Association for Computing Machinery
Advancing Computing as a Science & Profession

Ubiquity, an ACM publication
October 2020

Will Post COVID-19 Education Be Digital?

VIRTUAL ROUND TABLE

Featuring Peter Denning, Andrew Odlyzko, Espen Andersen, and Jeffrey Johnson

Moderated by Kemal A. Delic and Jeff A. Riley

Editor's Introduction

The world is experiencing large-scale social and behavioral changes in response to the COVID-19 pandemic. These changes have the potential to cause a fundamental and profound shift in the way we conduct our lives, which could have both positive and negative consequences.

The need to function, both socially and at work, while sheltering at home and social distancing has led to the widespread realization that online meetings and remote working is viable. Digital education is particularly important, as millions of pupils and students worldwide struggle to continue studies in these difficult circumstances.

We have posed four questions to our fellow Ubiquity editors, garnering a balanced view from academia and industry, from STEM and business (MBA) perspective, aiming to seed a follow-up debate from other editors, culminating in a free, one-hour webinar.

—Kemal A. Delic and Jeff A. Riley

 2020 Copyright held by the Owner/Author.

Will Post COVID-19 Education be Digital?

VIRTUAL ROUND TABLE

Featuring Peter Denning, Andrew Odlyzko, Espen Andersen, and Jeffrey Johnson

Moderated by Kemal A. Delic and Jeff A. Riley

Q1: ***Do you envision the rise of digital education and online learning as a consequence of the global pandemic?***

Peter Denning (PD): Digital education has been on the rise for some time. There were many small experiments in distance learning in the 1990s. The first commercial MOOC companies started up after 2009. A few universities began to offer degrees composed of MOOC courses. The pandemic greatly accelerated the process of using distance learning because many teachers and students were confined to home and could only meet in Zoom sessions. Teachers and institutions have done quite well ascending a steep learning curve. Education will be a much bigger user of digital classes permanently and they will be cheaper than in-residence courses. Combined with other serious financial disruptors, mainly the sharp drop in students attending campus, this is likely to cause reorganization and downsizing at universities.

Andrew Odlyzko (AO): No, nothing that simple—digital education and online learning have been growing and evolving for a long time. This came from a combination of the development and diffusion of basic information technologies, development of specialized tools for those topics, and teachers and students learning how to use and adapt those tools. But it did not seem likely this would lead to dramatic changes, and in particular it seemed that in-person instruction would continue to be central.

What the pandemic has done is to force a sudden shift to online instruction. This has compelled students and teachers to quickly gain some familiarity with digital tools. That experience will likely mean if the pandemic is brought to a quick end through an effective vaccine, say, or fades out on its own, the advance of digital education and online learning will have been accelerated compared to what would have happened otherwise.

However, it does not seem likely that digital education and online learning will be the dominant mode of instruction, not unless humanity if forced to live with recurring pandemics that force frequent curtailments of close physical human contact. There is far more to education than just the acquisition of precise technical knowledge. Further, given the growing importance of education, there will continue to be pressure to find an extra edge such as can be provided by human contact. So while I do expect an increasingly important role for digital education and online learning, I still expect in-person instruction to be regarded as the most valuable and desirable.

 2020 Copyright held by the Owner/Author.

Espen Andersen (EA): Digital and online will become a larger factor overall, simply because more teachers and students will be familiar with and comfortable with the format. Teachers will also discover that putting work into videos (which can be reused) can be a time saver. For certain kinds of subjects, particularly things that involve algorithms and details (such as programming) video-based asynchronous teaching can have a very beneficial effect compared to classroom and videoconference teaching, in that students can stop the video at any point to make sure they have got it right up to that point. Several of my colleagues have experienced increased levels of performance from students after converting the more specific and technical parts of their courses to pre-recorded video.

