



POLICY BRIEF

LEVERAGING DIGITAL TECHNOLOGY TO BRIDGE THE GLOBAL KNOWLEDGE DIVIDE: THE PROMISE OF MOOCS REVISITED



Task Force 7
**G20 SUPPORT FOR SDGS AND DEVELOPMENT
COOPERATION**

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موجز السياسة الاستفادة من التقنية الرقمية لسد الفجوة المعرفية العالمية: مراجعة وعد الدورات الضخمة والمفتوحة على الإنترنت

فريق العمل السابع
دعم مجموعة العشرين لأهداف التنمية المستدامة
والتعاون الإنمائي



المؤلفون
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ABSTRACT

Massive open online courses (MOOCs) can be critical in bridging the global knowledge divide. However, the promise of MOOCs has remained largely unfulfilled, mainly because of the global digital divide. The closure of schools following the COVID-19 pandemic has reignited interest in MOOCs, with many innovative solutions emerging worldwide. We offer a strong rationale and propose specific measures for national governments and the Group of Twenty (G20) to scale up the uptake of MOOCs—these include investment in infrastructure to adapt globally, and develop indigenous MOOCs in low- and middle-income countries; G20 funding for large-scale infrastructure initiatives in least developed countries; leveraging the deep penetration of mobile technology in developing countries; and expanded funding for UNESCO.

يمكن أن تكون الدورات الضخمة والمفتوحة على الإنترنت عاملاً جوهرياً في سد الفجوة المعرفية العالمية. إلا أن وعد الدورات الضخمة والمفتوحة على الإنترنت ما زال غير محقق على نطاقٍ كبير، ويعود ذلك في الأساس إلى الانقسام الرقمي العالمي. وقد جدد إغلاق المدارس بعد جائحة كوفيد-19 الاهتمام بالدورات الضخمة والمفتوحة على الإنترنت، مع وجود العديد من الحلول المبتكرة الناشئة على مستوى العالم. ونحن نقدم تبريراً منطقياً قوياً، ونقترح تدابير محددة على الحكومات الوطنية ومجموعة العشرين من أجل زيادة استيعاب الدورات الضخمة والمفتوحة على الإنترنت، وتتضمن هذه الإجراءات الاستثمار في البنية الأساسية لتبني الدورات الضخمة والمفتوحة على الإنترنت عالمياً، وتطويرها في البلدان منخفضة ومتوسطة الدخل، وأن تموّل مجموعة العشرين مبادرات واسعة النطاق للبنية الأساسية في البلدان الأقل تطوراً، والاستفادة من التغلغل العميق للتقنية المحمولة في الدول النامية، والتوسع في تمويل منظمة اليونسكو.



CHALLENGE

Low- and middle-income countries (LMICs) have the opportunity to take off by **leapfrogging (jumping technological generations)**—that is, building systems that are not hobbled by obsolete infrastructures and outdated technologies.¹

Leapfrogging is premised upon the transfer of scientific knowledge and technology. The Education 2030 Framework for Action² calls on countries to “develop policies and programmes for the provision of quality distance learning in tertiary education, with appropriate financing and use of technology, including the Internet, massive open online courses (MOOCs) and other modalities.” The Internet is the world’s intellectual common property, and open education resources (OERs) “render this knowledge accessible to all” (McGreal 2017, 122).

The rapid rise of MOOCs has been hailed by many experts as a revolutionary technological development that would enable LMICs to leapfrog and bridge the knowledge divide. MOOCs have the potential to transform the vision of open science into reality (Kellogg 2013; Ramirez-Montoya 2020). These courses are cost-free, online, scalable, and customizable. Anyone with access to a telecommunications network, in any geographical region, and who is self-motivated can access these courses. MOOCs, combined with other OERs, constitute a valuable and significant vehicle in meeting the United Nations and UNESCO’s educational goal (McGreal 2017, 299), in particular SDG 4.4.³

However, the digital divide has had a particularly disabling effect on the realization of the transformational promise of MOOCs.

The global digital divide is a multi-dimensional concept that encompasses the access and usage of digital technologies (Mubarak et al. 2020; Van Dijk 2012). Below, we summarize the emerging consensus on the major barriers to the uptake of MOOCs in the global south:

1. See the seminal article on leapfrogging by Gerschenkron (1962). In principle, and *ceteris paribus*, the cost for leapfroggers drops drastically as they are spared the investment that early starters/advanced countries had to make in the systems that are now inefficient and need to be replaced by latest technologies.

2. See http://uis.unesco.org/sites/default/files/documents/education-2030-incheon-framework-for-action-implementation-of-sdg4-2016-en_2.pdf.

3. See <https://sdg4education2030.org/the-goal>.

CHALLENGE

- Non-existent or inadequate infrastructure⁴ limits the uptake of MOOCs.
- Network services and devices remain either unaffordable or inadequate.⁵
- Lack of information communication and technology (ICT) skills⁶ limits the uptake of MOOCs.
- Local financial and human resources to develop indigenous, and/or utilize, international MOOCs are highly limited (Bali and Aboulmagd 2019; Czerniewicz et al. 2014; McGreal 2017, 293).
- Given the public good⁷ nature of MOOCs, universities perceive loss of revenue if prospective students switch to MOOCs.
- Lack of quality assurance in terms of transferable or marketable credits dampens paid participation (Hollands and Tirthali 2014; Xiao et al. 2014)
- Major beneficiaries of MOOCs are the privileged few with prior college credentials and access to well-connected devices (Hollands and Tirthali 2014; Xiao et al. 2014).
- One-directional flow of knowledge and lack of adaptability of MOOCs to local conditions is perceived as paternalistic, and even imperialistic (Bali and Aboulmagd 2019, 3; McGreal 2017, 298).
- Global consensus on the issues of privacy, cybersecurity, censorship, and Internet governance limits the spread of Internet (Shenglin 2017).
- Owing to the COVID-19 pandemic, the UN projects⁸ the global economy to contract sharply, further limiting the already meager aid to the least developed countries.

