EDUCATION: FAST FORWARD TO THE FUTURE

Accelerating Edtech Adoption in a Post-COVID-19 World

Citi GPS: Global Perspectives & Solutions

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As well as a big problem in its own right, COVID-19 has brought a number of other challenges to the fore, including political and social unrest, all of which have combined to put the very fabric of the modern society under significant pressure.

It is tempting to dismiss all these effects as one-off; that at some point things will 'go back to normal'. In practice, it seems likely it won't be that simple.

In terms of education, COVID-19 has created one of the most significant disruptions in history. Closures of schools and other places of learning have, based on UN data, affected nearly 1.6 billion learners in 190+ countries — 94% of the world's student population, and nearer 99% in lower income countries.

In the vast majority of cases, educators have done a heroic job in adapting to these extremely difficult circumstances. But COVID-19 has not only revealed a significant gap in terms of preparedness to deal with the sudden onset of 100% online learning, but shone a bright light on some of the pronounced and profound inequalities existing in many educational systems around the world. More, longer term, the inevitable fiscal pressure caused by the governments' response to COVID-19 is in danger of exacerbating these inequalities and the impact they have on both individual and societal wealth, health, and happiness. At the same time, what has happened does bring with it some hope.

Although education is an area few argue is unimportant, it is nevertheless an area that — relative to other industries — has been perhaps slower to adapt/evolve than other industries. On one key metric — the adoption of technology — education is a significant laggard: spending on technology barely represented 3% of the overall market (worth $6 trillion+) in 2019. And why is this? It is not, by and large, because the technology does not exist but rather because of inertia: a sense either it's not affordable, it's not worth it, it doesn't fit with certain political/ philosophical beliefs, or it's simply not how it has always been done.

Our survey work shows that while there is real sense of the risk posed by COVID-19, the crisis represents a watershed in terms of attitudes to technology/edtech amongst educators. That some of these sources of inertia may finally be swept aside as the value of technology — in terms of improved outcomes, finding new sources of revenue, offering variety in the mode of teaching, reducing costs and, now with COVID-19, building in redundancy — is truly being realized. In short, necessity isn't the mother of invention, for edtech, it is the mother of adoption.

And the implications couldn't be more significant. Looking at the education market, we see the current crisis driving an acceleration in edtech growth. We not only see the market doubling over the next five years to around $360 billion per year but note the 'Edtech Gap' — the gap between share of usage (50% of all study hours being digitized) and share of spend — could be almost 8x this at $2.7 trillion.

For society more broadly, we see the benefits of greater adoption of edtech being felt in not only better outcomes/lower costs but also increased access/reduced inequality, something that could have a meaningful impact on economic growth, especially in less advanced economies, but also at a global level. So while COVID-19 brings challenges, it also brings with it an opportunity to *Fast Forward to the Future*, which is potentially brighter for all.

Edtech – The Key to Enabling Greater Education Access

IN AN AUGUST SURVEY OF 700 UNIVERSITIES AND K-12 INSTITUTIONS ACROSS 8 COUNTRIES WE FOUND:

75%+ expect enrollment trends to be flat or rise in the next 3-5 years.

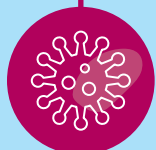Respondents are worried about international enrollments and travel mobility.

60% of universities see risk to government funding.

Only 25%-30% of respondents thought an economic downturn would result in higher university enrollments.

Cost of university education back in focus and tuition revenue is at risk of being diluted from online substitution.

Smaller institutions more likely to expect permanent damage to their financials from the pandemic.

ONE-THIRD OF RESPONDENTS ADMITTED THEY UNDERINVESTED IN EDTECH DUE TO BUDGET CONSTRAINTS, INERTIA OR PUSHBACK FROM TEACHERS OR PARENTS:

With 95% of respondents offering online learning during the COVID-19 pandemic, **over 80% of respondents said they intend to increase technology investments** over the next five years.

In developed markets:

60% hope tech spend will lower operating costs

40% also hope to lower barriers to entry for underrepresented groups

In emerging markets:

Almost 60% hope tech spend will (1) lower barriers to entry, (2) generate better learning outcomes, or (3) lower costs to students
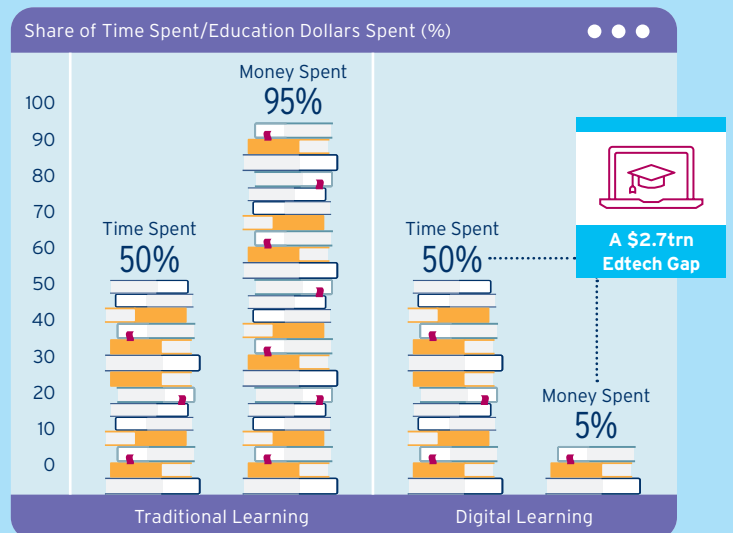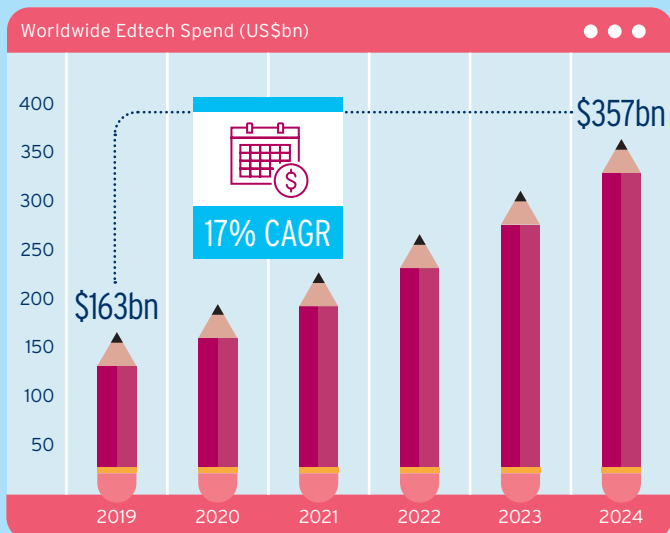
WE FORECAST WORLDWIDE EDTECH SPEND WILL MORE THAN DOUBLE TO ABOUT $360BN BY 2024 FROM ABOUT $160BN IN 2019 – AN AVERAGE GROWTH RATE OF 17% PER YEAR.

By 2024, edtech will still only make up 4.8% of total education spending.

INSTITUTIONS EXPECT AROUND 50% OF ALL DAILY STUDY HOURS WILL BE DIGITIZED IN THE NEXT THREE YEARS.

The long-term edtech opportunity could be as high as $2.7trn, or 8x our 2024 forecast, based on the gap between time and money spent online.

Worldwide Edtech Spend (US$bn)

400					$357bn
350		17% CAGR			
300					
250					
200	$163bn				
150					
100					
50					
	2019	2020	2021	2022	2023	2024

Share of Time Spent/Education Dollars Spent (%)

Money Spent 95%

Time Spent 50%

Time Spent 50%

A $2.7trn Edtech Gap

Money Spent 5%

Traditional Learning   Digital Learning

Source: HolonIQ and Citi Research

Contents

Fast Forward to the Future

The big question we are trying to answer with this report concerns the impact — both short- and longer-term — COVID-19 will have on the educational landscape and the implications this might have for various stakeholders exposed to this important and significant global market.

In short: will COVID-19 be a blip — a temporary 'learning crisis' — or is there a risk this becomes what the United Nations calls a 'generational catastrophe'? What are the implications for organizations providing education, in particular universities and K-12 schools? And finally, to what extent could technology play a role in mitigating or even offsetting some of the challenges posed/highlighted by the current crisis?

Our survey canvassed more than 700 K-12 institutions and universities across eight countries

In order to answer these questions we conducted a survey in August 2020 of more than 700 institutions, spanning eight countries (Australia, Canada, the U.K., the U.S., Brazil, China, India, and South Africa) to explore the potential impact of the COVID -19 crisis on both near- and medium-term expectations.

This work paints a picture which is fairly comprehensive and supports detailed takeaways for the educational market, which in turn form some of the central takeaways of this report, particularly around spend on education technology (edtech). We also consider the follow-on impact from this work not only for the broader macroeconomic landscape but what this might mean for areas we identify as particular opportunities for private capital.

To be clear, we are not looking to identify individual companies in this report but rather themes/sectors we think will be relevant for private investors considering the investment landscape in education and for governments and other stakeholders who are keen to encourage such investment.

Roadmap to the Report

The report is broken into six main sections:

- The first two sections outline the scope of the survey as well as the key headlines derived from the survey in terms of the impact the COVID-19 crisis is expected to have on enrollment, investment, and attitudes toward different types of learning and how that learning experience is delivered.

- In the third and fourth sections, we turn our focus to edtech. We look at how attitudes are evolving in light of the COVID-19 crisis and what this could mean longer term not only in terms of edtech adoption but also digital learning more broadly. We then consider the financial implications of edtech adoption, in particular in terms of market size.

- In the fifth section we look at the implications of this work not only in terms of the narrow implications for the education sector but also for society more broadly. In doing so, we bring in some of the important work done by our colleagues as part of our Women & Girls in the Economy, Inequality, and Technology at Work series of Citi GPS reports.

- In the final section, we conduct a series of interviews with industry experts and entrepreneurs/executives linked to the discussed themes, in particular around the adoption of technology in an educational setting. These interviews are designed to give readers a deeper insight into the bottom-up drivers of key themes as well as explore topics for debate and suggest interesting technologies.

Key Implications of Our Work

Universities are seeing a one-off hit to enrollment, but permanent damage to financials

While universities expect only a one-off hit to enrollments (i.e., a limited if not positive impact on a 3-5 year view), there is a general expectation that university financials will experience some level of permanent damage as a result of COVID-19. To some extent, this reflects survey data showing smaller institutions are more bearish about permanent financial impact relative to larger institutions, while the latter account for a bigger portion of enrollments. However, there are several pain points which universities of all sizes need to address including nervousness around international enrollments, risks around government funding and tuition dilution, and substitution risk from online offerings.

All this points to a list of things — be it related to outcomes, sources of revenue, modes of teaching, levels of costs or provisions of back-up systems during a time of crisis — the tertiary education industry needs to fix to be fit for the future and where greater adoption of technology may play a role.

There has been underinvestment in edtech by education institutions

At just 2.5% of worldwide education spend, edtech has historically been an afterthought for education institutions. Several K-12 and university respondents to the survey were candid enough to admit this historic underinvestment was driven by a variety of factors including budgetary constraints, pushback from some stakeholders, and sometimes plain old inertia.

But 80% of respondents said they intend to increase the edtech investment going forward

However, COVID-19 has to some extent mitigated the effects of these historical sources of inertia. The (admittedly forced) move to almost 100% online teaching during the pandemic meant faculty and administrators were obligated to consider how technology can be better incorporated into pedagogy, some of which will stick even after the pandemic. The importance of building resilience/redundancy and ensuring equitable access to education to some extent now trumps budgetary considerations and pushback from stakeholders. Overall 80% of respondents said they intend to increase their technology investments going forward.

Edtech spend is expected to double to $360 billion by 2024 from $160 billion in 2019…and 50% of all study hours in the next three years will be digitized

Putting all this together, we try to picture what edtech will look like in the medium term. The first headline takeaway is that worldwide edtech spend will more than double to around $360 billion by 2024 from almost $160 billion in 2019 implying an average growth rate of 17% per year. In terms of student engagement, the main takeaway is that in the next three years 50% of all study hours (in and outside class) will be digitized. This latter data points suggests there could be an even more meaningful edtech opportunity in the medium-term (at $2.7 trillion, almost 8x what we forecast in 2024E).

Increases in educational attainment are positively correlated with improvements in GDP per capita

When we look at the impact on society more broadly, we note historical correlations between educational outcomes/attainment are associated with materially better economic performance. Academic studies show that a 50-point improvement in a country's PISA score could yield a 1% improvement in GDP per capita growth. For less advanced economies, the impact could be even more dramatic with our research suggesting a 25 point improvement in a country's PISA score in math is associated with a 42% static increase in GDP per capita.

There are also some very real economic benefits in using education as a tool to even out inequality. In our Women in the Economy series of Citi GPS reports, analysis showed greater economic empowerment for women adding 6%+ to global GDP, while in our recent Citi GPS report Closing the Racial Inequality Gaps we estimated closing the racial gaps in the U.S. today would add 0.09% to global GDP growth. In both cases, greater access to education plays a key role and we see edtech being a key enabler of that longer term.

Survey Design

In August 2020, we conducted a survey of 700 universities and K-12 institutions in eight of the most important education markets around the world. Our objective was to understand what they made of the impact – both transient and structural – of current events on the education industry.

Figure 1. We Reached Out to 700 Institutions in Eight Countries
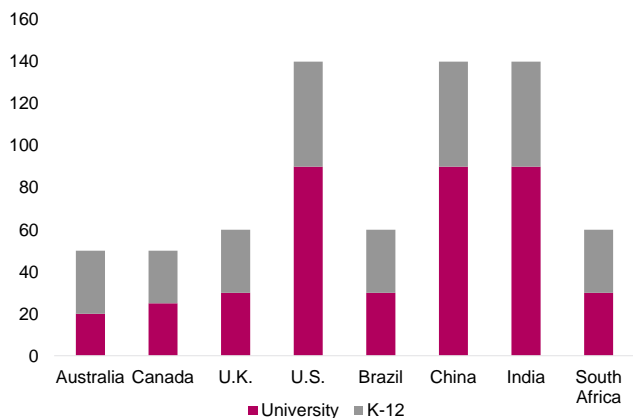
Source: Citi Research

Figure 2. Survey Sample Responsible for Deciding Edtech Strategy and Use of Funds
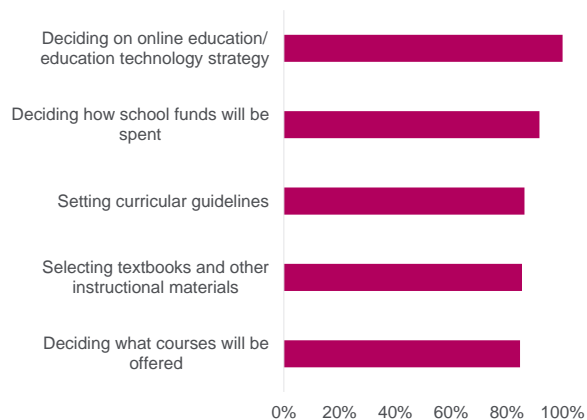
Source: Citi Research

Figure 3. Mean Enrollments of Institutions in Sample
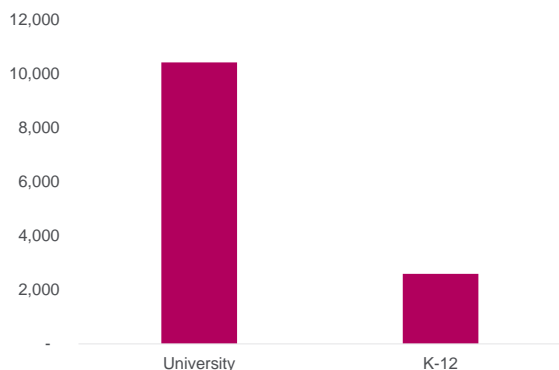
Source: Citi Research

Figure 4. International Enrollment as a % of Total University Enrollment
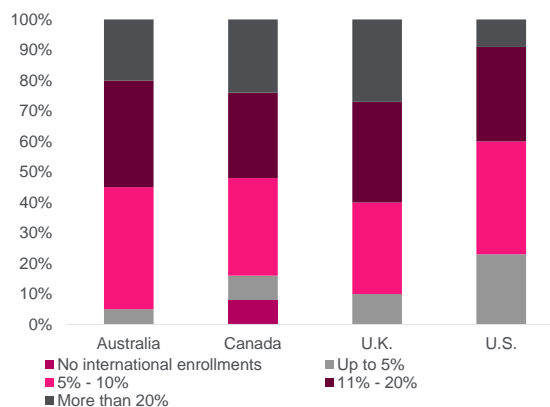
Source: Citi Research

Figure 5. University Type
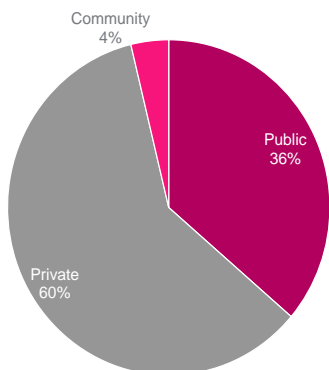
Source: Citi Research

Figure 6. K-12 Type
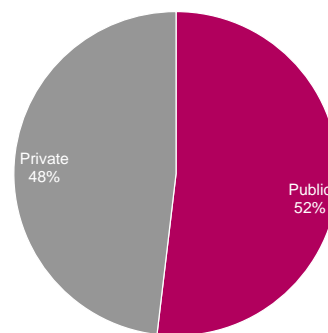
Source: Citi Research

In the survey and this report, we use the terms edtech, online learning, and e-learning interchangeably and our definition includes any or all of the following:

■ **Content:** Open educational resources (OER); Digital Courseware; Language learning apps; personalized learnings apps etc.