As to digital as the dominant paradigm, I am less certain. The one thing I know is that hybrid technologies seldom work well—and hybrid teaching, with some students in classrooms and others online, does not work at all. (Unless it is a straight talk, for which classroom presence is not really necessary). A group with low communication latency (classroom) will dominate one with high latency (online), unless the dominant group of students is online—which is seldom the case.

For one of my courses, with rather few students, I have had to abandon classroom sessions (even though we have enough space) because some students cannot come in because they either are in a risk group or live with someone who is. Since I do discussion-based teaching and want all students to be on equal footing, I have moved the course to videoconferencing only.

Jeffrey Johnson (JJ): In the U.K. during lockdown parents were expected to assist the online education of their children. What many parents learned is that teaching requires pedagogic skills that most people do not possess, and perhaps they value their children's teachers a little more than just child minders.

Similarly many universities tried teaching their students online with mixed results. Prestigious universities attract students on the basis of the research of their academic staff. Some brilliant research scientists are brilliant teachers, e.g. Richard Feynman. Some are terrible, e.g. Isaac Newton's professorship required a certain number of lectures per year, most of which were given to an empty room. Since the pandemic many institutions have been forced to teach online. The results have been variable but where successful lead to the question: "Why should I pay huge fees to attend a conventional university when I can learn at a much lower cost online."

Distance education has a long history. "The first distance education course in the modern sense was provided by Sir Isaac Pitman in the 1840s, who taught a system of shorthand by mailing texts transcribed into shorthand on postcards and receiving transcriptions from his students in return for correction. The element of student feedback was a crucial innovation in Pitman's system. This scheme was made possible by the introduction of uniform postage rates across England in 1840. … The first correspondence school in the United States was the Society to

 2020 Copyright held by the Owner/Author.

Encourage Studies at Home, which was founded in 1873. … Founded in 1894, Wolsey Hall, Oxford was the first distance learning college in the UK."[1]

More recently, since 1969 Open University in the U.K. has developed a very successful model of blended open learning that combines high-quality multimedia teaching materials with personal tutors accessed by post, telephone, and the internet. Over the last 20 years different kinds of online courses have appeared, including the following:

- MOOCs (massive open online courses): Open-access online course (i.e., without specific participation restrictions) that allows for unlimited (massive) participation,
- SPOCs (small private online courses): Online course that only offers a limited number of places and therefore requires some form of formal enrolment,
- SMOCs (synchronous massive online courses): Open-access online course that allows for unlimited participation but requires students to be "present" at the same time (synchronously), and
- SSOCs (synchronous private online courses): Online course that only offers a limited number of places and requires students to be "present" at the same time (synchronously).

I believe digital education will spread worldwide as a way of educating large numbers of people at low personal and national cost, especially in developing countries and countries with wide gaps between rich and poor (including the USA and U.K.). The move toward online education predated COVID-19 but will be accelerated by it.

But I note that making high quality distance education requires get skill. It's not just a question of video-recording your face-to-face lectures.

Q2: ***Assuming the world's economy becomes dominated by digital companies, what do you see as the fundamental topic to explore, develop and teach?***

AO: What are "digital companies," and in what sense would they dominate the world economy? Already almost all enterprises are "digital" in the sense of relying on data and modern information technologies. As time goes on, it seems clear that this will be true of more and more companies, and that the degree of being "digital" will grow in general. Most of the fundamental topics related to this ongoing evolution are already being explored, and likely will see more effort put into them. Issues related to general digital literacy, for example, will attract more attention.

But we should expect the basic technologies to be largely hidden from the public, although tended by somewhat enlarged corps of specialists.

[1] Harting, K. and Erthal, M. J. History of distance learning. *Information Technology, Learning, and Performance Journal* 23, 1 (2005), 35-44.

 2020 Copyright held by the Owner/Author.

The main emphasis is likely to be on how people use those technologies, and how it affects their lives.