4. See <https://itu.foleon.com/itu/measuring-digital-development/offline-population>.

5. See <https://itu.foleon.com/itu/measuring-digital-development/affordability>.

6. See <https://itu.foleon.com/itu/measuring-digital-development/ict-skills>.

7. As a form of data, MOOCs are a subset of public goods called 'club goods' in the sense that they are excludable but non-rival in consumption (WB: 2018, 1).

8. See <https://www.un.org/sustainabledevelopment/globalpartnerships>.

CHALLENGE

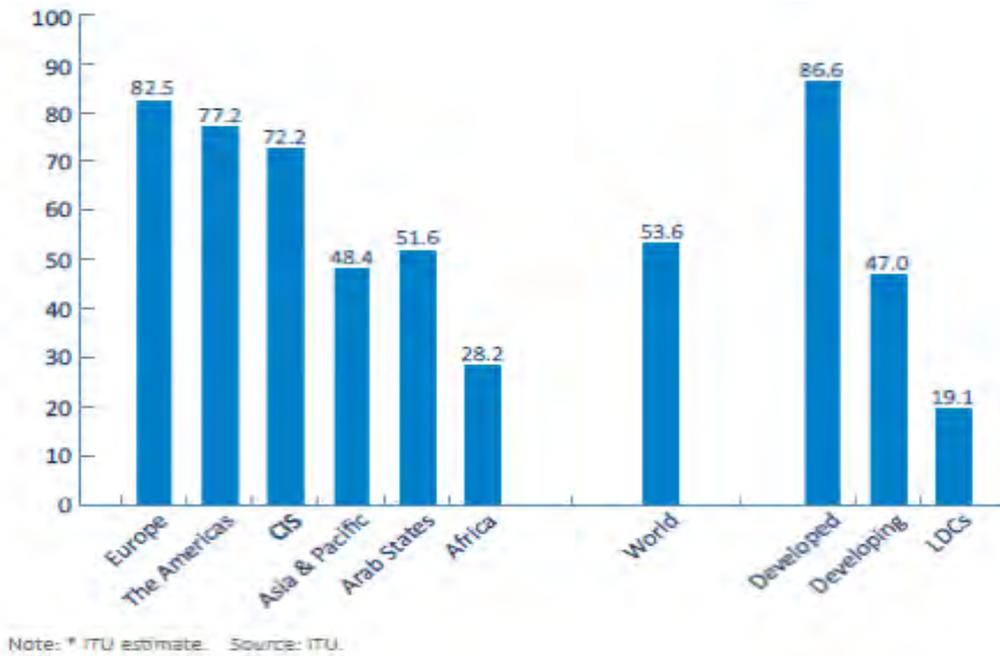


Figure 1. Percentage of Individuals using the Internet, by Region and Development Status, 2019
Source: ITU.

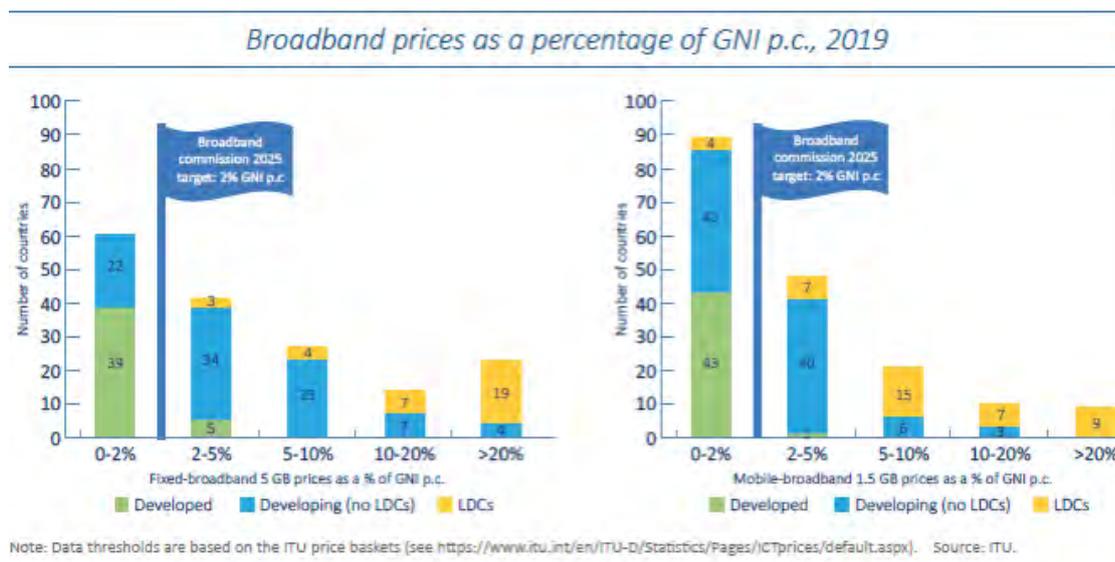


Figure 2. Broadband Prices as a Percentage of Gross National Income (GNI) p.c., 2019
Source: ITU.



PROPOSAL

Context: Evolving business models and the post-pandemic resurrection of MOOCs

The COVID-19 pandemic has increased interest in online and distance education and brought MOOCs back into the limelight (Lohr 2020). Class Central⁹ experienced a dramatic surge in traffic from March 15, 2020 to April 15, 2020 with 380,000 registrations in one month compared with 355,000 throughout 2019.

Even before the COVID-19 pandemic, significant growth in the development and uptake of MOOCs had been taking place. The potential of MOOCs for serving socioeconomically disadvantaged learners hyped in 2012–13 had energized and motivated a range of institutions with a passion for equality around the world to design and implement inclusive programs in 2014–16 (Lambert 2020). More than 900 universities around the world had roughly 11,400 MOOCs on offer, with about 2,000 new courses added during 2018. Already, there are now numerous MOOCs from different parts of the world in different languages (Paul et al. 2018; Bali and Sharma 2017; Adham and Lundqvist 2015).