■ **Online degrees/certifications:** Online program managers (OPM); collaboration with MOOCs; bootcamps, etc.

■ **Tools for assessment/ proctoring/ credentialing**

■ **Learning Management Systems (LMS)**

■ **Tools for student recruitment (admissions and enrollments)**

■ **Basic hardware:** Servers; user devices etc.

■ **Smart classrooms and furniture**: Interactive displays; remote classroom access, digital teaching assistants, etc.

■ **Next generation technology:** Augmented/virtual reality (AR/VR); artificial intelligence (AI); robotics etc.

COVID-19 Impact on Universities: Temporary and Permanent

The survey throws up an interesting conundrum. A majority of university respondents to our survey believed the hit to enrollments on the back of COVID-19 and the associated disruption would be a one-off in 2020. Most expect 2021 enrollments to rebound back to 2019 levels and move back to a growth trajectory over a 3-5-year time period.

If anything, the reality thus far seems to be better than these expectations. Running into the back to school period, there was a lot of debate about how fall 2020 enrollments would trend in the U.S. and by late August consensus had converged around a high-single digit percentage decline. However, preliminary data from the National Student Clearinghouse suggests undergraduate enrollments appear to have actually declined by only 4%, a much better performance than initially expected.

Against all this, in response to our question on the permanent financial implications of COVID-19, a majority of respondents across geographies said there will be some level of permanent adverse impact to their financials. From responses to the various questions in our survey, we identify five factors underpinning this bearish tone:

- First, there is some **nervousness around international enrollments** driven by a combination of COVID-19, restrictive government policies, and the risk of online substitution. This is important as international students make up 20%-30% of enrollments in the U.K., Canada, and Australia.

- Following the massive fiscal response to the pandemic, 60% of respondents see some **risk to university funding from governments**. These grants account for 30% to 40% of university revenues.

- While a tough macro environment might predictably impact the government's ability to spend on education, the **historic counter-cyclicality of higher education has also now been called into question**. Many respondents believe a recession might not be positive for higher education enrollments, with some attributing this to competition from short courses, bootcamps, and online offerings.

- **Tuition deflation is an omnipresent risk**. With greater substitution risk from online offerings, the ongoing debate about whether universities should be charging full tuition for a hybrid offering and governments looking to rein in spending on grants and loans, this issue is once again under the spotlight.

- One final point we make here is that clearly **smaller institutions are more pessimistic than larger institutions**. Some of these smaller universities came into this crisis with too much debt and too little assets (endowments). Against this backdrop even a brief disruption to tuition revenue or government grants could develop into an existential crisis, leaving education another industry where perhaps the impact of the crisis is that the 'big get bigger'.

Whether or not one believes it is too early to sound the 'death knell' for higher education — and recent data on fall 2020 enrollment performance in the U.S. suggests some respondents were too cautious — all this points to a list of things the industry needs to fix to be fit for the future. These include improved outcomes, finding new sources of revenue, offering variety in the mode of teaching, reduction in costs, and now, with COVID-19, building in redundancy.

Impact to Enrollments One-Off but Some Financial Damage Permanent

With the exception of China, and to some extent South Africa, more than 50% of respondents across all regions expected university enrollments to decline in the upcoming term. In the case of the U.S., this relates to the ongoing fall term, which, at the midpoint of our ranges, looked to be down around 7.5% (although recently released data suggests this may have been too cautious). Across our sample, the survey results suggest enrollments will decline, at the median, by around 6% albeit with a fairly wide range — slight growth in China and double-digit percentage decline in Brazil.

Figure 7. University Enrollment Expectations for Upcoming Academic Term (vs. 2019)
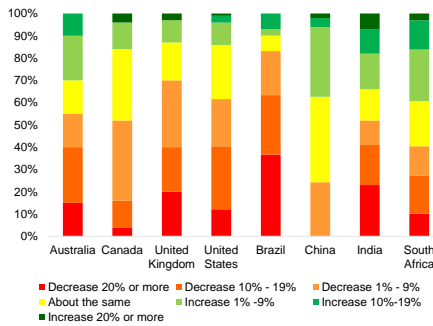
Source: Citi Research

Figure 8. University Enrollment Expectations for 2021 (vs. 2019)
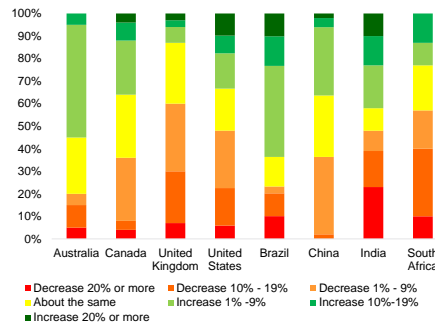
Source: Citi Research

Figure 9. University Enrollment Expectations for Next 3-5 Years (vs. previous 3-5 years)
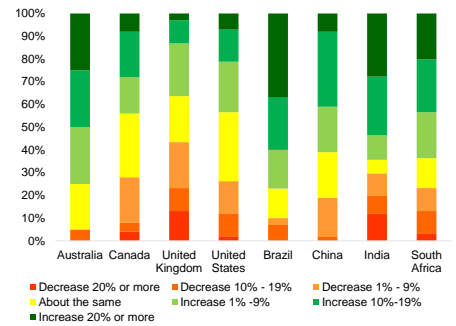
Source: Citi Research

Most respondents are of the opinion the hit to enrollments is one-off. According to our survey, the median enrollment trend is likely to be stable in 2021 versus 2019, although U.K. and South African respondents were more pessimistic both expecting 2021 enrollments to be below 2019 by mid-single digit percentages, using the midpoint of the ranges in Figure 8.

Most universities (~75%) have a favorable long-term view and expect enrollment trends in the next 3-5 years to be similar (20%) or higher (55%) than the previous 3-5 years. This optimistic view of the future is consistent across most regions.

The latter fits with our view that demand for higher education from the perspective of students will continue to rise into the medium term, especially in less advanced economies where participation rates in higher education are naturally lower.

Figure 10. What Permanent Impact Do You Anticipate the COVID-19 Outbreak Will Have on Your Institution's Finances?
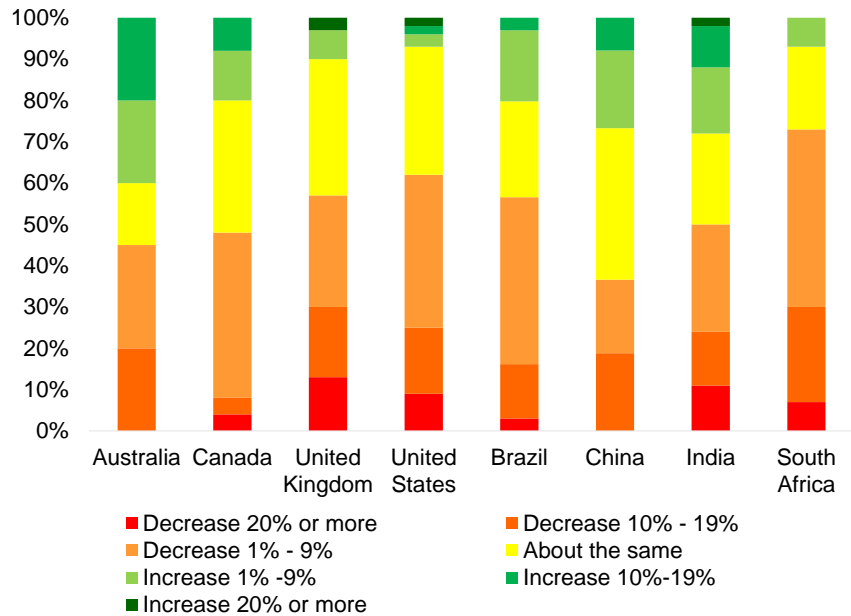
Source: Citi Research

Notwithstanding the view that the hit to enrollments is temporary, a majority of universities believe there will be some form of permanent impact to their financial health from COVID-19. In the following pages, we highlight the underlying drivers of this belief.

1. Some Nervousness Around International Enrollments

Higher fee-paying international students are an attractive source of revenue for universities and any hit to enrollments will have a disproportionate impact on the financials.

Figure 11. University International Enrollment Expectations for Upcoming Academic Term (vs. 2019)
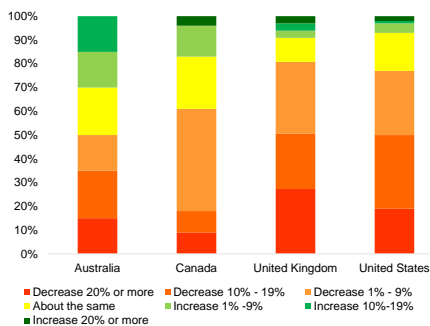
Source: Citi Research

Figure 12. University International Enrollment Expectations for 2021 (vs. 2019)
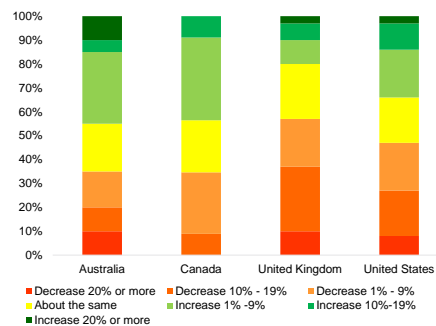
Source: Citi Research

**Figure 13. University International Enrollment Expectations for Next 3-5 Years (vs. previous 3-5 years)**
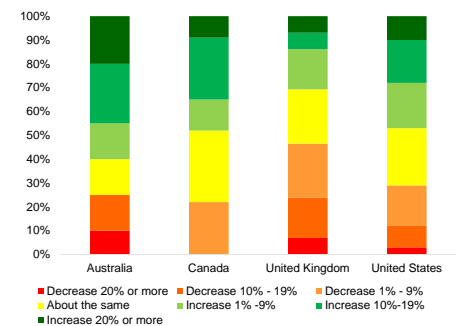
Source: Citi Research

International enrollments at the four large destination markets — the U.S., the U.K., Australia, and Canada — are likely to generally follow a path similar to overall enrollments. Restrictions around international mobility will weigh on near-term enrollments although the structural drivers in the major source markets such as China and India (rising disposable income, demand supply gap of quality higher education infrastructure) should aid demand recovery after we have dealt with the pandemic. However, about 25% of respondents in both the U.K. and Australia believe international enrollments might decline by greater than 10% over a 3-5 year time period.

Figure 14. International Students as a Percentage of Total Higher Education Enrollments
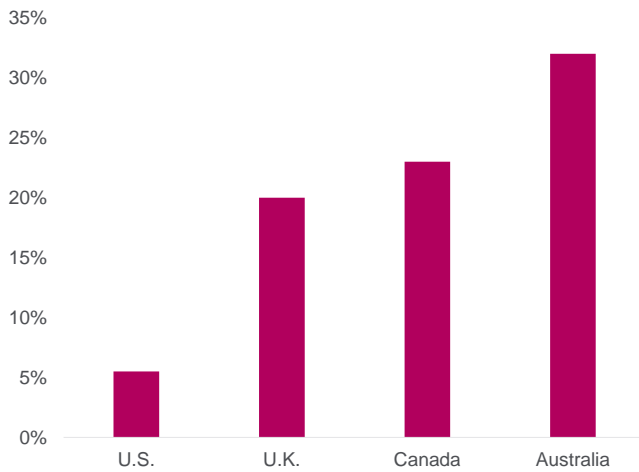
Source: NCES, Universities UK, Universities Canada, and Australian Department of Education, Skills & Employment

Figure 15. Why Do You Think International Enrollments Will Slow Down Over the Next 3-5 Years? Select All That Apply

Source: Citi Research
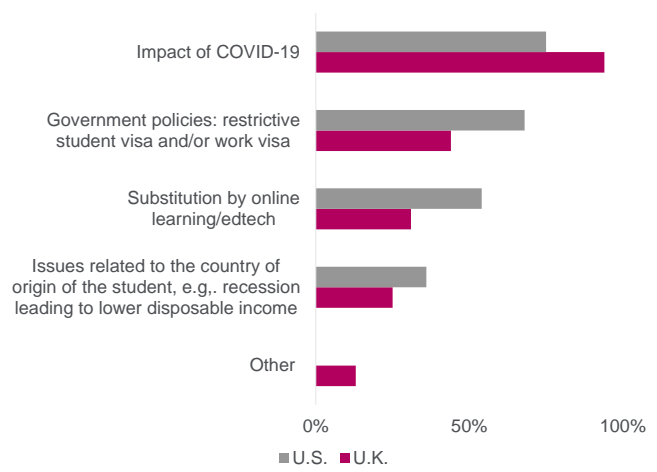
2. Risks Related to Government Funding

Figure 16. U.S. Federal & State Grants Per Full-Time Equivalent Student

Source: Collegeboard

Across countries, government grants are an important source of revenue for higher education institutions, accounting for 30% to 40% of their top line. Even in the case of private non-profit universities in the U.S., government grants are not insignificant at 12%.

Governments around the world might be tempted to re-evaluate their monetary commitment to the education sector due to the fiscal impact of the pandemic and the broader economic downturn. This is especially the case because the consequence of increasing or reducing spend on education is not necessarily felt in the short term.

To put some numbers to this, we note that in the U.S., federal and state grants per student have declined after peaking in 2011. In Australia, the 'Group of Eight' universities pushed back against the government's Job-ready Graduates Package reform arguing it would result in a 6% drop in funding per student in 2021. They also noted that by 2024, universities would be expected to teach an additional 5,000 students with a A$94 million ($66m) reduction in funding.

Figure 17. Government Grants as a Proportion of Postsecondary Revenue
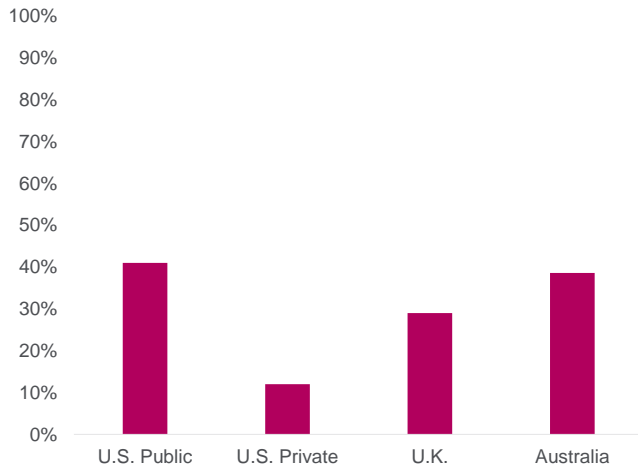
Source: NCES, HESA, Universities Australia

Figure 18. How Do You Think Government Funding Pressures on Education Will Impact the Outlook for Your Institution?

- ■ I see indirect risk from government funding cuts on the revenue for my institution in the form of reduced supports for students to cover tuition fees, etc.
- ■ I see direct risk from government funding cuts on the revenue for my institution in the form of lower direct grants, etc.
- ■ I expect pressure on government funding but I don't expect my institution to be affected directly or indirectly
- ■ I don't expect pressure on government funding (direct or indirect) in my area
- ■ Not applicable

Source: Citi Research

Nearly 60% of universities across both developed and emerging markets believe they are directly or indirectly at risk from pressure to government spending.

3. Higher Education Counter-Cyclicality Called Into Question

Higher education typically exhibits counter-cyclical tendencies

While the shape of the economic recovery remains uncertain, there is literally decades of empirical evidence suggesting enrollment in higher education typically exhibits counter-cyclical tendencies.