EA: Human nature and organizational psychology does not disappear with digital transformation, so most of the old lessons should still work fine. A major new property of digital organizations is that they are driven by data-based decisions, rather than tradition, probability distributions (real or inferred) or intuition. Collecting, systematizing, modeling and acting on data becomes paramount—and as for leaders, the key skill will be understanding what kind of questions can be answered by data and which are unanswerable, which is new to traditional management and very well understood by computer scientists.

But I will be wary of predicting that algorithms and data will "take over"—that is akin to the predictions of centrally (computer-based) planned economies that were tried in Chile and other places in the 1970s. Algorithms will drive more of what we do and more of what businesses do, but the cost of computing will drive the ability to do this down also to smaller companies. In the 1980s, operations analysis was the big topic and people envisioned using queuing theory and linear programming for everything. Reality intervened, operations analysis went from major fad to Excel subroutines, and, well, intuition still dominates. I think something similar will happen to data scientists, once we have established that most large decisions managers need to make are resource-constrained allocation problems under considerable uncertainty, which computers still haven't manage to crack.

As for basic, necessary skills for students (outside of language, math, and critical thinking, of course)—how about touch-typing?

JJ: I don't assume that the world will become dominated by digital companies (alone). The world is already dominated by chemical, energy, pharmaceutical, agricultural, financial, engineering, transportation and other companies. Digital companies are just another part of this multinational ecology.

A fundamental topic to explore is how social, economic and political systems work at every level from the individual through kinship, friendship and other social networks, and networks of organizations and interests, through to national and international level. COVID-19 shows that we do not know what kind of societies want or how to achieve them. It also shows that we collectively ignore existential crises such as pandemics, plastic pollution, environmental damage and climate change.

Data science is very popular at the moment. It's over-sold and not the answer to everything. We need new science (see previous paragraph). It's a pity that AI and machine learning have come to mean rather superficial techniques. AI (proper AI) and robotics will be increasingly important. Social media will continue to be very important. Again, what we have at the moment is a superficial version of what is possible.

 2020 Copyright held by the Owner/Author.

Our teaching needs to be trans-disciplinary and life-long. And free!

PD: I don't see a useful answer to this question. Digital companies already dominate the economy. Digital distance learning is already on the rise. Institutions will make offers in this milieu. Some will succeed in drawing customers and others will fail.

Q3: ***The education industry is a mix of state and privately-run institutions, with funding coming from both quarters—each bringing certain qualities, but also some important deficiencies. How do you see this model changing, if at all?***

EA: There is considerable difference between the U.S. and Europe/Asia in this regard. European and Asian universities are mainly public institutions where students don't pay much tuition and students and the universities subsist largely on public funding. In the U.S., the situation is rather different and many universities charge high fees largely motivated by the campus experience and extracurricular activities. The corona pandemic means this model will be challenged by online education, which (without cheerleading and beer bongs) will offer the same experience at 80 percent off. At the same time, brand name institutions can vastly expand their student numbers digitally. This means the middle tier of the market—universities that are good, but not household names—will face very difficult times, especially if they are poorly endowed.

For all universities, there is a problem of publishing research versus teaching, where the latter funds the former. With digital lectures widely available, students will compare their teachers not to the local heroes, but to the world-class teachers found on YouTube, Coursera, and other places. This will place a premium on good teaching and a need to re-evaluate promotion criteria and remuneration—all over the world.

JJ: In the U.K. the university model has been exposed as vulnerable by COVID-19. There are no state universities. All universities are independent institutions. Students can borrow money for fees and support from the government. At 6 percent interest! Many do. They pay back when they earn about a certain amount (£20 K). Many don't and the student loan debt carried by the government is large.

Many U.K. universities gain a considerable income from overseas students, including many from China. This is seriously diminished. Fees are very high even for U.K. students and COVID-19 has made many young people question the value of a conventional degree. Nonetheless demand for university places in 2020 has been high.

The model won't change at all for Oxford, Cambridge, etc. because they can fill their places *n* times over. Some students might look for lower fees through online education and some universities may adapt. I don't think the top half of universities will change much. Some universities may go bust.