The direct online offerings of a growing number of institutions around the world, the growing reach and impact of major MOOC platforms, and mushrooming of various forms of blended learning in recent months signify the continued mainstreaming of online learning. Not only are most of these online degrees fully accredited, but also, in most cases, the final degree awarded is hardly distinguishable from traditional degrees (Heba 2020). Indeed, MOOCs have almost evolved into a viable business model (Sultan 2019). These developments carry global implications for higher education and raise the prospect of bridging the North–South knowledge divide. It is time to seize the moment.

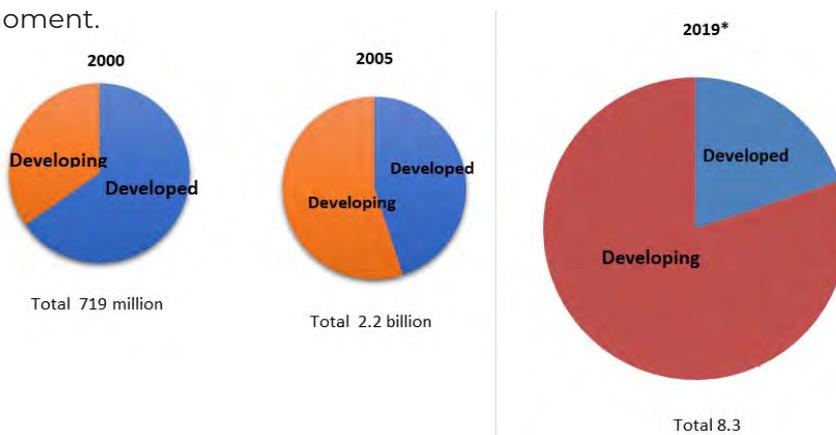


Figure 3. Increasing Mobile-Cellular Subscriptions, by Level of Development (2005–2019)

Source: International Telecommunication Union (2019).

9. See <https://www.classcentral.com/report/mooc-based-masters-degree>.

The ongoing scaling up of MOOCs could not have been possible without the dramatic rise in mobile ICT use worldwide,¹⁰ with the share of the developing countries increasing from 35% in 2005 to 80% in 2019 (see Figure 3). Other technological advances contributing to the MOOCs phenomenon include broadband deployment using low-cost satellites, as well as drones, balloons, and other nonpermanent structures (World Bank 2018; OECD Directorate for Science, Technology and Innovation 2017, 59).

Recommendations

Guiding principles

We live in a highly interdependent, complex, and increasingly unpredictable world that requires collective effort to cope with the common challenges facing humanity. We believe the following two principles should be explicitly recognized by all stakeholders. In light of the common threats facing humanity, we need to rise above the Westphalian concept of national sovereignty and embrace the global community spirit.

1. Operationalize internet connectivity as a basic human right in the AI era

Data and information are increasingly recognized as an indispensable resource in the era of the 4th Industrial Revolution. Data is often stated to be the “oil of the future.” “Those who own the data, own the future” (Harari 2018, 73). The Internet has become one of the most fundamental and vital infrastructures for the information society. It has moved from a commercial service to a public utility, ensuring our fundamental right to freedom of speech and the right to development. Indeed, as cyberspace becomes the main means of socialization and discourse in the 21st century, human beings qua reasoning animals may increasingly feel incomplete without connectivity. When properly instituted, the Internet could be a unique and reliable instrument for the preservation of basic human rights (Reglitz 2020, 328).

The Internet could be the gateway to unite stakeholders across the globe seeking to promote SDGs. In the 2015 Group of Twenty (G20) Digital Economy Development and Cooperation Initiative,¹¹ member states clearly recognize the potential of the digital economy to facilitate the implementation of the 2030 Agenda for Sustainable Development, and declared to “strive to ensure that all our citizens are digitally connected by 2025 and especially welcome infrastructure development in low-income countries in that regard” and to “promote digital literacy and digital skills in

10. See <https://itu.foleon.com/itu/measuring-digital-development/mobile-vs-fixed>.

11. See <http://www.g20chn.org/English/Documents/Current/201609/P020160908736971932404.pdf>.

all forms of education and life-long learning” (Snower 2017). The following year, the UN declared access to the Internet to be a human right, incorporated as Article 19¹² in the Universal Declaration of Human Rights.¹³ Finland took the lead as early as July 2010 in defining access to the Internet at broadband speeds as a legal right (World Bank 2016, 204). Many other European governments, such as Germany, are moving in that direction.

Though nonbinding, a UN resolution does hold some moral authority and helps create awareness of the value of broadband and generates a positive environment. Governments can gain more credibility with their citizens by ensuring uninterrupted high-speed access to the Internet.

2. Recognize the urgent need to repurpose education in the face of human redundancy threatened by increasingly capable machines associated with the 4th industrial revolution

Although artificial intelligence (AI) is automating an increasing number of routine tasks, general skills revolving around human care and creativity for improved decision-making and ethical judgments are crucial to ensure broader socioeconomic inclusion (Acemoglu and Restrepo 2020). The key insight is that, for complex occupations, business activities, or public services, the Internet usually can make only a portion of the tasks cheaper, more efficient, or more convenient through automation. Another portion still requires higher-order capabilities that humans possess in abundance, but computers do not. Simple numeracy and literacy are no longer sufficient (Goldin and Katz 2009). MOOCs are particularly suitable for lifelong learning and “learning as you go,” as one needs to continuously upgrade one’s knowledge and acquire the relevant skills for professional survival in the face of increasingly capable machines. Hence, there is continued significance of higher education and the need to repurpose education in its race with technology (ibid.). MOOCs are ideal for lifelong learning and the promotion of nimble competencies designed for the age of AI. The marginal individual who does not acquire higher education of the right kind leaves too many bills on the sidewalk, and unless they pick them, they will find themselves penniless in the new economy (ibid., 325).