Figure 19. Year-over-Year Growth in U.S. Real GDP and U.S. Postsecondary Enrollment
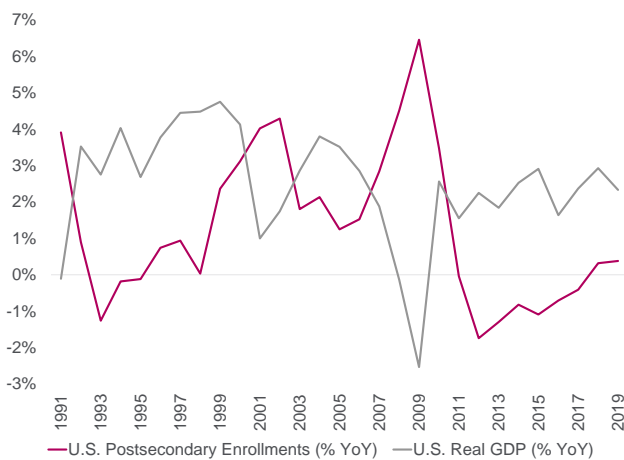
Source: U.S. FRED, National Student Clearinghouse

Figure 20. U.S. Unemployment Rates vs. U.S. Postsecondary Enrollments
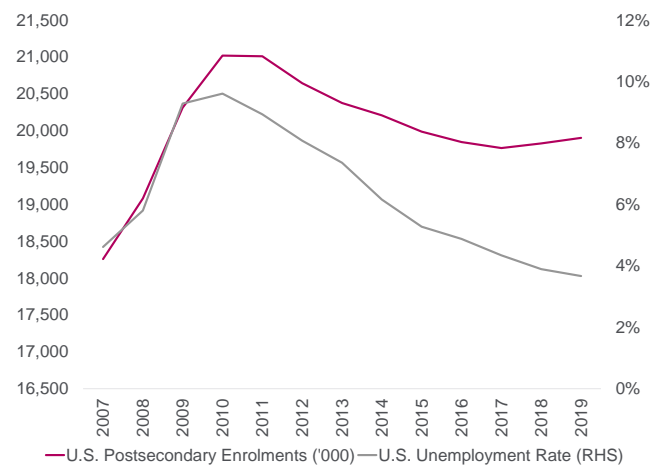
Source: U.S. FRED

This is because higher unemployment drives greater demand for reskilling and upskilling, while lowering the opportunity cost related to choosing further studies over a paying job.

Figure 21. Developed Markets: If There is a Broader Economic Recession, How Do You Think This will Impact Demand for (Higher Ed/ Private Ed) Both at Your Institutions and More Broadly?
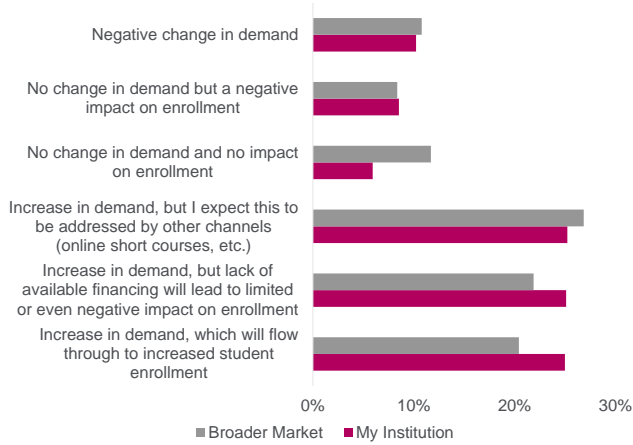
Source: Citi Research

Figure 22. Emerging Markets: If There is a Broader Economic Recessions, How Do You Think This Will Impact Demand for (Higher Ed/ Private Ed) Both at Your Institution and More Broadly?
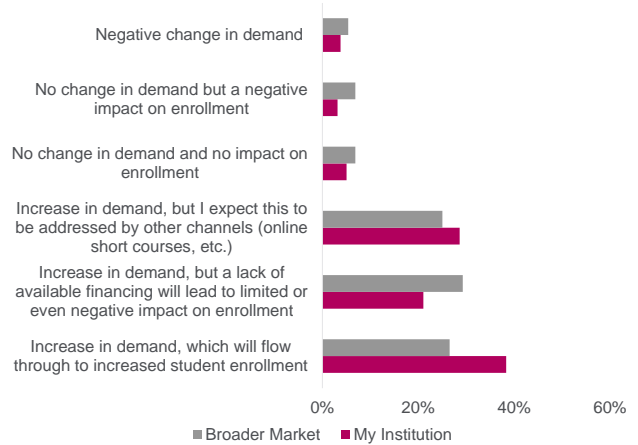
Source: Citi Research

But only 25% of respondents in developing markets believe an economic downturn would lead to higher university enrollments

Against this backdrop, the generally pessimistic response to what impact an economic recession might have on tertiary demand was rather surprising. Only a quarter of developed market respondents believe an economic downturn would result in higher university enrollments. It is slightly higher for emerging markets at 35%.

Demand is expected to shift to short courses and online degrees

Around 25% of respondents think higher demand will benefit providers of short courses rather than traditional university degrees. Over 40% in developed markets and 30% in emerging markets expect a negative impact on enrollments in a recessionary scenario. Again, about a quarter of respondents believe any increase in demand might be served by online degrees and short courses.

4. Risk of Tuition Dilution

High tuition cost is a major factor driving down satisfaction levels associated with the perceived value derived from education

We did not cover tuition in our current survey but in a separate survey last year, we asked the general population what they thought about the cost of higher education and to identify the main areas for improvement. The cost of education appears to be a major factor in driving down satisfaction levels associated with the perceived value derived from education. Nearly 50% of U.S. respondents in that survey cited lower cost of education as the main opportunity for improvement. The distant second and third opportunities cited were better meeting the needs of employers and narrowing the disparity in quality. Similarly, when we asked U.K. respondents what they thought about the value proposition of an undergraduate degree, over two-thirds said it was expensive and represents poor value for money.

Figure 23. Respondent Subset U.S.: The Main Opportunity to Improve the College Education System Is To…

- Lower cost of education 49%
- Improve completion/dropout rate 9%
- Utilize technology to improve learning 11%
- Narrow the disparity in school quality among schools 12%
- Better meet the needs of employers 19%
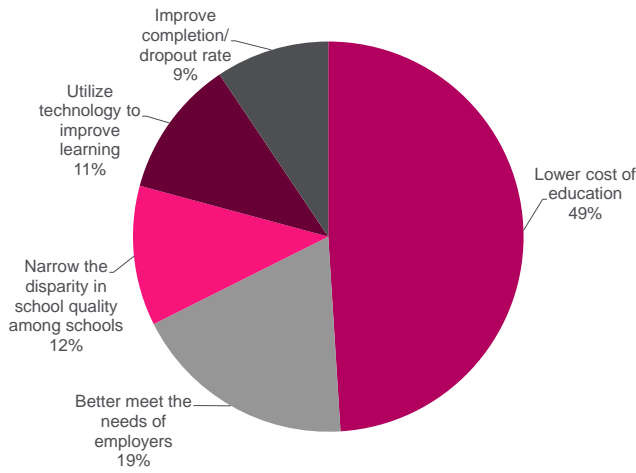
Source: Citi Research

Figure 24. Currently Universities in the U.K. Can Charge Up to £9,250 Per Year for English/Welsh Students to Study for an Undergraduate Degree, Before Considering Living Costs in the U.K.: Do You Think…

- Current fees are fair 11%
- Current fees are too low and should/could go up given the value of a university degree 3%
- Current fees are expensive but represent fair value given the value of university degree…
- Current fees are too expensive and represent poor value for money 68%
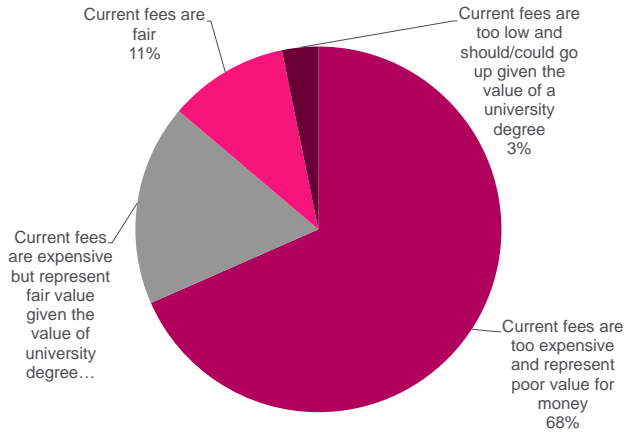
Source: Citi Research

Figure 25. U.S. Higher Education Expenses and Enrollment
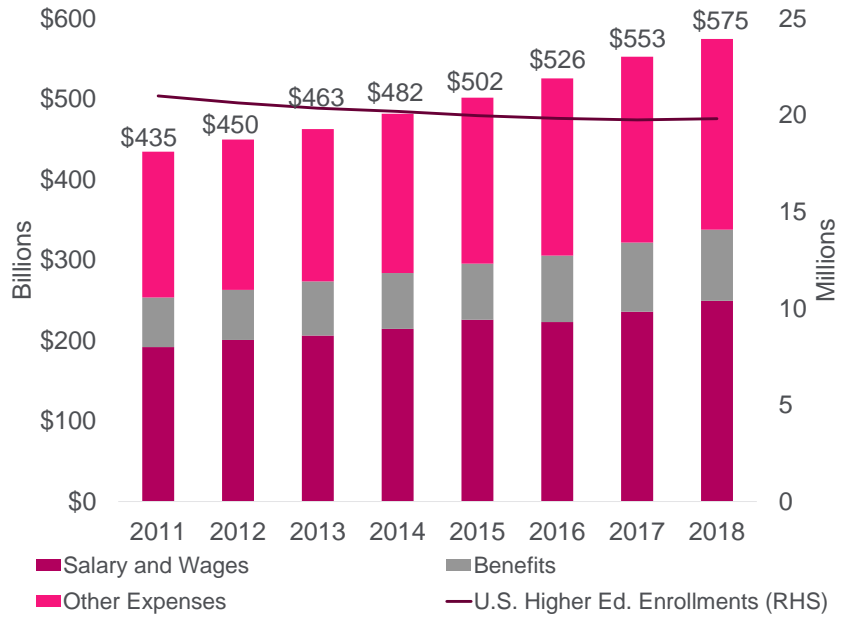
Source: E&Y Parthenon, IPEDS, IRS

In the past we suggested universities suffer from 'Baumol's disease' — the idea that universities have lower rates of productivity growth as the core elements of their service have not been fundamentally innovated or productively re-organized. Universities still employ, predominantly, the same technologies to teach students as they did fifty years ago. Professors teach or lecture students using means that would be fundamentally recognizable to a student from the 1950s. The implication is that as the rest of the economy has become more productive, the costs of university have risen faster than inflation. Universities have to pay more for space, for professors, and for other resources as these could have been put to more productive use elsewhere in the economy.

Staff costs have been especially important. Not only have wages gone up, but other benefits such as healthcare and pension costs have pushed up liabilities and forced overall costs higher. Universities cannot convert these more expensive inputs into degrees at any greater rate, as they still employ the same fundamental technologies and processes. The net result is the cost of a university education (as well as ancillary goods and services, e.g., textbooks and course materials) has increased at a much greater rate compared to the rest of the economy.

To be clear, the push back against high tuition has been an issue for some time but with little impact. However, the current crisis has bought the issue to the fore again and also ties in with our earlier point about government's wanting to rein in education costs and also the potential break-down in historic counter-cyclicality. On the first point, the U.S. government is considering capping federal student loan amounts in the hope that it might indirectly place a cap on tuition fees. The Australian government is attempting a different approach. They have proposed legislation which would increase the tuition costs for subjects less in demand in the job market, e.g., Humanities for example, while reducing the tuition for subjects more in demand in the job markets, e.g., STEM (Science, Technology, Engineering & Mathematics). The government hopes to achieve this by reallocating subsidies, rather than by coercing universities to actually reduce the tuition they charge. U.K. Prime Minister Boris Johnson has also indicated he is considering a similar move for the U.K. On the second point, as noted in the previous section, at least some university respondents don't expect to see the traditional counter-cyclical uplift to enrollments this time around because of competition from online degrees and short-form courses. To the extent, universities launch their own online degrees to mitigate the loss of enrollments, this could still dilute average tuition fees due to the mix effect.

5. Smaller Institutions More at Risk

In Figure 26 we highlight that, across our survey sample, the smallest colleges (by enrollments) were the most pessimistic i.e., they expect the largest permanent damage to their financials from the ongoing crisis. A combination of high debt and limited endowments means some of the smaller colleges would face an existential crisis if tuition revenue or government grants falter.

Figure 26. Permanent Financial Impact by Average Enrollment Size
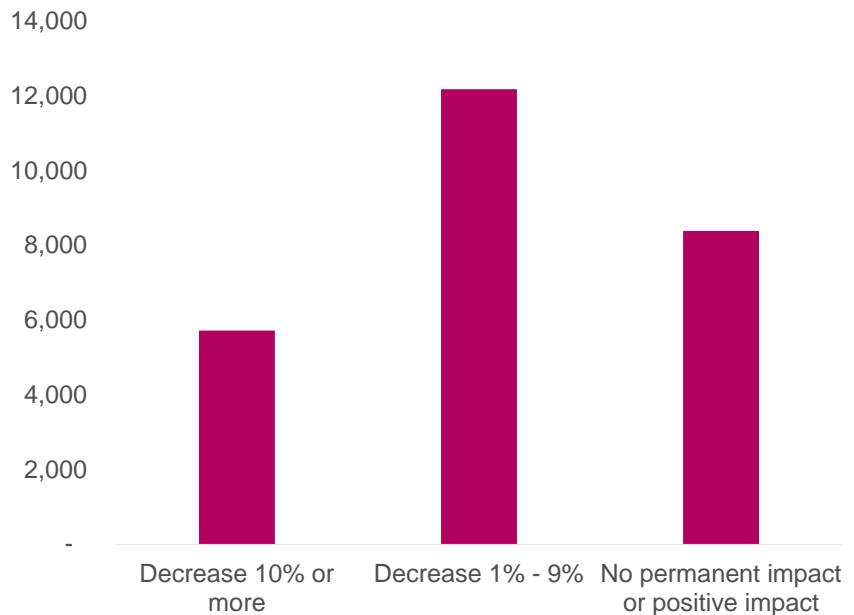
Source: Citi Research

Figure 27. U.S. Private University Institutional Debt by Enrollment
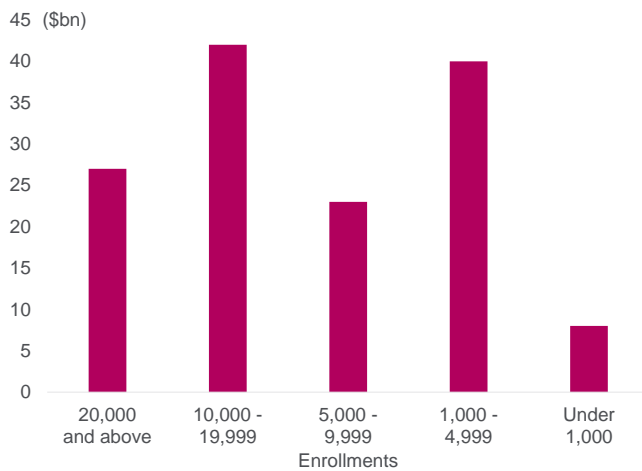
Source: E&Y Parthenon

Figure 28. U.S. Private University Debt, Endowment Assets, and Revenue on a Per Student Basis
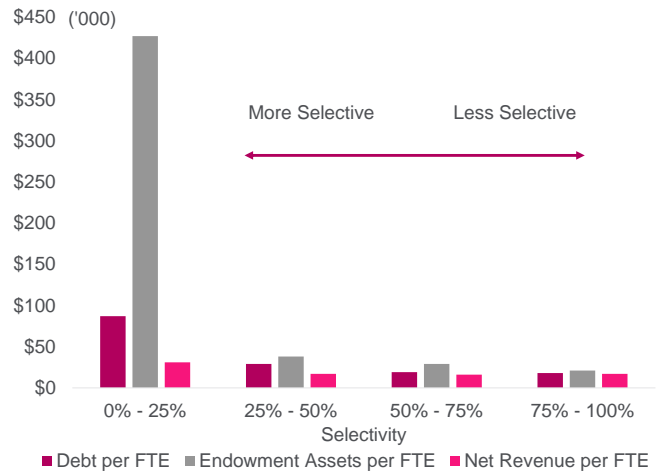
Source: E&Y Parthenon

35% of institutional debt in U.S. universities sit with smaller colleges

In the U.S., colleges with an enrollment size of less than 5,000 carry total institutional debt of around $50 billion, or about 35% of the total institutional debt of U.S. universities. As we go down the selectivity scale, the gap between debt and endowment assets, on a per student basis, narrows. In fact debt and endowment assets are almost equal for the least selective (less prestigious) colleges.