 2020 Copyright held by the Owner/Author.

PD: Higher education is an assortment of many kinds of institutions: large and small, well endowed and poor, and private and public. The COVID pandemic has administered a massive disruption to them all. Students cannot come to campus. Foreign students, who provide a third of many institutions' incomes, cannot come. Revenues have dropped precipitously. Many programs such as athletics have been eliminated. Faculty have been let go or furloughed. It is quite likely there will be hundreds of bankruptcies, especially among the smaller institutions. The largest and well endowed will survive and will continue to dominant, but will be much pared back. Significant changes are ahead.

AO: This mix currently describes most accurately the United States education system; many other countries have almost all educational institutions run by their governments. However, all countries are moving away from the traditional scheme of young people spending between a decade and two in educational institutions, and then the rest of their lives in employment with only some on-the-job training. In its place we see an evolution of a system of life-long learning. This will place a premium on flexibility, and so is likely to lead to more private institutions, and also, in that category, more profit-making ones.

Q4: ***How do you envision governments reacting to changes in the education sphere precipitated by the pandemic? What legislation do you think might be required to facilitate the rise of digital education?***

JJ: In the U.K. I don't think the government will do much. Unless the student loan scheme creates too much government debt. It's possible that policy will require more students to absorb unemployment caused by COVID-19, but that's a short-term fix. Education in the U.K. may become more skills and employability oriented. Loans may become more subject-specific. Although I don't see much changing in the U.K., I think there will be changes worldwide where there is a great need for low-cost high quality education. Organizations, like UNESCO and our UNESCO UniTwin Complex Systems Digital Campus, may have a big impact. If successful university education in rich countries could get shaken up—not everyone is rich in rich countries and high-quality low-cost education could become widespread (with lesser universities going out of business as students divert).

PD: State and federal governments are in deep financial trouble and do not appear to have made backstopping universities a priority. They may have little choice but to cut public support for these institutions. That may force more digital education. A lot of people like in-person universities for a variety of reasons but as long as schools are seen as transmission grounds for the virus, students won't be there and governments will see less justification to hold funding at current levels. The absence of students will be a major setback to our young people's futures, which depend so much on higher education. I don't see how new laws will solve this. The whole model of state-sponsored education held at crowded universities may be difficult to sustain.

 2020 Copyright held by the Owner/Author.

AO: This depends on the course of the pandemic. If it is dealt with quickly (say through an early arrival of effective vaccines), there may not be much immediate effect on legislation, as there would not be much expectation of digital education becoming dominant. The world may go back pretty much to doing things as before, with only evolutionary steps being taken. The main changes would likely be in preparation for the next pandemic. This would likely involve more stress on network expansion to provide universal broadband access, and on funding methods that allow for more flexible instructional methods than before.

Should the current pandemic persist, or be followed soon by another one, digital education would surely become dominant, and there would be large changes.

EA: In most countries in the world, the government has a role in quality control and to a certain extent in making sure that the universities respond to challenges in society (many places expressed as responding to skill shortages (particularly STEM and healthcare.) The reaction from government will probably (for most places) come in the form of more money to various digitalization schemes, establishment of national platforms for digital learning, and attempts to define what skills, subjects, and research areas are most desirable.

Given that this will involve innovation not just in content but in form, I am very unsure as to how governments can further digital education. Perhaps the most important contribution can be providing resources to allow digital education to happen (particularly to economically disadvantaged students), providing some sort of regulation to ensure the market will not be dominated by just a few actors (given that externalities, particularly in certification, are quite pronounced), and ensure minimum standards in at least the more common subjects and curricula.

A particular problem with digital education is it frequently is disruptive to the existing actors, who have a tendency to attempt to regulate the new so that it does not push out the old. Governments have a habit of asking the existing actors how to deal with the new. For digital education, as with many other things, perhaps the most important role of enlightened government is to protect the future from the present, rather than the other way around.

DOI: 10.1145/3427755

 2020 Copyright held by the Owner/Author.