12. See <https://www.humanrights.com/course/lesson/articles-19-25/read-article-19.html>.

13. Notably, Facebook’s founder, Mark Zuckerberg, asserted Internet connectivity to be a “human right” in a 2013 whitepaper (Zuckerberg 2013). See also Kay (2012) and Merten (2020).

Inequality is the most pressing challenge in the era of the 4th Industrial Revolution, which is markedly different from all previous industrial revolutions in terms of the speed of the change and the marriage of fintech and biotech (Harari 2018, 21). The latest technological revolution is task-biased, with machines replacing human beings performing routine tasks, and, thus, hollowing out the labor market (Suskind 2020, 36–37).¹⁴ While capitalism has an innate logic of inequality (Piketty 2014), the transformation of the economy in the wake of robotization and automatization has aggravated the problem of inequality by creating an unprecedented “skill premium” (Suskind 2020, 140; Harari 2018, 72). Faced with increasingly capable machines, structural technological unemployment in the era of AI threatens to give rise to a global economically useless class (Harari 2018, 18; Suskind 2020, 166). Countries that have failed to undertake concerted actions to reap the digital dividends, while technology progressively permeates every sector of the economy, are likely to have experienced widened disparities (Schenglin et al. 2017).

Economic inequality, already higher in the era of the AI, has been further aggravated by the COVID-19 pandemic, and the lack of educational attainment is a major contributor to economic inequality (ibid.).

Thus, all stakeholders must harness their energies toward the transformational project.

National government and other domestic stakeholders

In the field of education, change depends mainly, but not exclusively, on national and sub-national players within the system.

1. Invest in developing indigenous MOOCs and localize the international

In contrast with the generic model for MOOCs design and delivery, a different kind of MOOC architecture is required for the developing countries to accommodate the specific conditions, such as limited or restricted Internet access, learner need for offline access, and insufficient levels of mentoring and learner support (Bhartu and Naidu 2019; Patru and Balaji 2016, 31; James 2008). MOOCs should be designed to target specific populations, such as those with disabilities or special needs (McGreal 293). Blended learning or flipped classrooms can complement traditional campus

14. The idea is christened as the ALM hypothesis and was propounded by Autor, Levy, and Murnane (2003).

(Lohrmann 2017). Lambert finds that where fully online programs succeeded, they had strong teacher presence in the online for a, supplemented by email, phone, or synchronous webinar-style tutorials.

2. Facilitate public-private partnership to promote MOOCs

The costs of tertiary education continue to increase because of the usual practice of bundling too many services. With MOOCs, some of these services can be transferred to the public or private sector (Patru and Balaji 2016). Complaints about the mismatch between the qualifications of university graduates and the skill requirements of businesses and industry are ubiquitous. Small private online courses are said to have revolutionized the corporate education landscape (Kaplan and Haenlein 2016). Universities can finance their MOOCs project by partnering with the private sector to provide job-oriented training. A case in point is that of the partnership between Exxon Mobil and Universities in Papua New Guinea (Woruba and Abedin 2015).

3. Facilitate the formation of consortia of universities to create or adapt MOOCs

MOOCs are costly in terms of salaries and time of the OER creators/adapters/assemblers. The costs of adapting international MOOCs or of developing indigenous MOOC can be significantly reduced by sharing OERs with other institutions. (McGreal 2017, 292). Participating institutions will have a considerably larger repository of models to draw upon. A certain amount of experimentation in matters such as pedagogy and platform design must be allowed. Besides open-licensing policies, governments could support the creation of regional or national centers to finance and promote MOOCs and allied activities. Governments should facilitate the formation of interdisciplinary teams across institutions, and even countries should be engaged. Government's approval of cross-institutional Institutional Review Board agreements could facilitate multi-institutional collaborative projects (Hollands and Tirthali 2014, 170).

4. Build up digital literacy and ITC skills of teachers and students

The G20 Task Force on the Digital Economy¹⁵ recognizes the need for digital inclusion, including digital literacy skills as well as development of content and services in a variety of languages and formats that are accessible to all people. It is also important to develop a system of recognition, including financial rewards and incentives for faculty, to develop MOOCs.

15. See <http://www.g20.utoronto.ca/2017/170407-digitalization.html>.

5. Establish a quality assurance framework for MOOCs

A quality assurance framework is a critical component for a national strategy. MOOCs' quality has a direct bearing on the recognition of online learners' credentials, sustainability of MOOCs per se, as well as the reputation of the offering universities (Jansen 2017; Porter 2015).

Establishing an accrediting organization for MOOCs and other non-traditional educational experiences would allow learners to accumulate a portfolio of credentials that serve as a viable supplement or alternative to a college degree.

The role of the G20 and other international stakeholders

The issues confronting humanity in the 21st century are complex and know no geographical boundaries—nor should the solutions be limited to the national domains. Since MOOCs are public goods, international players have an important role to play in coping with the challenges in the uptake and scaling up of MOOCs.

1. Foreign aid budget for physical and human capacity development in LDCs

The absence, or inadequacy, of infrastructure (e.g., the absence of stable electricity in remote and/or rural areas) in LDCs is due to a scarcity of available resources. Affordability, including the cost of purchasing a mobile device, remains one of the main challenges in addressing the global digital divide.¹⁶ The marginal value-added of such investment is enormous. The World Bank estimates that, to double broadband connectivity in Africa by 2021 (i.e., extending access to another 220 million people), a paltry investment of \$9 billion would suffice. This requires enhancing the catalytic role of multilateral development banks (MDBs). Most of the European broadband projects (e.g., Poland, Croatia, Slovenia, Romania, and Estonia) have been implemented using structured EU funds, such as ERDF¹⁷ and the EAFRD.¹⁸ There are lessons from the European initiatives to draw upon. For the LDCs, external finance may be the only hope of bridging the digital divide.