The Institute of Fiscal Studies estimate 13 universities in the U.K., accounting for about 5% of total enrollments, are at risk of insolvency. A study by the University of Melbourne identified seven of the country's 38 universities to be at high financial risk, with four of these being below the median in terms of size of the university (by revenue).

How Edtech Forms Part of the Solution

In the previous section, we posited that while the traditional on-campus model of higher education is not necessarily at complete risk, there are several areas which need to be fixed for the education system to be fit for purpose to face the challenges of the future. The respondents to our survey believe edtech has a central role to play here. In this section, we talk about why this is the case.

K-12 institutions share common challenges with universities such as uncertainty about government funding, suboptimal productivity and the need to improve outcomes

In this section of the survey, alongside universities, we also talked to K-12 institutions across the world. While K-12 enrollments are typically not characterized by cyclicality or volatility, they do share some common challenges with universities including uncertainty around government funding, suboptimal productivity, and the need for improvement in outcomes.

Constraints on budgets, pushback from stakeholders, and plain old inertia have all contributed towards limited uptake of technology by educational institutions. However, with COVID-19 forcing institutions to experiment with online learning, our survey suggests there is now a greater appetite to incorporate technology. While some of this relates to new found challenges like building out resiliency/redundancy — online degrees in the case of universities, devices and LMS at K-12, and digital courseware at both universities and K-12 — a lot also relates to finding answers to older problems such as improving outcomes, lowering operating costs, and improving access to education.

Mostly Ed, Very Little Tech

Edtech spending currently accounts for just 2.5% of worldwide education spending

As we note in Figure 29, spend on edtech currently is almost an afterthought, accounting for just about 2.5% of worldwide spend on education.

Figure 29. Spend on Education Technology as a Proportion of Worldwide Education Spend

Edtech, 2.6%
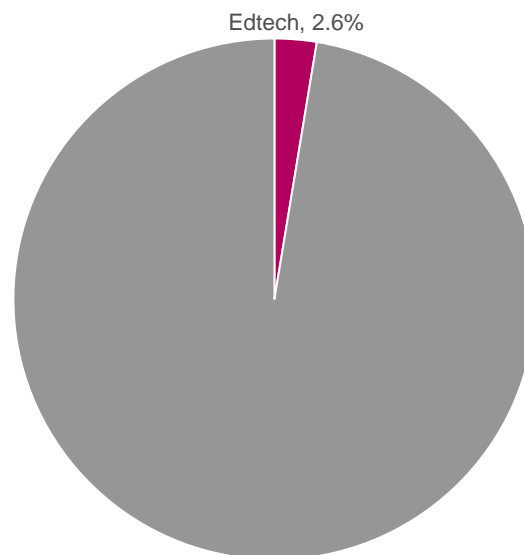
Source: HolonIQ

Figure 30. Universities: Why Do You Say That Your Institution Has Underinvested in Online Learning/Education Technology? Select All That Apply

- Never bothered to evaluate/did not realize utility of technology in education
- Budgetary constraints
- Student's lack of engagement
- Pushback against technology from faculty, parents etc.
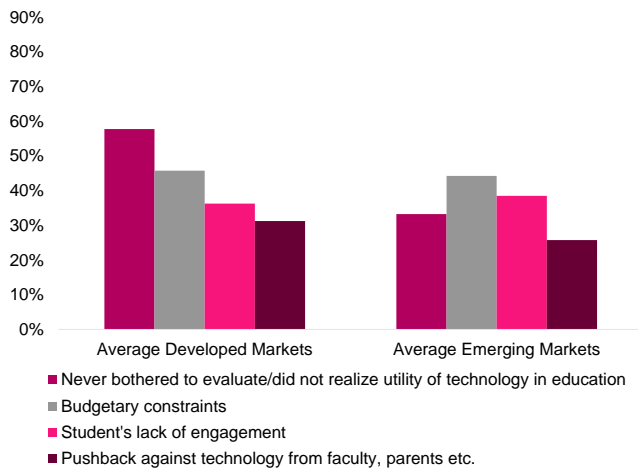
Source: Citi Research

Figure 31. K-12: Why Do You Say That Your Institutions Has Underinvested in Online Learning/Education Technology? Select All That Apply

- Budgetary constraints
- Never bothered to evaluate/did not realize utility of technology in education
- Student's lack of engagement
- Pushback against technology from faculty, parents etc.
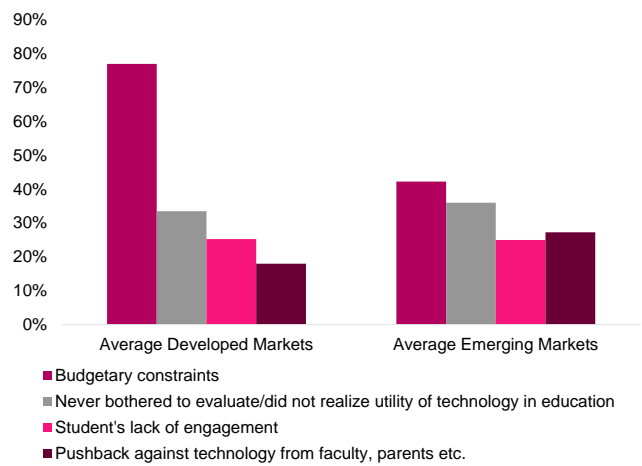
Source: Citi Research

Around a third of all survey respondents candidly admitted they had underinvested in edtech tools

Around a third of all survey respondents candidly admitted they had underinvested in edtech tools. When quizzed as to why this was the case, nearly 60% of university respondents in developed markets said they had never bothered to seriously evaluate online learning as an option. Budgetary constraints was the second most popular reason, with just under 50% of respondents also attributing their underinvestment to this. A similar proportion of universities based in emerging markets cited budgets as the main reason for underinvestment but plain 'inertia' was less of a factor with emerging market respondents, with slightly over 30% of respondents attributing this as the driving force of edtech underinvestment.

Budgets and inertia were the major factors behind underinvestment, plus pushback from key shareholders

Among developed market K-12 respondents there was a broad consensus the primary reason behind underinvestment was budgets. Nearly 80% cited it as the determining factor. Among emerging market K-12 respondents, budgets and inertia played an equally important role in historic edtech underinvestment. About 20%-30% of respondents also flagged pushback from key stakeholders — teachers and parents — as a reason for their tepid reception to edtech.

Finally some respondents flagged a lack of student engagement as a mitigating factor. This seems to be more of an issue at universities where 40% cited it as a reason versus about 25% at K-12 institutions. Out of the four main reasons cited for underinvestment this is perhaps the only one which is a direct comment on the effectiveness of edtech itself. But even in this case, the fact these respondents admit to underinvesting in edtech implies they are introspecting on how to make technology work.

COVID-19-Driven Necessity Accelerating Adoption

Over 80% of respondents to our survey said they expect technology budgets to increase over the next 5 years.

Figure 32. Proportion of Respondents Who Offered Online Learning During COVID-19 Period

Yes
96%

Source: Citi Research

Figure 33. Proportion of Respondents Aiming to Increase Spend on Edtech Over the Next Five Years
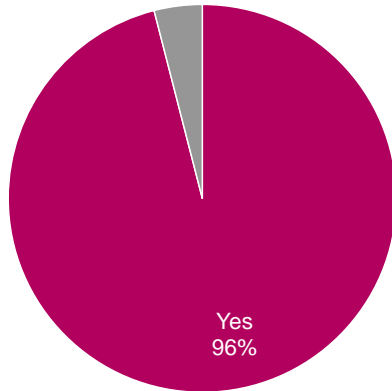
Source: Citi Research

As COVID-19 forced all educational institutions to move online, there is now a greater appetite for adopting edtech resources
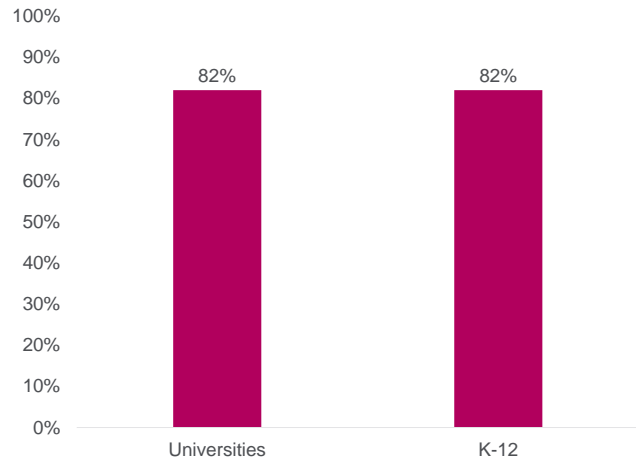
While budgetary issues are, if anything, more acute now, we suspect attitudes towards edtech might have changed considerably. In a crisis such as COVID-19 inertia or status-quo is not an option. Virtually all institutions around the world — universities and K-12 schools — have been forced to teach online. Given the amount of time administrators and faculty have been compelled to invest in thinking about integrating online learning into their pedagogy, the survey suggests there might be a greater appetite for adopting edtech resources to deliver a more engaging and personalized learning experience.

Hybridization continues to be prevalent in the classroom in the fall semester

While the summer (or equivalent) term was completely online, many are shifting to a hybrid model starting with the fall (or equivalent) term. We believe some of this hybridization will continue in the post-COVID-19 world in the form of flipped classrooms (assigned reading and listen/view online lectures at home, concept engagement in the classroom), virtual labs and field trips using immersive tech, greater engagement through gamification, or greater personalization through adaptive digital courseware.

As well as forcing people *out* of their inertia regarding edtech, current events have also pushed people *towards* technology in search of solutions to the longer-term challenges they are facing – some old and some new. We asked the 80%+ of respondents who intend to increase spend on edtech what they hope to achieve by doing so (Figure 34).

Figure 34. Universities: What Do You Hope to Achieve by Increasing Spend on Online Learning/Educational Technology? Select All That Apply

Source: Citi Research

Legend:
- Lower operating costs
- Generate better outcomes
- Lower costs for students
- Other
- Lower entry barriers to education for underrepresented population groups
- Resilience/ redundancy
- Additional revenue
- Don't know
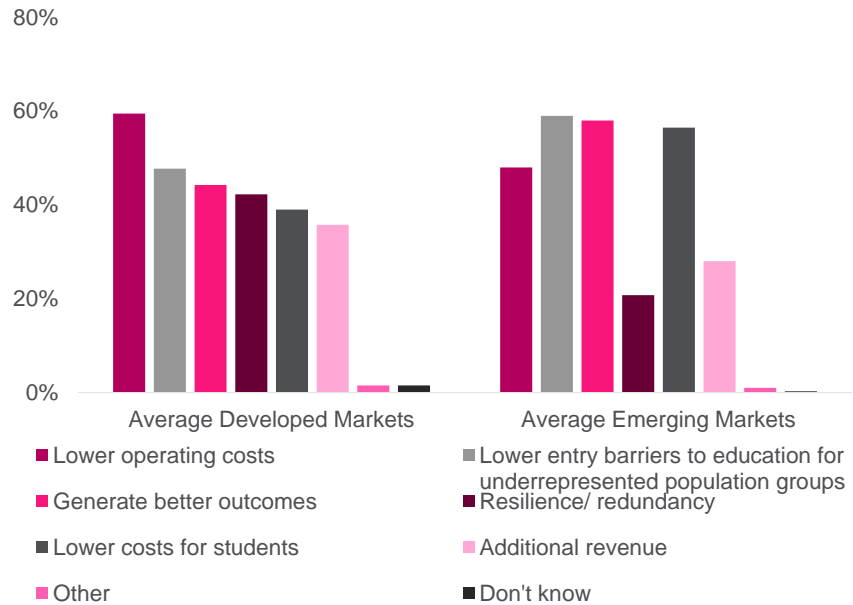
Lowering operating costs is a big motivator for tech spend in developed markets vs. lower barriers to entry for education in emerging markets

At universities in developed markets, the biggest motivator (60% of respondents) was the expectation of lowering operating costs. This is not necessarily surprising given the pain points we highlighted in the previous section around potential tuition dilution, lower government funding, and the impact to international enrollments. Over 40% of respondents also hoped to lower entry barriers to education for underrepresented groups, generate better outcomes, and improve resiliency and redundancy. The need for resilience and redundancy has of course come into prominence following the pandemic, which is likely to drive greater demand for digital courseware, devices, and offerings such as online degrees.

At universities in emerging markets around 60% of respondents hoped to lower entry barriers to education for underrepresented groups, generate better outcomes, and lower costs for students.

In the context of improving access to underrepresented groups and generating better outcomes, we refer to our 2017 Citi GPS report Education: Back to the Basics. In that report we noted the absence of a nearby school in several frontier regions meant younger children and girls of all ages were excluded from formal schooling. In developed markets, there is a noticeable gender gap in STEM tertiary education and a racial gap in tertiary education more broadly. Online learning, while not a panacea, might have a role to play here.

Figure 35. K-12: What Do You Hope to Achieve by Increasing Spend on Online Learning/Educational Technology? Select All That Apply

Source: Citi Research

For K-12, improving outcomes was the most important expectation from edtech

The expectation from edtech among K-12 administrators is quite pointed. Improving outcomes was the single most important expectation among both DM and EM respondents.

Figure 36. Total Public and Private Spend Per Student on Education (High-Spending Countries) vs. PISA Scores
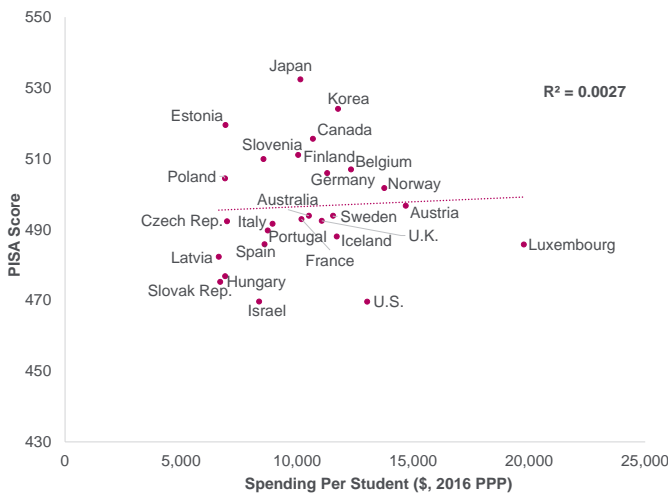
Source: OECD

Figure 37. School Enrollment Rates (%)
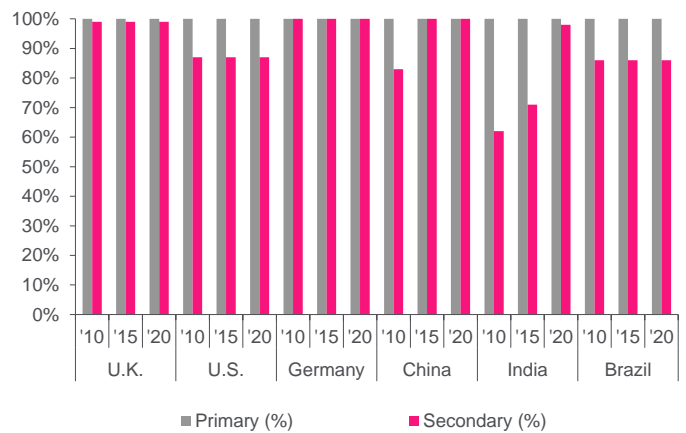
Source: Citi Research calculations - 2010 figures from Lee, J.W. & H. Lee

In developed markets, an analysis of PISA scores (a measurement of proficiency in reading, writing, and math), suggests only a limited improvement in outcomes by increasing the spend per student on education beyond a certain level. Schools are looking for technology solutions to mimic personalized 1 to 1 instruction.

In several emerging or developing markets the focus until now at the primary and secondary level was on improving enrollments without much thought to actual outcomes. With many of these countries now having achieved high levels of enrollment, policy makers are more interested in how to improve outcomes.

