters, “We Need to Change Everything on Campus,” *TED*, January 27, 2014, <https://ideas.ted.com/we-need-to-change-everything-on-campus-anant-agarwal-of-edx-on-moocs-mit-and-new-models-of-higher-education>
42. Di Xu, Shana Smith Jaggars, “Online and Hybrid Course Enrollment and Performance in Washington State Community and Technical Colleges,” *Community College Research Center Working Paper No. 31*, 2011, <https://eric.ed.gov/?id=ED517746>.
43. Elias Aboujaoude, “Telemental Health: Why the Revolution Has Not Arrived,” *World Psychiatry* 17 no.3 (2018):277-278, https://doi: 10.1002/wps.20551.
44. Lisa Beatty, Claire Binnion, “A Systematic Review of Predictors of, and Reasons for, Adherence to Online Psychological Interventions,” *International Journal of Behavioral Medicine* 23 no.6 (2016):776-794.
45. Seb Murray, “MOOCs Struggle to Lift Rock-Bottom Completion Rates,” *Financial Times*, March 3, 2019, <https://www.ft.com/content/60e90be2-1a77-11e9-b191-175523b59d1d>.
46. Seb Murray, *Financial times*.
47. Reich and Ruiperez-Valiente, “The MOOC Pivot.”
48. Daphne Koller, Andrew Ng and Zhenghao Chen, “Retention and Intention in Massive Open Online Courses: In Depth,” *Educause*, June 3, 2013, https://er.educause.edu/articles/2013/6/retention-and-intention-in-massive-open-online-courses-in-depth.
49. Jon Marcus, “Harvard, MIT: Despite Low Completion Rates, MOOCs Work,” *The Hechinger Report*, January 21, 2014, <https://hechingerreport.org/harvard-mit-despite-low-completion-rates-moocs-work>.
50. Koller, Ng and Chen, *Educause*.
51. Julian Tudor Hart, “The Inverse Care Law,” *Lancet* 1 no.7696 (1971):405–12.
52. Devaki Nambiar and Harsh Mander, “Inverse Care and the Role of the State: The Health of the Urban Poor,” *Bulletin of the World Health Organization* 95 (2017):152-153, <http://dx.doi.org/10.2471/BLT.16.179325>.
53. Natalie Ornestein, “Who Gets to Learn in Berkeley, and How, When COVID-19 Has Closed All Schools?” *Berkeleyside*, March 25, 2020, <https://www.berkeleyside.com/2020/03/25/who-gets-to-learn-in-berkeley-and-how-when-covid-19-closes-all-schools>.
54. Federal Communications Commission. “Promoting Telehealth for Low-Income Consumers,” *Federal Register*, April 9, 2020, <https://www.federalregister.gov/documents/2020/04/09/2020-07587/promoting-telehealth-for-low-income-consumers-covid-19-telehealth-program>.
55. A. Rodgers, C. Lawes C and S MacMahon, “Reducing the Global Burden of Blood Pressure- Related Cardiovascular Disease,” *Journal of Hypertension* 18(Supplement) (2000):S3-6.