Funds may be targeted at specific solutions that have been demonstrated to have worked in order to:

16. World Bank (2019b, 19).

17. See https://ec.europa.eu/regional_policy/en/funding/erdf.

18. See https://ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy/rural-development_en.

- Build sizeable high-cost infrastructure projects that the private sector sees as commercially nonviable.
- Extend affordable broadband access to commercially nonviable rural and remote areas, and to disadvantaged groups under a Mobilizing Finance for Development¹⁹ approach.
- Support UNESCO and other organizations that have successfully spearheaded the scaling up of MOOCs.²⁰
- Provide short-term scholarships to faculty to participate in training courses.
- Subsidize MOOCs providing universities and platforms to facilitate the uptake of MOOCs in LDCs.

2. Commit to support the establishment of a global accreditation mechanism for MOOCs

MOOCs are a global phenomenon. Establishing an accrediting organization for MOOCs and other non-traditional educational experiences would allow learners to accumulate a portfolio of credentials that serve as a viable supplement or alternative to a college degree. Here too, UNESCO could play a key role in establishing an accreditation mechanism.

3. Reaffirm the leading role of the UNESCO in bridging the global knowledge divide

The challenge of bridging the global knowledge divide demands comprehensive planning, concerted effort, and collaborative action by all stakeholders. As a global education think tank, UNESCO is in a unique position to spearhead this effort. It can undertake continuous monitoring and evaluation of MOOCs. The mobilization and contribution of the network of UNITWIN/UNESCO Chairs²¹ is a key part of this process of engagement. The role of the UNESCO/COL/ICDE Chair in OERs is to continue lobbying for OER initiatives and policies among the relevant constituencies (school boards, higher educational institutions, ministries of education and advance edu-

19. See <https://www.un.org/sustainabledevelopment/financing-for-development/>.

20. The Canada-based Commonwealth of Learning (COL) is charged with promoting open education throughout the 53 countries of the Commonwealth. COL's MOOC for Development provides simple technology solutions such as a basic mobile phone interface, social media integration and delivery in low bandwidth situations to reach grassroots communities.

21. See <https://en.unesco.org/themes/higher-education/unitwin>.

cation, faculty, students, etc.) in order to expand participation and extend access. Funding for UNESCO should thus be appropriately expanded.

Enlarge the pool of talent through learner analytics and scholarships

Data mining techniques can be applied to data from the MOOC platforms to generate learner analytics. Profiles of learners can be used to “iteratively improve courses” (Holland and Tirthali 2014, 170; Corrin et al. 2017). Such applications would be greatly facilitated by government-approved standardization of data formats across various MOOCs platforms (ibid.).

Global businesses demand global talent, as evidenced by their strong opposition²² to any move by governments to restrict work visas and relaxation of formal degree requirement.²³ As Big Data firms, along with other global businesses, are also the beneficiaries of MOOCs learners, they could support the uptake of MOOCs by offering small scholarships to participants from low-income countries who cannot afford the fees for participation certificates. Big Data firms need little convincing, as they recognize that, for a small financial contribution, they can significantly enlarge and tap into the vast pool of global talent.²⁴ Conversely, such support for MOOCs can offer students from the LDCs the opportunity to “study abroad” without leaving home, and enhance their employability by superstar firms.

22. See <https://www.theverge.com/2020/6/22/21299812/trump-guest-worker-h1-b-visa-google-tech-itic-internet-association>.

23. Many big tech companies offer jobs that do not require a degree. To quote, Elon Musk, “Colleges ‘are not for learning,’ but rather a place to have fun.” (see Beasley 2020; Slayter 2020). Others offer jobs while candidates pursue higher studies often with company funding. The Indian tech firm WIPRO

24. In 2017, Google and Bertelsmann initiated the first large-scale scholarship program for MOOCs; see <https://monitor.icef.com/2017/09/first-large-scale-scholarship-programmes-moocs>.

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Disclaimer

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REFERENCES

Acemoglu, Daron, and Pascual Restrepo. 2020. "Robots and Jobs: Evidence from US Labor Markets." *Journal of Political Economy* 128, no. 6: 2188–2244. <https://doi.org/10.3386/w23285>.

Adham, Raniah Samir, and Karsten Oster Lundqvist. 2015. "MOOCs as a Method of Distance Education in the Arab World—A Review Paper." *European Journal of Open, Distance and E-learning* 18, no. 1: 123–138. <https://doi.org/10.1515/eurodl-2015-0009>.

Asha Kanwar. 2020. "Taking the Road Less Travelled: TEDx." TEDx Krasnaya Polyana Salon. Accessed August 05, 2020. http://oasis.col.org/bitstream/handle/11599/3557/2020_Kanwar_TEDx_Script.pdf?sequence=9&isAllowed=y.

Autor, David H., Frank Levy, and Richard J. Murnane. 2003. "The Skill Content of Recent Technological Change: An Empirical Exploration." *The Quarterly Journal of Economics* 118, no. 4: 1279–1333. <https://doi.org/10.1162/003355303322552801>.

Bali, Maha Ayham, and Shyam Sharma. 2017. "Envisioning Post-Colonial MOOCs: Critiques and Ways Forward." In *Massive Open Online Courses and Higher Education*, edited by Rebecca Bennett and Mike Kent, 26–44. NY: Routledge. ISBN 9780367349202.

Bali, Maha, and Nadine Aboulmagd. 2019. "The Different Faces of Open in Egypt." In *MOOCs and Open Education Across the Global South: Challenges, Successes, and Opportunities*, edited by K. Zhang, C. J. Bonk, T. C. Reeves, & T. H. Reynolds, 45–55. NY: Routledge. <https://doi.org/10.4324/9780429398919>.