Figure 38. Universities: Why Have You Decided Not to Increase Spend on Online Learning/Education Technology? Select All That Apply
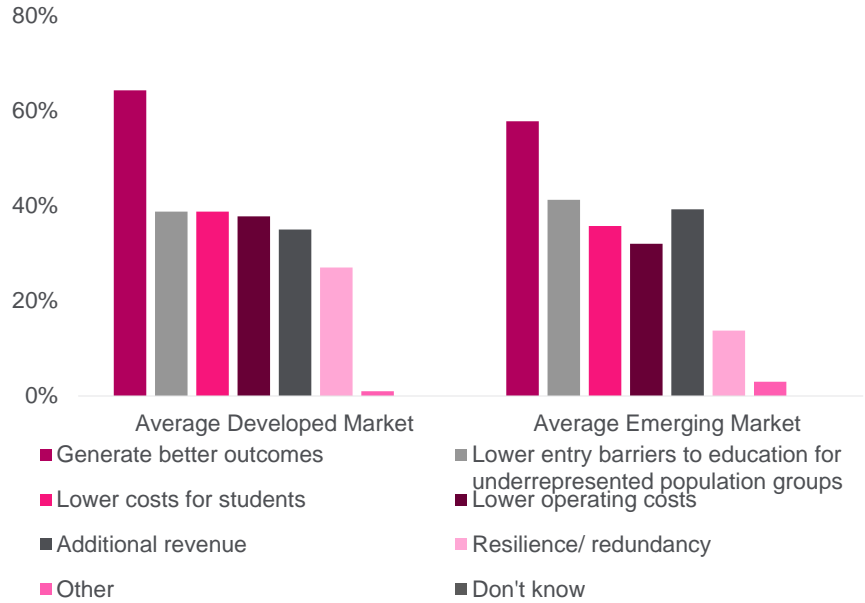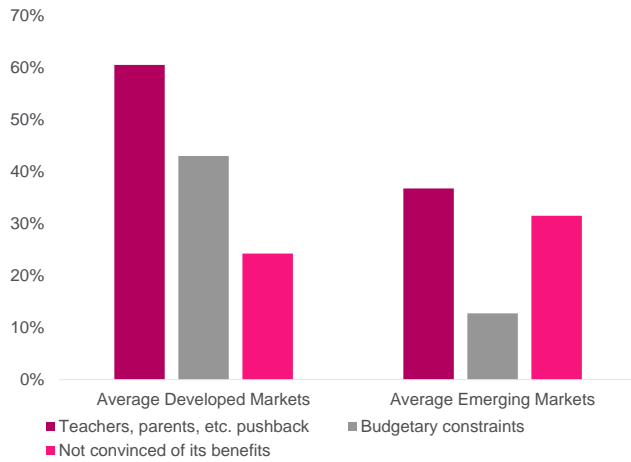

Source: Citi Research

Figure 39. K-12: Why Have You Decided Not to Increase Spend on Online Learning/Education Technology? Select All That Apply
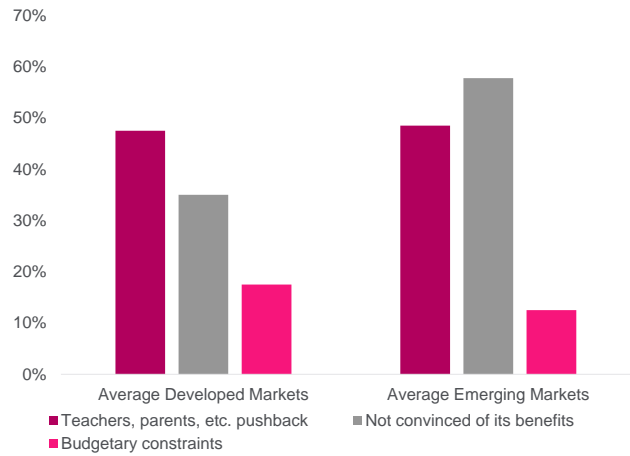
Source: Citi Research

For those not looking to increase spending, pushback from stakeholders and lack of conviction around the benefits of edtech were most cited

Of course not all respondents are convinced about the utility of edtech with about 17% of respondents indicating their intention to either leave their amount of spend on technology constant or reduce it.

Generally, across institutions — universities and K-12 — and across regions — developed and emerging markets — the most commonly cited reason for not increasing edtech spend was pushback from stakeholders such as teachers and parents, suggesting inertia is not entirely eliminated as a feature of this landscape. Among K-12 respondents, lack of conviction around the benefits of edtech was also cited fairly frequently (and in almost 50% of cases in EM).

Edtech in Five Years

In the previous two sections, we articulated the challenges facing the education industry and how some of it can be tackled through judicious investments in online learning resources or edtech. In this section, we talk about what all this means for actual spend on edtech tools.

Figure 40. Worldwide Edtech Spend to Grow at a 17% Compound Annual Growth Rate
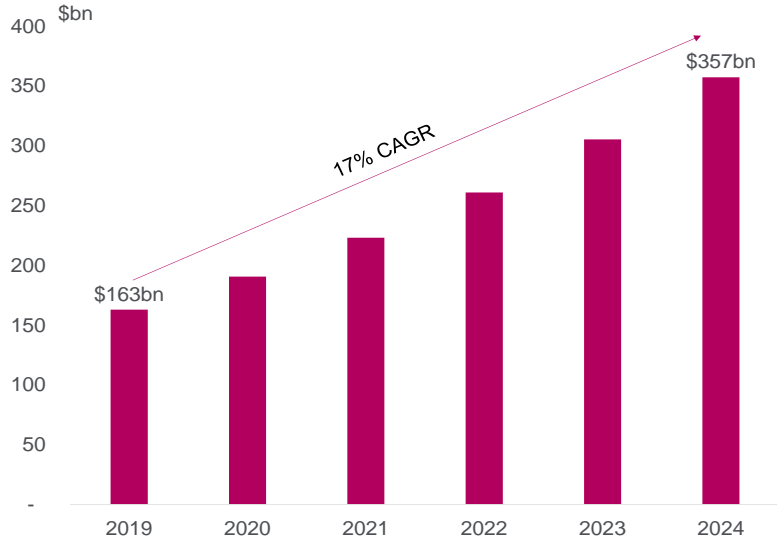
Source: 2019 edtech estimate from HolonIQ, Citi Research

We forecast worldwide edtech spend will more than double to about $360 billion by 2024 from around $160 billion in 2019

The headline takeaway is we forecast worldwide edtech spend will more than double to about $360 billion by 2024 from around $160 billion in 2019, implying an compound average growth rate (CAGR) of around 17% per year. In the following pages we highlight the various moving parts underpinning our headline estimate growth in edtech spend.

Figure 41. University: By How Much Will Your Budget for Online Learning/Education Technology Change on Average Per Year During the Next Five Years?
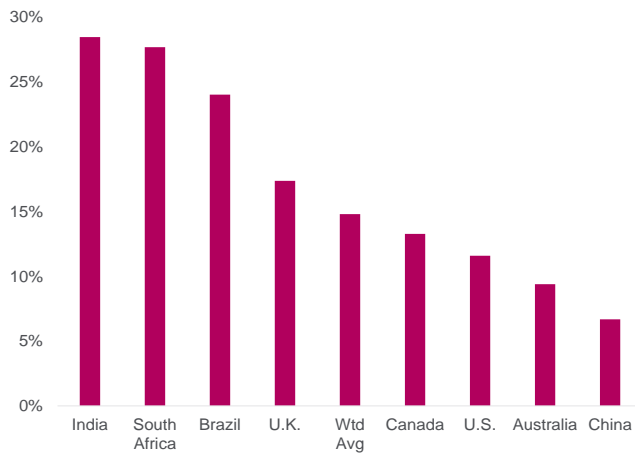
Source: Citi Research

Figure 42. K-12: By How Much Will Your Budget for Online Learning/Education Technology Change on Average Per Year During the Next Five Years?

Source: Citi Research

At a country level, we note emerging market universities are more eager about increasing edtech budgets over the next five years. Respondents from India, South Africa, and Brazil all expect to grow their budgets by over 20% per year with the former two signaling spending growth in excess of 25% per year.

The average for developed market respondents was between 10% (Australia) and just over 15% (U.K.). The divergence between the two regions likely reflects the historic acute underinvestment in edtech.

While we were surprised to see that Chinese universities intend to grow edtech spend by only 7%, we believe this is at least partly explained by the fact that Chinese institutions have been prolific spenders on technology in the previous decade.

Universities on a weighted average plan to increase technology budgets around 15% per year while K-12 plan around 16% growth

Overall, on a weighted average basis, this implies universities are planning to increase technology budgets by around 15% per year. For the purpose of weighting the growth rates we assume developed markets account for 50% of the total edtech market, China 25%, and other emerging markets 25%.

Growth in technology budgets at K-12 institutions are broadly similar to universities. K-12 schools in Brazil and South Africa are likely to increase technology budgets by 25% per year. Most other countries flagged plans for a 15% annual increase in edtech budgets. On a weighted average basis, this implies around 16% growth in K-12 technology budgets.

Figure 43. Proportion of Respondents Who Believe Students' Take Up of Supplemental Tools Will Either 'Somewhat Increase' or 'Significantly Increase'
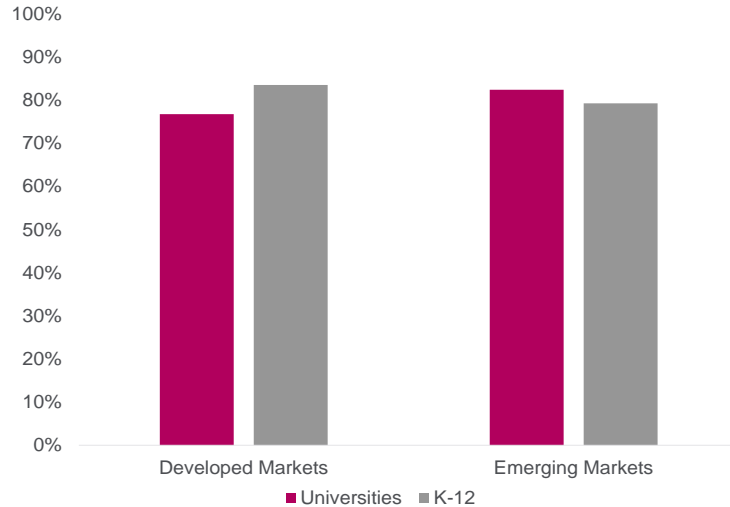
Source: Citi Research

One potential drawback of our survey is our results primarily relate to Business-to-Business (B2B) spend expectations since our survey was targeted at university and K-12 administrators. i.e., there is no representation of the Direct-to-Consumer (D2C) market.

When we asked administrators what they thought about the uptake of supplemental D2C learning tools by students in their institutions, the response was quite favorable. Around 80% of respondents said uptake of such tools will increase somewhat or significantly going forward. This sentiment was consistent across regions and types of institutions.

Against this, we do note that D2C is as yet a fairly small component of the education industry. To quantify this, the top 10 D2C edtech companies in the world have an aggregate revenue of only about $3.8 billion and by the time we get to the companies ranked 11th and below, none have revenues of more than $50 million. Notwithstanding the high growth rates, revenue for these companies therefore made up just 2% of the worldwide edtech spend of $160 billion in 2019. While these companies certainly would be followed by a long tail, we don't believe this tail would materially move the needle in terms of D2C's position in the education industry. Overall, we assume the D2C market is about 3-4% of the total edtech market.

Another issue with our choice of sample is we miss out on any meaningful contribution from the professional/corporate/lifelong learning market. There is some data suggesting the global corporate training market is about $360 billion in size of which about $31 billion is e-learning (or about 19% of the global edtech market) and growing at a CAGR of about 11% Against this we note the cloud enterprise learning & development (L&D) market is growing at a CAGR of around 9.5%. We also believe there are likely to be definitional issues around professional certification and lifelong learning. Ultimately, we assume this market segment constitutes just under 20% of the edtech market and is growing at around10%.

Putting all this together in the waterfall chart below, we show the percentage contribution of each individual element to our 17% growth expectation for edtech.

Figure 44. Growth in Edtech Spend by Type of Institution

	Weighting	5-Yr CAGR
Universities	*35%*	*15%*
K-12	*43%*	*16%*
Professional/ Corporate/ Lifelong Learning	*19%*	*10%*
B2B	97%	14%
D2C	4%	95%
Growth in worldwide edtech spend		**17%**

Source: Citi Research

Figure 45. Deconstructing the Growth in the Edtech Sector
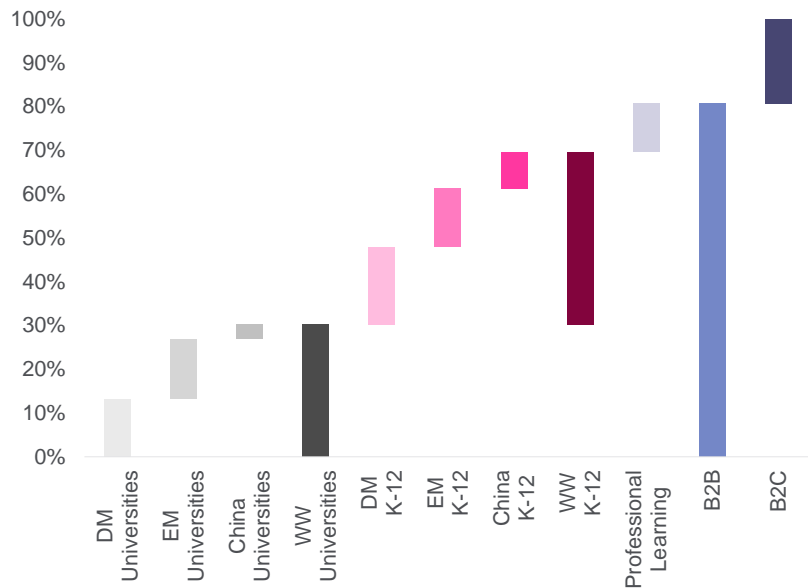
Source: Citi Research

The largest driver of growth in edtech spend is estimated from K-12, followed by universities and professional learning

We estimate universities will contribute to slightly more than 30% of the overall edtech growth. As highlighted previously, based on the responses to our survey this increase will be primarily driven by emerging markets (ex-China) and developed markets. K-12 is estimated to be the single largest driver of growth in edtech spend, contributing to around 39% of the growth. Professional learning is estimated to drive 11% of the growth.

Overall we expect B2B will account for slightly over 80% of the growth, whereas D2C, while not large is an absolute sense, will still contribute just under 20% to the total edtech growth due to its high growth profile.

50% of All Studying Will be Done Online

In terms of actual engagement, institutions expect around half of all daily hours to be digitized. Emerging market respondents expect e-learning to be more ubiquitous than developed market respondents.

Figure 46. What Percentage of Daily Study Hours (In and Outside Class) Will be Digitized in the Next Three Years?
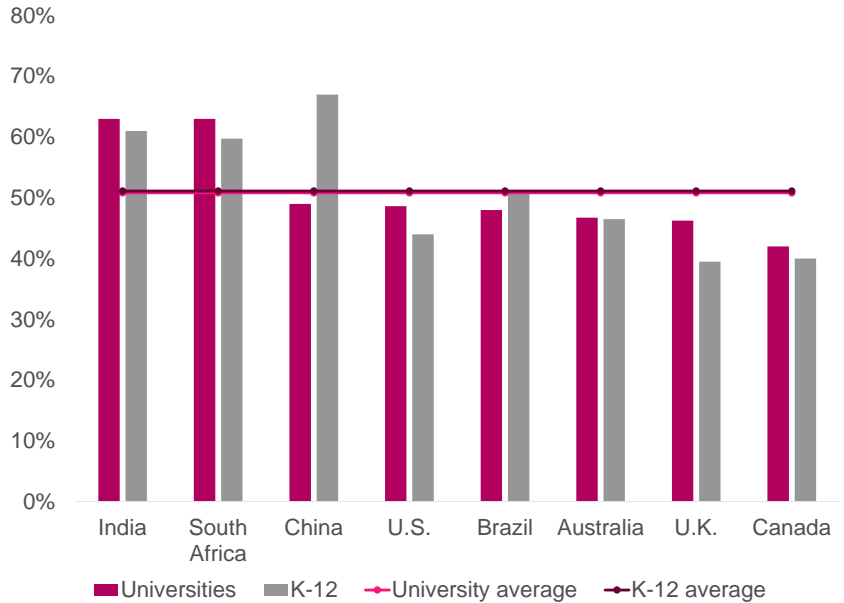
Source: Citi Research

Figure 47. I Would Consider Online Education Programs as an Option for Myself
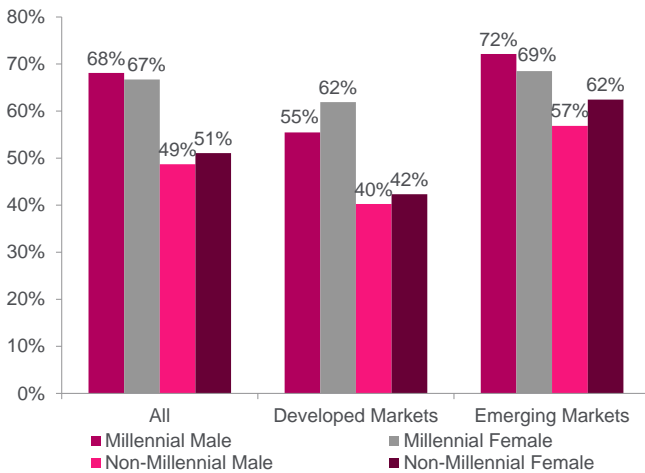
Source: Citi Research

Figure 48. I Would Consider Online Education Programs as an Option for My Child
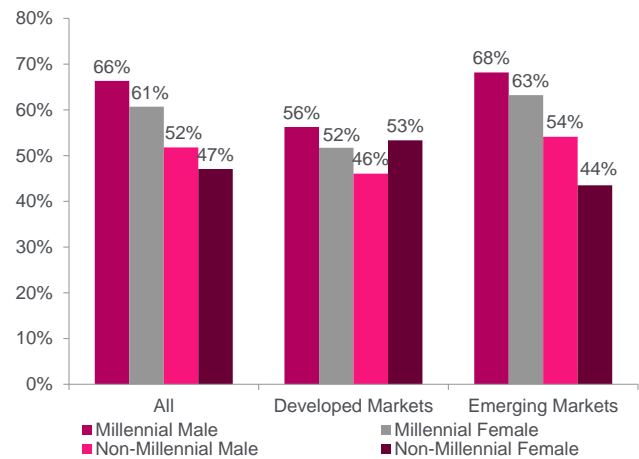
Source: Citi Research

This largely ties in with the findings of our survey of education trends across five countries from 2019. As we note in the charts below, emerging market respondents were consistently more likely to have a favorable opinion on online education programs both for themselves and their children.

Looking at the Implication of Our Work

When we consider the fundamental implications of our survey work longer term, we try to draw a distinction between the narrow impact on the education market and the impact more broadly on the global economy. We also try to distinguish between the quantitative implications of our work on market size and growth rates and the more qualitative elements, for example how what we talk about may impact behavior and what the implications might be for non-financial stakeholders.

In this section, we explore these implications looking at each of the four quadrants depicted in Figure 49 in turn:

- In the Micro/Quantitative segment, we consider what the acceleration in edtech adoption we highlight in the first section of the report might mean for the broader education market in terms of overall market growth.

- In the Micro/Qualitative segment, we consider what behavioral changes in an educational setting might mean for various stakeholders — either financial or non-financial in nature. Factoring in both qualitative and quantitative perspectives, we also consider what our work might mean for the various pockets of education at a sub-sectoral level, e.g., the K-12 market vs. university services etc.

- In the Macro/Quantitative segment, we look beyond the implications for the education market and consider what greater adoption of edtech might mean for overall access to education and, by extension, the impact on the global economy. In order to do this we build not only on our previous work on education but also other Citi GPS reports, e.g., in our Women in the Economy series of reports.

- Finally, in the Macro/Qualitative segment we consider what a changing educational landscape might mean for the world of work building on the research done in our Technology at Work series of Citi GPS reports.

Figure 49. Looking at Implications – Micro vs. Macro and Quantitative vs. Qualitative

	Micro	**Macro**
Quantitative	What will an acceleration in edtech growth mean for the education market more broadly?	How will a change in take up of edtech impact economic growth?
Qualitative	How will a change in adoption of edtech impact behavior in an educational setting?	How will adoption of educational technology impact life in the workplace and beyond?

Source: Citi Research

Micro/Quantitative: Edtech Spend to Double Over Next 5 Years but the Long-Term Opportunity Could Be 8x This

Total education spend is expected to increase by 5% per year vs. our forecast for edtech growth of 17%

As we discussed above, the headline takeaway from our survey is that edtech budgets will see compound annual growth of around 17% over the next five years, meaning the total edtech market opportunity is set to double by 2024. Although this is an impressive figure, some context is required. Data from HolonIQ suggests total worldwide spend on education will increase by around 5% per year.

By 2024 edtech is still only forecast to account for 5% of total education spend

As another pointed reminder of the limited uptake of technology in the education sector, despite the huge gap in prospective growth rates, even on our revised growth estimates, edtech is estimated to account for only 5% of total education spend by 2024.

Figure 50. Edtech as a Proportion of Worldwide Spend on Education
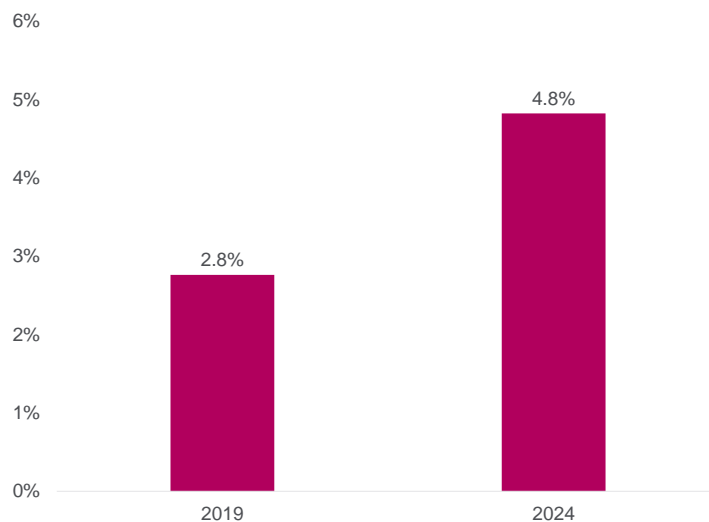
Source: HolonIQ, Citi Research

Where Media Leads Could Education Follow?

In traditional consumer media one of the most famous charts — commonly referred to as the 'Mary Meeker' chart, in honor of the analyst who brought it to prominence — is one that looked at time spent on various media relative to the proportion of advertising spent on that medium. Underlying this analysis was the simple observation that where consumer time led, advertising dollars would surely follow. In the charts below we show a snapshot of this chart based on U.S. data from 2011.

Figure 51. U.S. Media Usage vs. Ad Spend, 2011
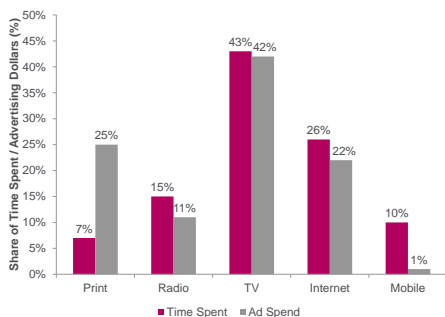
Source: Bond Capital, Kleiner Perkins, IAB, eMarketer

Figure 52. U.S. Media Usage vs. Ad Spend, 2015
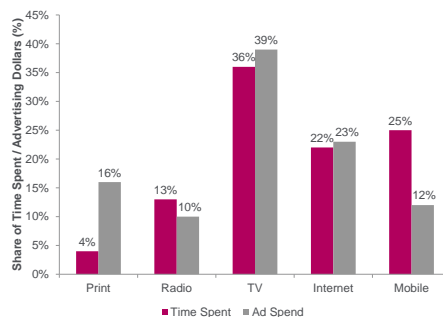
Source: Bond Capital, Kleiner Perkins, IAB, eMarketer

Figure 53. U.S. Media Usage vs. Ad Spend, 2018
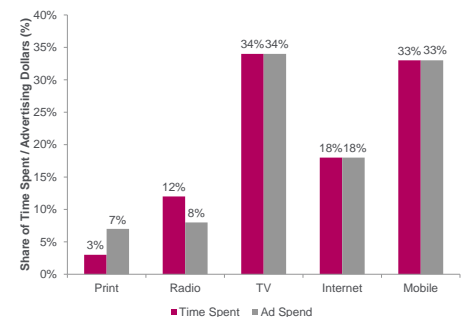
Source: Bond Capital, Kleiner Perkins, IAB, eMarketer

Needless to say, the factors driving media business models are necessarily different from education in a number of ways. The data above looks at time spent versus advertising and while advertising spend has adapted fairly quickly to changing usage (albeit with a lag) this analysis misses the offset provided by other revenue streams, e.g., subscription, which has kicked in to support some traditional media business models. In the same breath, there are some compelling subscription-based models in the online sphere so this is perhaps not a reason to dismiss the analysis entirely.

Adding in data from the survey suggesting 50% of study hours will be digitized, we see an edtech opportunity gap of up to $2.7 trillion

For education, while it might be overdoing it to paint a direct parallel with media, it is nevertheless intriguing that our survey suggests 50% of study hours will be digitized in fairly short order. Even if we are talking about a simple hybridization of education — a mixed mode between traditional face-to-face learning and online elements — a similar analysis suggests a remarkable edtech opportunity gap: up to $2.7 trillion based on today's market size.

In practice this may be too extreme, not least because there are parts of the market which edtech will struggle to reach (e.g., state K-12 schools), but it is yet another potent reminder of the scale of the edtech opportunity in a global setting in terms of pure market size relative to the $360 billion forecast we have for 2024.

Figure 54. Sizing the Edtech Opportunity Gap Using Time Spent vs. Money Spent
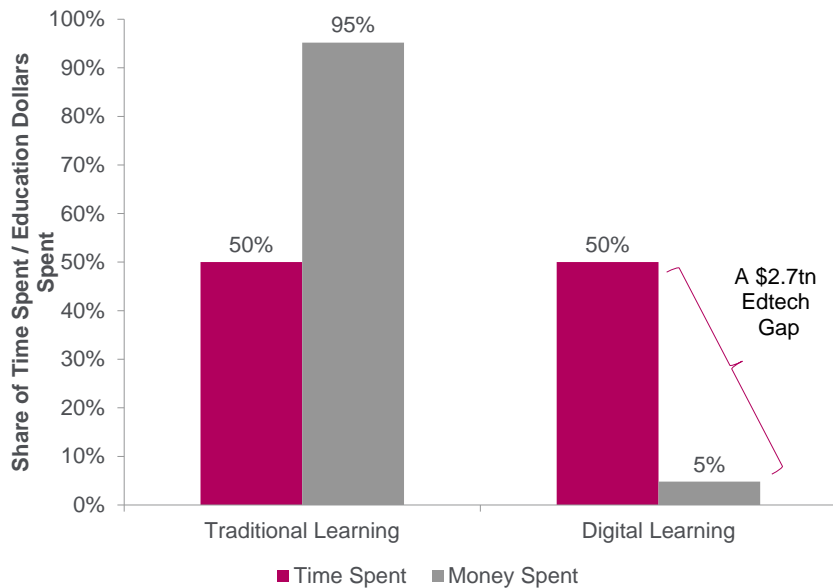
Source: Citi Research

Micro/Qualitative: Flexing the Curve to Provide Greater Access & Productivity

One of the themes coming out of all of our previous work on education is that while this is a huge global market (worth some $6 trillion per year) the market itself is not monolithic, nor indeed are the challenges and opportunities faced by different stakeholders at different stages of education and across different markets.

In our first Citi GPS report (see Education: Back to Basics) we talked qualitatively about the challenges in terms of access to education in some of the more deprived areas of the world and amongst some of the more vulnerable communities and/or social groups as well as various demand- and supply-side interventions that could be used to address these severe global imbalances. As one isolated example, in Figure 55 below, we show the gender gap in education across various countries and how this is linked to the level of discrimination observed in social institutions within those countries. The chart shows how embedded gender inequality is in some countries around the world.

Figure 55. Discriminatory Social Institutions vs. Gender Gaps in Lower Secondary Completion Rates
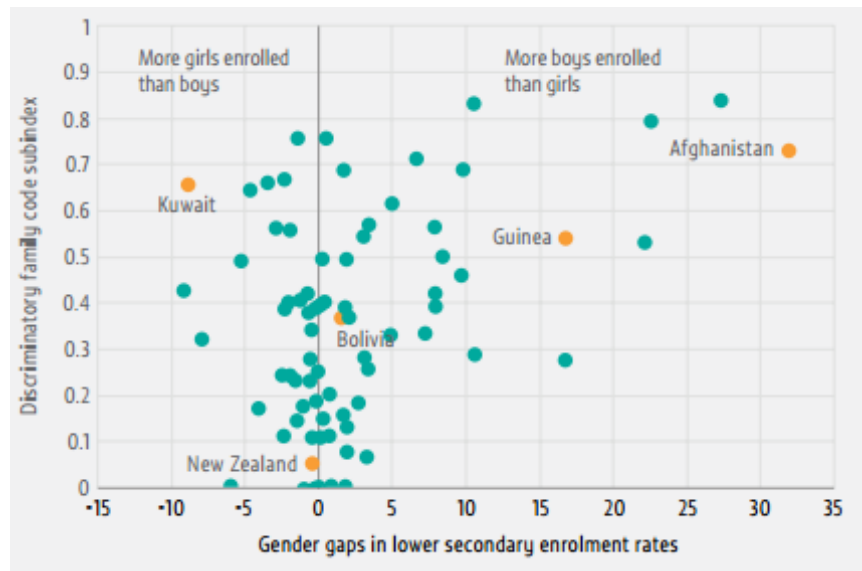
Source: UNESCO

Meanwhile, the survey work we conducted in our second Citi GPS report (see Education: Power to the People) allowed us to quantify some of the divergences in attitudes to education across four dimension: age, geography, gender, and stage of life.

Figure 56. Proportion of Developed Market Respondents Satisfied with Tertiary Education
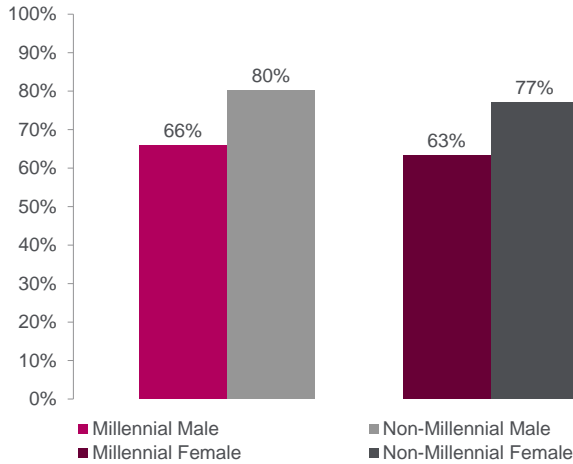
Source: Citi Research

Figure 57. Proportion of Respondents Who Aspire for Their Children to Attain Tertiary Education
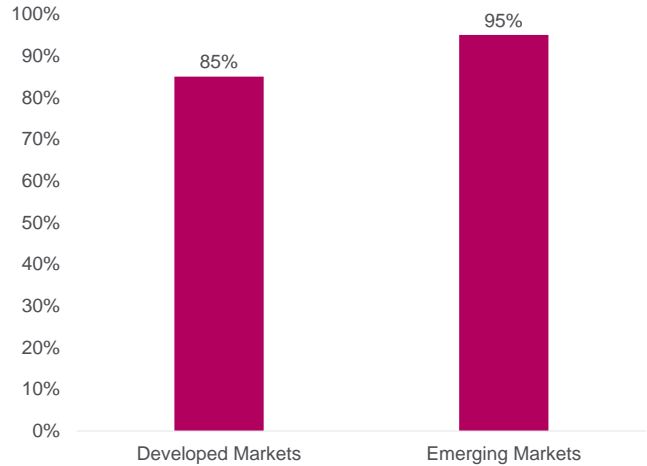
Source: Citi Research

Figure 58. Proportion of STEM Graduates
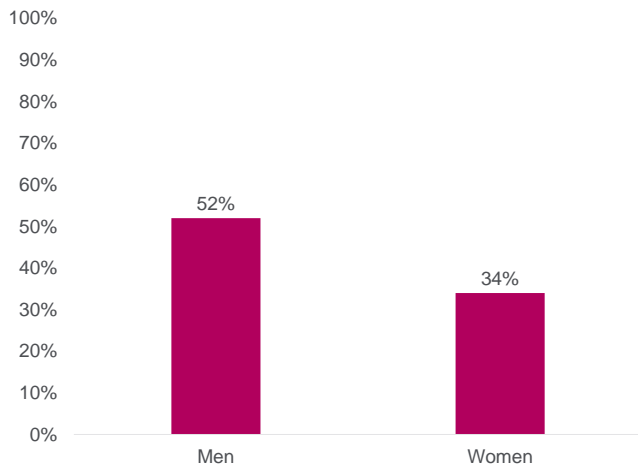
Source: Citi Research

Figure 59. Vocational Training Is Becoming More Important Even Relative to Academic Qualifications
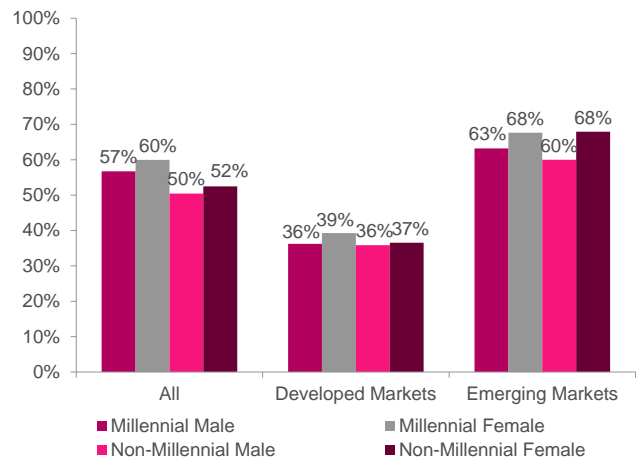
Source: Citi Research

Targeted use of technology can play a role in solving challenges in attitudes towards education

Clearly with each of these challenges, technology is not a panacea. It does not by itself solve all of these problems. This said, we think targeted use of technology can play an important role:

- In developed markets, we believe current events will lead to a hybridization of education aimed at improving personalization, engagement, and ultimately outcomes.