Beasley, David. 2020. "For Hot Technology Jobs, No Degree Required." *Forbes*. Last updated June 5, 2020. <https://www.forbes.com/sites/beasleydavid/2020/06/05/for-hot-technology-jobs-no-degree-required/#5ef58852693c>.

Bordoloi, Ritimoni, Prasenjit Das, and Kandarpa Das. 2020. "Lifelong Learning Opportunities Through MOOCs in India." *Asian Association of Open Universities Journal* 15, no. 1 (April). ISSN: 2414-6994.

Carver, Leland, and Laura M. Harrison. 2013. "MOOCs and Democratic Education." *Liberal Education* 99, no. 4 (Fall): n4. <https://www.aacu.org/publications-research/periodicals/moocs-and-democratic-education>.

REFERENCES

Czerniewicz, Laura, Andrew Deacon, Janet Small, and Sukaina Walji. 2014. "Developing World MOOCs: A Curriculum View of the MOOC Landscape." *Journal of Global Literacies, Technologies, and Emerging Pedagogies* 2: 122–139.

Cornell University, INSEAD, and WIPO. 2019. "The Global Innovation Index 2019: Creating Healthy Lives-The Future of Medical Innovation." Accessed August 05, 2020. https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2019.pdf.

Corrin, Linda, Paula G. De Barba, and Aneesha Bakharia. 2017. "Using Learning Analytics to Explore Help-Seeking Learner Profiles in MOOCs." In *Proceedings of the Seventh International Learning Analytics & Knowledge Conference*, 424–428. <https://doi.org/10.1145/3027385.3027448>.

Dennis J. Snower. 2019. "The G20 Summit was More Successful than you Think." *G20 Insights*. Last Updated July 14, 2017. <https://www.g20-insights.org/2017/07/11/g20-summit-successful-think>.

Dutta, Indrajeet. 2016. "Open Educational Resources (OER): Opportunities and Challenges for Indian Higher Education." *Turkish Journal of Distance Education* 17, no. 2: 110–121. ISSN 1302-6488.

G20. 2016. "G20 Digital Economy Development and Cooperation Initiative 2016 Hangzhou Summit Hangzhou, September 5, 2016." Accessed August 05, 2020. <http://www.g20.utoronto.ca/2016/160905-digital.html>.

G20. 2017. "G20 Digital Economy Ministerial Declaration: Shaping Digitalisation for an Interconnected World April 7, 2017, Düsseldorf." Accessed July 01, 2020. <http://www.g20.utoronto.ca/2017/170407-digitalization.html>.

G20. 2018. "G20 Digital Economy Ministerial Declaration August 24, 2018, Salta, Argentina." Accessed July 01, 2020. <http://www.g20.utoronto.ca/2018/2018-08-24-digital.html>.

G20. 2019. "G20 Ministers Meeting on Trade and the Digital Economy Tsubuka, Ibaraki, Japan, June 9, 2019." Accessed July 05, 2020. <http://www.g20.utoronto.ca/2019/2019-g20-trade-chairs-statement.html>.

REFERENCES

G20. 2020a. "G20 Addressing the Role of Digital Technologies to Fight COVID-19 Riyadh, Saudi Arabia, April 28, 2020." Accessed July 01, 2020. <http://www.g20.utoronto.ca/2020/2020-g20-digital-0428.html>.

G20. 2020b. "G20 Digital Economy Ministers Meeting, July 22, 2020." Accessed July 25, 2020. <http://www.g20.utoronto.ca/2020/2020-g20-digital-0722.html>.

Galvin, Ray. 2020. "Recent Increases in Inequality in Developed Countries." In *Inequality and Energy*, 3–30. Academic Press, 2020. <https://doi.org/10.1016/B978-0-12-817674-0.00001-1>.

Gerschenkron, Alexander. 1962. *Economic Backwardness in Historical Perspective: A Book of Essays*. Cambridge, MA: Belknap Press of Harvard University Press.

Ghoshray, Atanu, Mercedes Monfort, and Javier Ordóñez. 2019. "Re-Examining Inequality Persistence." *Economics Discussion Papers*, No 2019-70 Kiel Institute for the World Economy. <http://www.economics-ejournal.org/economics/discussionpapers/2019-70>.

Goldin, Claudia Dale, and Lawrence F. Katz. 2009. *The Race Between Education and Technology*. Harvard University Press. ISBN: 0674035305, 9780674035300.

Harari, Yuval N. 2018. *21 Lessons for the 21st Century*. London, UK: Jonathan Cape.

Heba, Ledwon. 2020. "55 Legit Master's Degrees You Can Now Earn Completely Online." *Class Central MOOC Report*, May 31, 2020. <https://www.classcentral.com/report/mooc-based-masters-degree>.

Hodgkinson-Williams, Cheryl Ann, and Henry Trotter. 2018. "A Social Justice Framework for Understanding Open Educational Resources and Practices in the Global South." *Journal of Learning for Development* 5, no. 3 (November). <http://orcid.org/0000-0003-2794-8638>.

Hollands, Fiona M., and Devayani Tirthali. 2014. "MOOCs: Expectations and Reality. Full report." Accessed July 01, 2020. <https://files.eric.ed.gov/fulltext/ED547237.pdf>.

ICEF Monitor. 2019. "The Year in MOOCs: Increased Revenue and More Degrees." Accessed August 10, 2020. <https://monitor.icef.com/2019/01/the-year-in-moocs-increased-revenue-and-more-degrees/ITU>.

REFERENCES

International Telecommunication Union. 2019. "Measuring Digital Development Facts and Figures 2019" Accessed May 20, 2020. <https://www.itu.int/en/ITU-D/Statistics/Documents/facts/FactsFigures2019.pdf>.

James, Jeffrey. 2008. "Digital Divide Complacency: Misconceptions and Dangers." *The Information Society* 24, no.1 (July): 54–61. <https://doi.org/10.1080/01972240701774790>.

Kaplan, Andreas M., and Michael Haenlein. 2016. "Higher Education and the Digital Revolution: About MOOCs, SPOCs, Social Media, and the Cookie Monster." *Business Horizons* 59, no. 4 (July–August): 441–450. <https://doi.org/10.1016/j.bushor.2016.03.008>.

Kellogg, Sarah. 2013. "Online Learning: How to Make a MOOC." *Nature* 499, no. 7458 (July): 369–371. <https://doi.org/10.1038/nj7458-369a>.

Lambert, Sarah R. 2020. "Do MOOCs Contribute to Student Equity and Social Inclusion? A Systematic Review 2014–18." *Computers & Education* 145, (February): 103693. <https://doi.org/10.1016/j.compedu.2019.103693>.

Lohr, Steve. 2020. "Remember the MOOCs? After Near-Death, They're Booming." *The New York Times*. Last updated May 26, 2020. <https://www.nytimes.com/2020/05/26/technology/moocs-online-learning.html>.

Lohrmann, Christiane. 2017. "Online Learning—Do MOOCs Contribute to the Goals of Agenda 21: "Education Harnessing Science, Technology and Innovation to achieve the Sustainable Development Goals." In *Sustainability in a Digital World: New Opportunities Through New Technologies*, edited Thomas Osburg and Christiane Lohrmann, 211–224. Springer. https://doi.org/10.1007/978-3-319-54603-2_18.

Mathiesen, Kay. 2012. "The Human Right to Internet Access: A Philosophical Defense." *The International Review of Information Ethics* 18, (December): 9–22. ISSN 1614-1687.

McGreal, Rory. 2017. "Special Report on the Role of Open Educational Resources in Supporting the Sustainable Development Goal 4: Quality Education Challenges and Opportunities." *The International Review of Research in Open and Distributed Learning* 18, no. 7 (November): 292–305. <http://www.irrod.org/index.php/irrod/article/view/3541/4433>.

REFERENCES

McGreal, Rory. "Open Educational Resources and Global Online Learning." In *Humanistic Futures of Learning: Perspectives from UNESCO Chairs and UNITWIN Networks*, 122–126. UNESCO. ISBN: 978-92-3-100369-1.

Millward, Wade T. "To Attract Talent, Corporations Turn to MOOCs." EdSurge. Last updated May 24, 2019. <https://www.edsurge.com/news/2019-05-24-to-attract-talent-corporations-turn-to-moocs>.

Mubarak, Farooq, Reima Suomi, and Satu-Päivi Kantola. 2020. "Confirming the Links Between Socio-Economic Variables and Digitalization Worldwide: The Unsettled Debate on Digital Divide." *Journal of Information, Communication and Ethics in Society* 18, no. 3 (June): 415–430. <https://doi.org/10.1108/JICES-02-2019-0021>.

OECD Directorate for Science, Technology and Innovation. 2017. "Key issues for digital transformation in the G20." OECD. Accessed March 01, 2020. <https://www.oecd.org/g20/key-issues-for-digital-transformation-in-the-g20.pdf>.

OECD. 2012. *Divided We stand: Why Inequality Keeps Rising*. OECD Publishing.

Patru, Mariana, and Venkataraman Balaji. 2016. *Making Sense of MOOCs: A Guide for Policy-Makers in Developing Countries*. Commonwealth of Learning. <http://hdl.handle.net/11599/2356>.

Paul, Prantosh, A. Bhuimali, Tiwary Kalishankar, P. S. Aithal, and R. Rajesh. 2018. "SWAYAM: The Platform for Modern and Enhanced Online and Flexible Education-A Knowledge Survey." *International Journal of Applied Science and Engineering* 6, no. 2 (December): 149–155. <https://ssrn.com/abstract=3380513>.

Piketty, Thomas. 2014. *Capital in the Twenty-First Century*. Cambridge, MA, USA: Harvard University Press.

Ramirez-Montoya, Maria-Soledad. 2020. "MOOCs and OER: Developments and Contributions for Open Education and Open Science." In *Radical Solutions and Open Science*, 159–175. Singapore: Springer. https://doi.org/10.1007/978-981-15-4276-3_10.

Reglitz, Merten. 2020. "The Human Right to Free Internet Access." *Journal of Applied Philosophy* 37, no. 2 (November): 314–331. <https://doi.org/10.1111/japp.12395>.

REFERENCES

Shenglin, Ben, Felice Simonelli, Zhang Ruidong, Romain Bosc, and Li Wenwei. 2017. "Digital Infrastructure: Overcoming the Digital Divide in Emerging Economies." G20 Insights. Last modified April 03, 2017. https://www.g20-insights.org/wp-content/uploads/2017/05/Digital_Overcoming-Digital-Divide-II.pdf.

Scherngell, Thomas, ed. 2013. *The Geography of Networks and R&D Collaborations*. Berlin, Heidelberg/New York: Springer.

Slyter, Mary Ellen. "10 High-Paying Tech Jobs You Can Get without a College Degree." Monster Career Advice. Accessed August 10, 2020. <https://www.monster.com/career-advice/article/high-paying-tech-jobs-no-degree-0217>.

Sultan, Nabil. 2019. "The Disruption and Global Implications of Massive Open Online Courses (MOOCs) for Higher Education." In *Globalization and Development Entrepreneurship, Innovation, Business and Policy Insights from Asia and Africa*, edited by Nezameddin Faghieh, 201–215. Springer, Cham. <https://doi.org/10.1007/978-3-030-11766-5>.

Susskind, Daniel. 2020. *A World Without Work: Technology, Automation and How We Should Respond*. London, UK: Penguin Books Ltd.