- In K-12, there is evidence simply spending more money does not result in superior outcomes beyond a point. Greater blended learning — which can mimic 1-to-1 personalization — could include use cases such as flipped classrooms, virtual labs, field trips using immersive tech, greater engagement through gamification, and greater personalization through adaptive digital courseware. Many of these technologies have been available in the market for some time, but have suffered from low adoption rates for reasons described previously.

■ In the context of higher education, apart from broadening access and improving outcomes the challenge will be to lower costs thereby addressing one of the key challenges in developed markets, which is the perception that education, at a tertiary level, is not sufficiently good value relative to its cost.

■ And this is not just an issue for students. As one of our expert interviewees points out (see the interview later in the report from Dan Sandhu: CEO, Sparx), teacher welfare is also impacted by the increased demands associated with more students coupled with lower funding. As well as potentially driving better outcomes for students, technology in the classroom, when used well, can also improve teacher welfare.

Figure 60. Total Public and Private Spend Per Student on Education (High Spending Countries) vs. PISA Scores
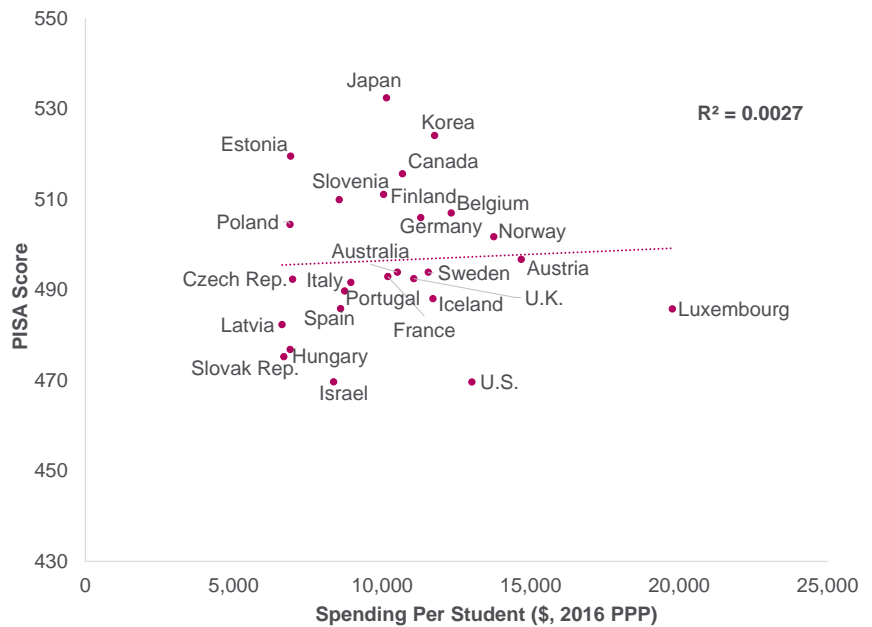
Source: OECD

Figure 61. The Main Opportunity to Improve the College Educational System Is To… (Respondent Subset: U.S.)
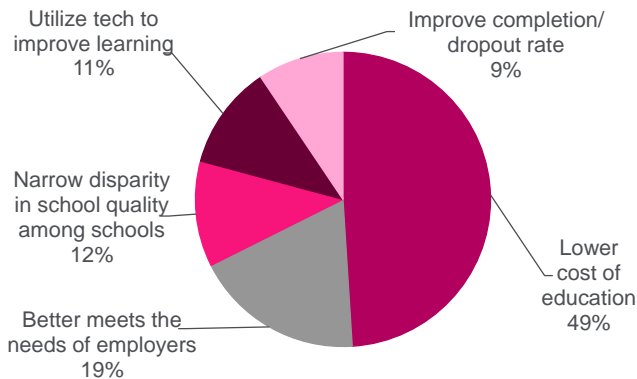
Source: Citi Research

Figure 62. In the Context of U.K. Universities, Do You think … (Respondent Subset: U.K.)
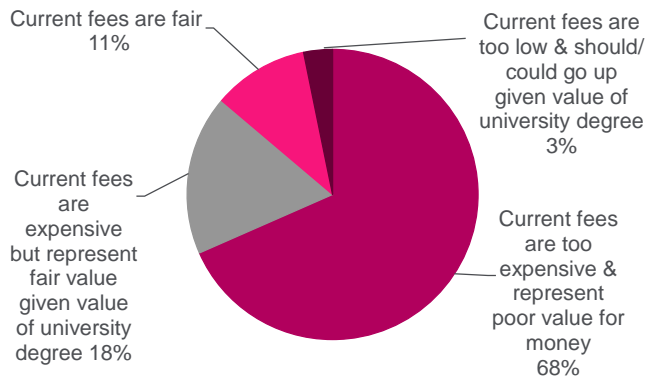
Source: Citi Research

- In a developing world context it may be too much to assume widespread adoption of online learning by governments, but private markets can play a role via online provision of supplemental materials and/or technology based pathways to studying in other markets while domestic access is still being built out.

Figure 63. Proportion of Respondents with Favorable Opinion About Education Apps
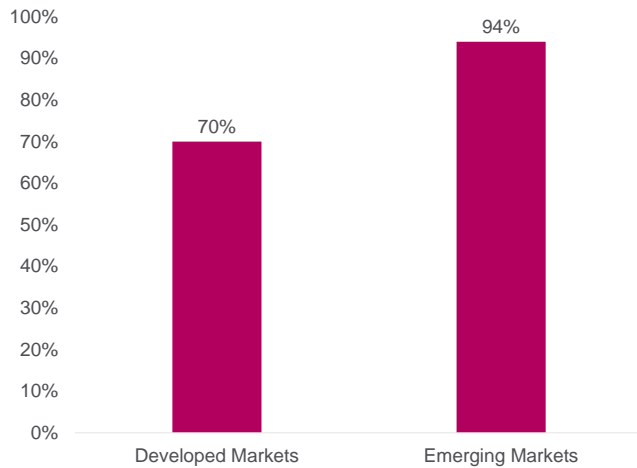
Source: Citi Research

Figure 64. Proportion Willing to Consider Studying Abroad as an Option for Themselves
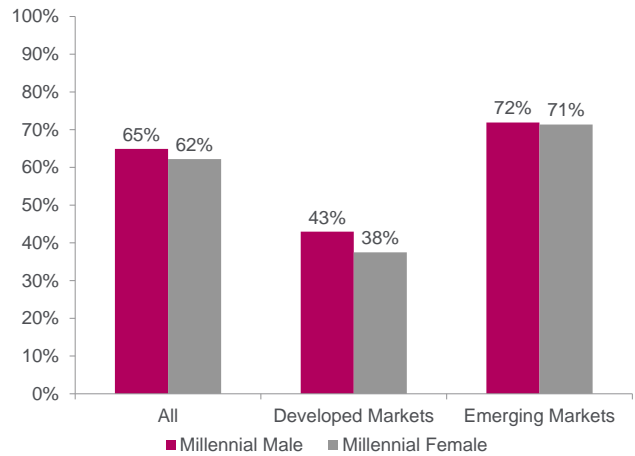
Source: Citi Research

- Learning of course is not restricted to K-12 and higher education. The "half-life of knowledge" — an expression used to describe the time it takes for half the knowledge in a particular domain to be superseded — is declining rapidly. Deloitte now estimates the half-life of a learned skill at just five years. According to some estimates, software engineers need to redevelop skills every 12–18 months. Within corporate learning, we expect an acceleration of existing trends, i.e., a shift in investment for instructor-led classroom training to online tools, with future trends like permanent 'Work from Home' only adding further momentum. As careers become less linear and the knowledge body in an existing field becomes outdated faster, an employer should look to curate the learning experience rather than control the learning catalog itself. The learning management system should resemble a consumer website providing content and access to experts, as well as personalized recommendations helping people find precisely what they need. Increasingly corporates are tying up with MOOCs (Massive Open Online Courses), coding bootcamps (22,500 corporate training graduates at about 1000 corporates in the U.S. in 2019), and other technology-oriented training solution providers for content and measurement of proficiency/ mastery. Learning Management System modules increasingly offer personalized, mobile, and social learning capabilities with an interface created with the user in mind (rather than an administrator) thus driving engagement.

One final thing to consider is the potential negative consequences of greater adoption of technology in an educational setting. There are two aspects that we particularly call out:

■ The first is the practical implications of greater automation — ultimately what edtech is all about — on employment in the education industry. Indeed concerns that somehow technology will replace teachers is one of the principal (and principled!) objections to edtech adoption. In this context, we argue the risk is low and this appears to be backed up by the work we have done as part of our Technology at Work series of Citi GPS reports (see Citi GPS: Technology at Work Series). In this research, Educational Services came out as one of the lower risk industries. We would further amplify this point by arguing that edtech is principally about expanding access/enhancing productivity — i.e., complementing existing educational resources – rather than (primarily) lower costs/replacing existing educational resources.

Figure 65. Employment Share at Risk by Industry

	Low Risk (%)	Medium Risk (%)	High Risk (%)
Accommodation & Food Services	2.8%	10.5%	86.7%
Administrative & Support Services	1.6%	36.2%	62.2%
Agriculture, Forestry, Fishing & Hunting	75.6%	12.0%	12.3%
Arts, Entertainment & Recreation	47.9%	12.5%	39.6%
Construction	21.6%	19.8%	58.6%
Educational Services	**63.1%**	**19.7%**	**17.2%**
Finance & Insurance	28.9%	17.3%	53.7%
Government	46.2%	30.6%	23.2%
Health Care & Social Assistance	39.4%	25.0%	35.6%
Information	51.6%	38.3%	10.1%
Management of Companies & Enterprises	82.8%	6.2%	11.0%
Manufacturing	19.9%	18.4%	61.7%
Mining, Quarrying and Oil & Gas Extraction	7.8%	46.3%	45.9%
Other Services (ex-Public Administration)	44.9%	24.7%	30.4%
Professional, Scientific & Technical Services	54.0%	10.9%	35.1%
Real Estate and Rental & Leasing	0.7%	32.0%	67.2%
Retail Trade	14.5%	18.9%	66.6%
Self-Employed	60.4%	8.9%	30.7%
Transportation & Warehousing	5.5%	19.4%	75.0%
Utilities	40.3%	27.8%	31.9%
Wholesale Trade	15.9%	18.4%	65.7%

Source: Citi GPS Technology at Work, Oxford Martin School

■ The second is to consider the impact adoption of technology can have on mental health and wellbeing. This is a point made by Daisy Christodoulou in our expert interview below: there are some of the pastoral elements of teaching where we would never want technology to have a role or where there may be serious ethical considerations if it were. In his interview Daniel Cordaro of the Contentment Foundation observes there are some very serious mental health considerations in a modern educational setting and if anything COVID-19 has amplified these. The point is that edtech has to be used judiciously but it is encouraging that there is high level awareness of some of these pitfalls and resources in place to address some of these challenges.

Putting this together, we come back to our original point: edtech itself is not a panacea, but anything that accelerates adoption and/or increases awareness, and indeed tolerance of, online learning has to be considered as a positive not only in terms of financial outcomes — increased market size and opportunity for private capital — but also in terms of access and outcomes for the students themselves as well as the productivity and well-being of the teachers that educate them.

Macro/Quantitative: Better Educational Outcomes for the Individual Drives Better Outcomes for Society At Large in Terms of Wealth, Health & Happiness

In our first Citi GPS report we tackled the issue of the 'value of education' head on and concluded that, de facto, education represents a win-win-win for individuals, governments, and society more broadly.

To unpack this a bit, it is worth revisiting some of the data, starting with individuals. As per the chart below, across OECD countries there appears to be a fairly clear association between higher levels of education and relative earning power/absolute lifelong earnings, albeit we have to acknowledge the benefit of higher education differs depending on what subject is taken and, indeed, across different markets given the cost of education can vary substantially.

Figure 66. Relative Earnings of Adults Working Full Time, by Educational Attainment (OECD average, 2014)
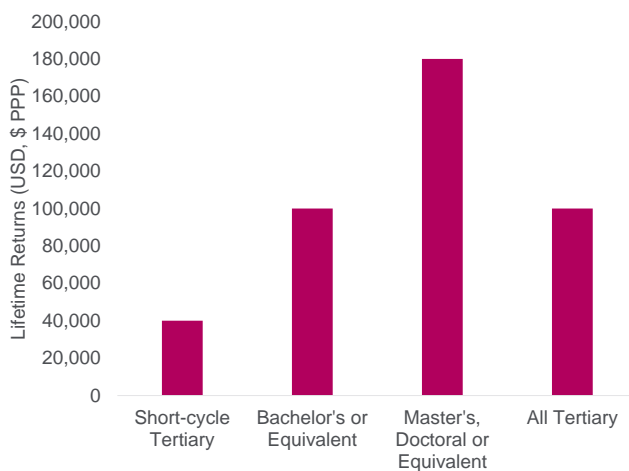
Source: OECD (2016) Education at a Glance, Citi Research

Figure 67. Private Net Financial Returns in the U.S. (BA degree, by subject)
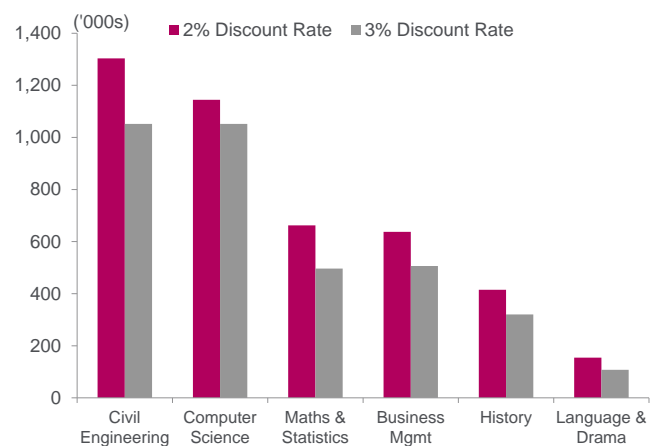
Source: OECD (2016) Education at a Glance, Citi Research

There is a clear relationship between attainment of primary/secondary education and economic growth

What is interesting, however, is the value of education should not be measured purely from the perspective of the individual. Although, as we discuss above, there are real concerns about diminishing returns on educational spend, there is a relatively clear relationship between educational attainment at primary/secondary level and economic growth. Our analysis finds a 50-point improvement in a country's PISA score yields, on average, a 1% improvement in GDP per capita growth.[1]

Looking beyond primary and secondary education, we also note the return on tertiary education appears to be positive at a population level. OECD data from 2012 shows there is a comfortable positive lifetime return on investment in tertiary education. In the U.K., this return is between £60k and £110k for undergraduates, rising to £110k-£180k for graduate programs (i.e., Master's level qualifications).

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[1] Woessmann, L. (2014). The Economic Case for Education. EENEE Analytical Report No. 20, Prepared for the European Commission. European Expert Network on Economics of Education (EENEE).