United Nations. 2020. "Goal 17: Revitalize the Global Partnership for Sustainable Development." Sustainable Development Goals. Accessed August 10, 2020. <https://www.un.org/sustainabledevelopment/globalpartnerships>.

Van Dijk, Jan A. G. M. 2012. "The Evolution of the Digital Divide: The Digital Divide turns to Inequality of Skills and Usage." In *Digital Enlightenment Yearbook*, edited by Jacques Bus, Malcolm Crompton, Mireille Hildebrandt, George Metakides, 57–75. IOS Press Ebooks. ISBN: 978-1-61499-057-4.

Walter Mayer, Gary Madden, and Chen Wu. 2020. "Broadband and Economic Growth: A Reassessment." *Information Technology for Development* 26, no. 1 (March): 1–18. <https://doi.org/10.1080/02681102.2019.1586631>.

World Bank Group. 2018. "Innovative Business Models for Expanding Fiber-Optic Networks and Closing the Access Gaps." World Bank Digital Development Partnership. Accessed March 02, 2020. <http://documents.worldbank.org/curated/en/674601544534500678/pdf/132845-7-12-2018-17-20-11-InnovativeBusinessModels.pdf>.

REFERENCES

World Bank Group. "World Development Report 2016: Digital Dividends." World Bank. Accessed March 02, 2020. <https://www.worldbank.org/en/publication/wdr2016/> <https://doi.org/10.1596/978-1-4648-0671-1>.

World Bank. 2018. "Information and Communications for Development 2018: Data-Driven Development." World Bank. Accessed April 02, 2020. <https://openknowledge.worldbank.org/handle/10986/30437> License: CC BY 3.0 IGO.

Woruba, Russell, and Babak Abedin. 2015. "Investigating Massive Open Online Courses (MOOCS) Opportunities for Developing Countries: Case of Papua New Guinea." PACIS 2015 Proceedings. Accessed April 02, 2020. <https://aisel.aisnet.org/pacis2015/211>.

Xiao, Chong, Hanqin Qiu, and Soo May Cheng. "Challenges and Opportunities for Effective Assessments within a Quality Assurance Framework for MOOCs." *Journal of Hospitality, Leisure, Sport & Tourism Education* 24 (June): 1–16. <https://doi.org/10.1016/j.jhlste.2018.10.005>.

Zuckerberg, Mark. 2013. "Is Connectivity a Human Right." Facebook Newsroom 20: 8. <https://about.fb.com/news/2013/08/mark-zuckerberg-is-connectivity-a-human-right>.



APPENDIX

List of MOOCs providers

The following is a list of notable massive open online course (MOOCs) providers worldwide. The total number of worldwide providers listed by Class Central is 44.

Name	Topics	Education level	Cost	Languages courses are available in	Type	Content License	Year Founded
Alison	IT ,Language, Science ,Health, Humanities, Software Development ,Marketing ,Business, Math ,Lifestyle, Healthcare ,Life sciences ,Operations ,Skilled trades ,Finance		Freemium		Commercial		2007
Canvas Network		K12, Higher education			Commercial	All Rights Reserved ,registration required.	2008
				English,			
				Hindi,			
				Spanish,			
				French,			
				Chinese,			
Coursera			Subscription ,some free courses	Arabic, Russian,	Commercial	Different course licenses	2012
				Portuguese,			
				Turkish,			
				Ukrainian,			
				Hebrew,			
				German,			
				Italian			
				English,			
				Spanish,			
				French,			
				Mandarin			
				Italian,			

APPENDIX

Name	Education level	Languages courses are available in	Type	Content License	Founded
		Russian, Simplified Chinese, German,			
edX	Free)fee for certification(Portuguese, Japanese,	Non-profit	All rights reserved	2012
		Arabic, Dutch, Korean. Turkish, Tibetan, Chinese- Traditional, Hindi, Hungarian, Vietnamese			
		Free access			
FutureLearn ^{[61][5]}		to courses, paid certification ^[6]	Commercial	All rights reserved.	2012
The Great Courses			Commercial		1990
iversity ^[10]			Commercial		2013
Kadenze			Commercial	Different course licenses.	2015
	Early				
Khan Academy	General education	Child-hood Education to Masters	Non-profit	all rights reserved.	2006
	level				
LinkedIn Learning			Commercial		1995

APPENDIX

Name	Education level	Languages courses are available in	Type	Content License	Founded
OpenClassrooms ^{[16][15]}			Commercial	Creative Commons license, type BY-NC-SA	2007
openHPI ^{[19][18]}		English, Chinese, German, Spanish	N/A	All rights reserved	2012
OpenLearning ^[21]			Commercial		2012
OpenSAP			Non-profit		2013
Open Universities Australia ^[24] ^[25]			Commercial		2013

Name	Topics	Education level	Cost	Languages courses are available in	Type	Content License	Founded
Peer to Peer University					Non-profit	Creative Commons Attribution Share Alike 4.0	2009
POLHN					Non-profit	Free software	2005
Shaw Academy					Commercial		2013
Stanford Online					Non-profit	Personal/non-commercial usage	2006
SWAYAM	Science ,Engineering ,Humanities ,Arts		Free) Fee for Exams and certification(English, Hindi	Non-profit		2017

APPENDIX

Name	Topics	Edu- cation level	Cost	Languages courses are available in	Type	Content Li- cense	Found- ed
Udacity					Commercial		2012
Udemy	Various	Any- thing from intro- ductory tuto- rial to profes- sional certifi- cation track	Paid)content longer than 2hours ,(de- termined by instructor)content2 ≥ hours ⁽³³⁾		Commercial	depends on the creator) free courses ,(ex- clusive license)paid courses(2010
WizIQ					Commercial	All rights re- served.	2007

Adapted and retrieved from https://en.wikipedia.org/w/index.php?title=List_of_MOOC_providers&oldid=969499272



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