Figure 68. Public Financial Returns on Attaining Tertiary Education by Educational Level (2012)
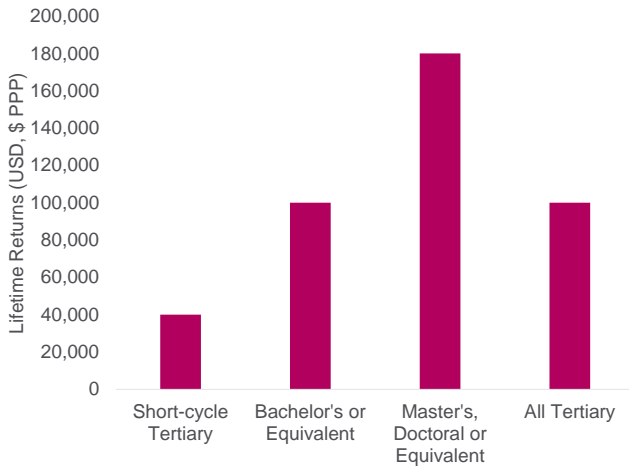
Source: OECD (2016), Citi Research

Figure 69. Average Net Benefit to Government of Financing an Undergraduate and a Master's Degree in the U.K.
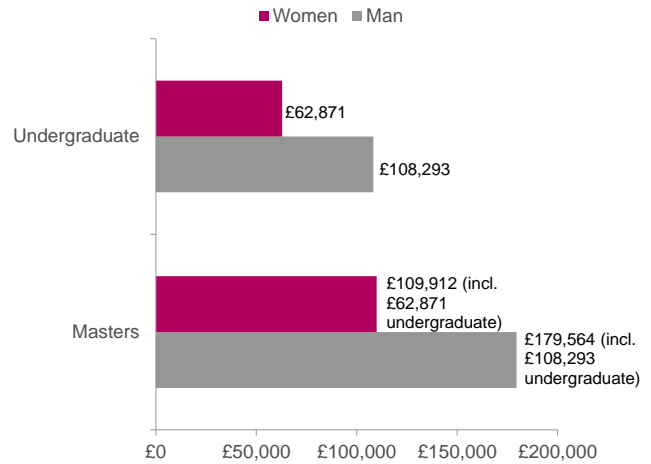
Source: London Economics, Citi Research

Education can provide a number of social benefits

And it is not just on economic measures that education makes a difference. Education can also provide a number of social benefits. These include, amongst others, an increase in life expectancy, high life satisfaction, less crime in society, and active involvement in society. For example, it is estimated on average amongst OECD countries, a 30-year old tertiary educated man can expect to live eight years longer than a 30-year old man who has not completed upper secondary school. Figure 70 below show on average a person with tertiary education is more likely to have less activity limitation due to health problems and better life satisfaction when compared to a person with upper or lower secondary education.

Figure 70. Percentage of Adults Reporting Activity Limitation Due to Health Problems by Educational Attainment and Age Group (2014)
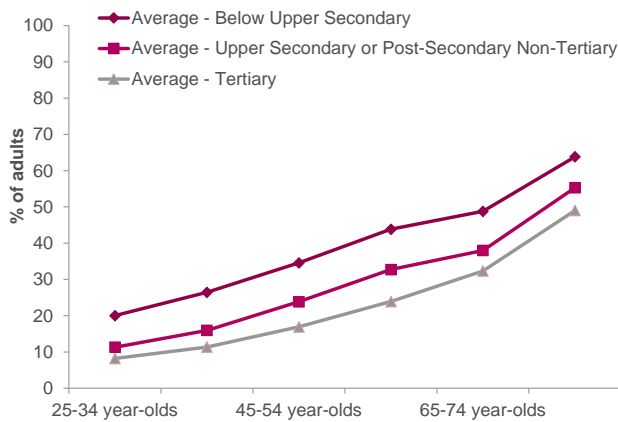
Source: OECD, Citi Research

Figure 71. Trends in Life Satisfaction Based on Educational Attainment
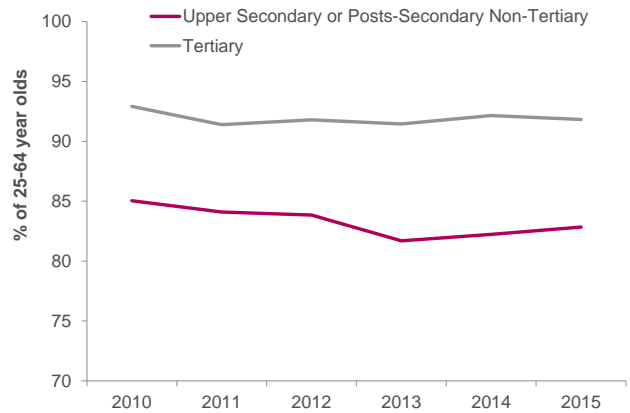
Source: OECD, Citi Research

Turning to what an acceleration of edtech adoption could mean more broadly for society is simultaneously quite simple and quite complicated. It seems to us fairly intuitive that anything that can simultaneously broaden access to education in markets where there are supply constraints while increasing productivity in those markets where there appear to be diminishing returns, will likely improve outcomes for individuals as well as society at large.

But how do we go about quantifying this? Of course it remains an open question as to what effect the acceleration in edtech spending will have on participation in education over time, but suffice it to say that we expect it will be positive.

Even then, we are necessarily left with fairly blunt tools as to gauging its impact. As above, there appears to be a relationship between PISA scores and GDP per capita. We also note a similar positive correlation between GDP per capital and enrollment in higher education. What could this tell us about the potential impact on GDP from a more open and effective educational market?

Figure 72. GDP Per Capita vs. Average PISA Mathematics Score (2018)
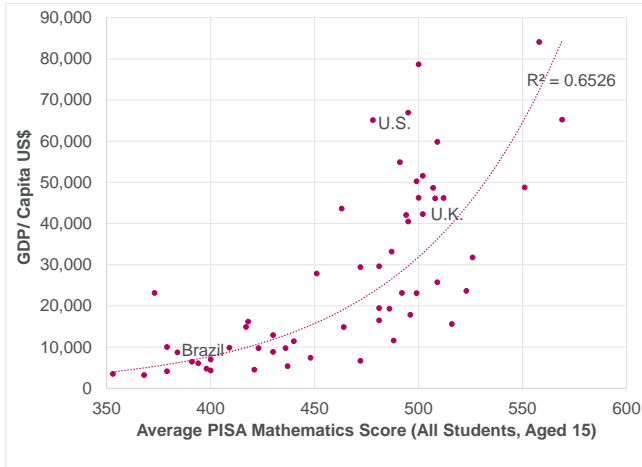
Source: PISA/OECD, World Bank, Citi Research

Figure 73. GDP Per Capita vs. Gross Tertiary Enrollment Rate
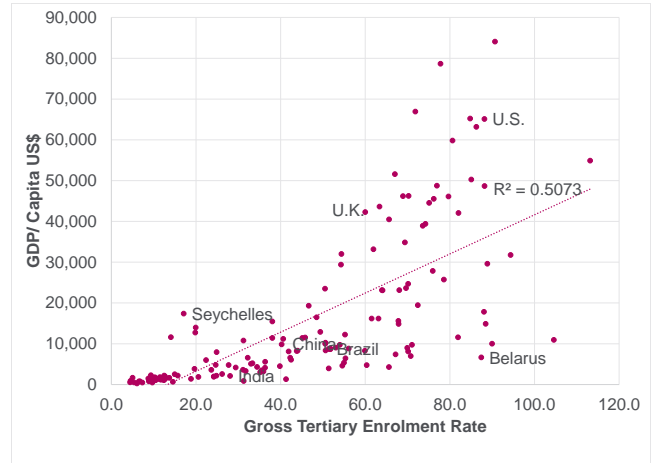
Source: World Bank, Citi Research

Based on the correlations we plot above, we make the following observations about the impact of improvements in educational access (to higher education) or attainment (better PISA scores):

■ We note that there is a fairly good correlation between GDP per capita (based on World Bank data) and the average PISA mathematics score (based on all students as per the last big international comparison in 2018) such that around 65% of the variation in GDP per capita can be explained by the variation in PISA scores (or, conceivably, vice versa as causality should not necessarily be assumed). On this basis, should greater use of technology in the classroom be associated with, say, a 25 point improvement in the average PISA score in maths, this could drive (or would be associated with) a 42% increase in GDP per capita. Some context, however, is required here. Based on PISA data, the average move between the triennial tests has been consistently below 2 points since 2003. Even over the period 2003 to 2018 there have only been seven countries/regions that have seen a cumulative 20+ point improvement — Montenegro, Brazil, Macao (China), Turkey, Poland, Portugal, and Colombia.

■ With respect to higher education enrollment, again the causality is open to debate (indeed we note that one of our expert interviewees in our previous Citi GPS posited higher education enrollment is driven by GDP growth), but 50% of the variance in GDP per capita can be explained by the variance in higher education enrollment and while the relationship shows a clear profile of diminishing returns, at a low level, an improvement in higher education enrollment (say from 20% to 30%) is typically associated with a material movement in GDP per capita (+140%).

Macro/Qualitative: Greater Access to Education to Drive Lower Inequality and Defang the Risk of Automation

In our Women in the Economy series of Citi GPS reports (see Women in the Economy and Women in the Economy II) we talked about how implementing a Women's Economic Empowerment Agenda might make a meaningful difference to economic growth, adding up to 6% to GDP in advanced economies.

Figure 74. U.S.: Female Share of Workforce and Labor Productivity by Sector (2016)
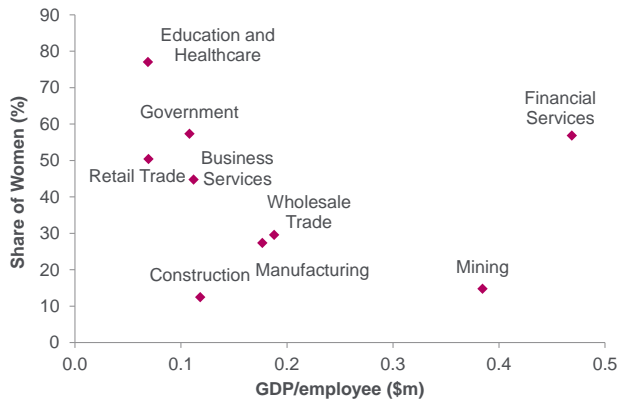
Note: Productivity estimated as value added of each sector divided by number of employees. The share of women is the # of female employees as % of employment.
Source: Bureau of Economic Analysis, Bureau of Labor Statistics, Citi Research

Figure 75. Selected Countries: Labor Force Participation Rate and Female/Male Gap (2016)

$y = 0.8296x - 73.317$
$R^2 = 0.4657$
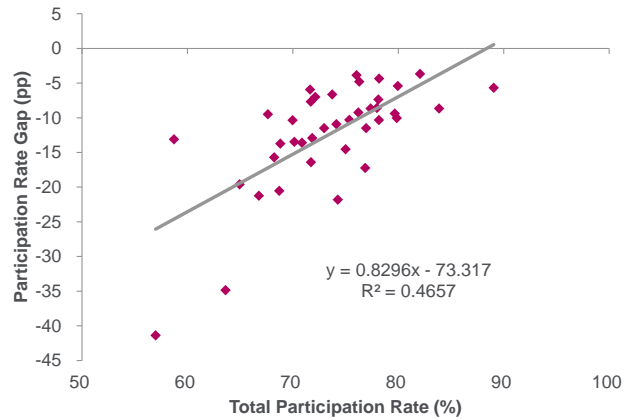
Source: OECD, Citi Research

We have extended this work in our (very) recent follow-on Citi GPS report The Case for Holistic Investment in Girls. Here we make the point that gender inequality often starts in childhood and is rooted in educational inequality. Resolving these educational inequalities could have materially beneficial impacts not only for the girls in question but for the world more broadly.

Figure 76. Some Key Findings From the Literature

Finding	Source
If all girls completed 12 years of education, child early and forced marriage rates would drop by 64% and 59% fewer girls would become pregnant	UNESCO, 2013
Every extra year a girl stays in primary school, her income increases by 10-20%, and an extra of year of secondary school increases her income by 15-25%	UN Women, 2012
Each additional year of schooling is associated with an 18% higher GDP per capita	UNICEF, 2015
One % point increase in female education raises the average level of GDP by 0.37 percentage points	UNICEF/UNESCO EFA, 2011
Limited educational opportunities and barriers to completing 12 years of education cost countries between $15 and $30 trillion in lost lifetime productivity and earnings	Wodon et al., 2018
One extra year of education is associated with a reduction of Gini coefficient by 1.4 %	Patrinos and Psacharopoulos, 2013

Source: Citi Global Insights

In our recent Citi GPS report on racial inequality (see Closing the Racial Inequality Gaps), which looked at the economic cost of Black inequality in the U.S. The report concluded that closing the racial gaps in the U.S. today would drive $5 trillion of additional GDP, adding 0.35% percentage points of U.S. GDP growth per year and 0.09 percentage points to global GDP growth per year.

Figure 77. Racial Gaps Cause Economic Harm
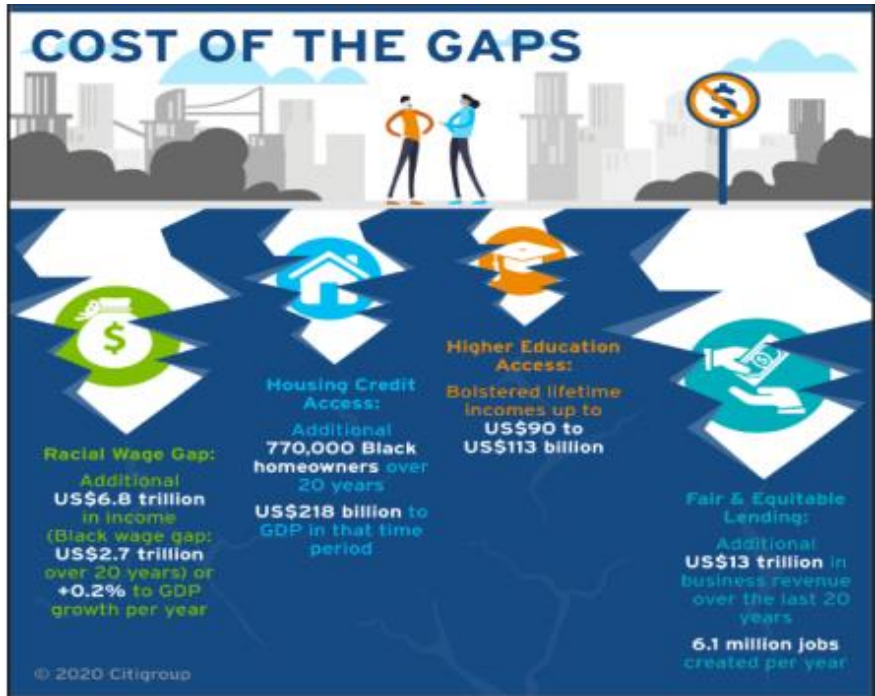
Source: Citi Research

In addition to the drag on economic growth caused by existing inequalities, we also have to think about the potential for drag from future inequalities and in particular the importance of the skill gap we have discussed in depth in our Technology at Work series of reports (see Technology at Work Series).

Figure 78. Jobs at Risk of Automation by Economic Sector
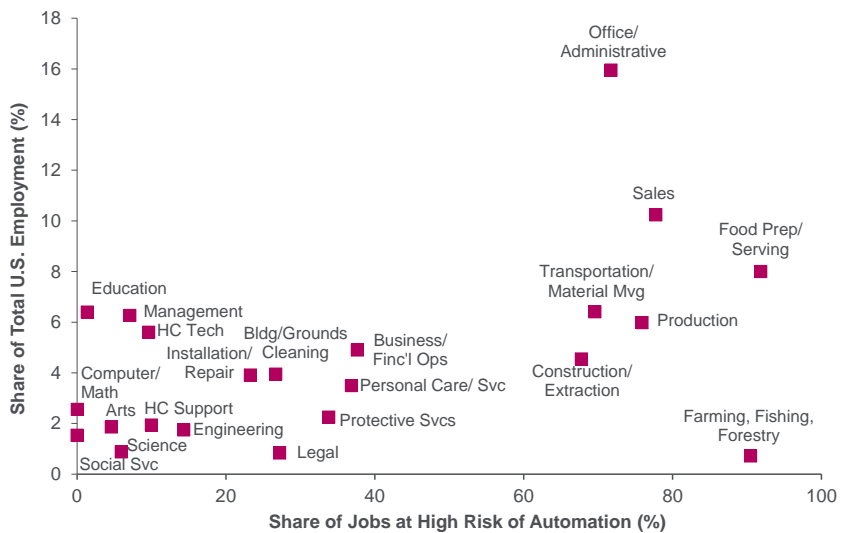
Source: Frey, C.B. & Osborne, M.A. (2017). The future of employment: How susceptible are jobs to computerization? Technological Forecasting and Social Change, 114: 254-2580

Although difficult to precisely quantify, we think increased access to education potentially has a material role to play in addressing each of these challenges:

- In the case of gender inequality, we note again the systemic imbalance in access to education for young girls in some parts of the world. Some will be addressed by greater direct provision from governments but this will not always be the case. We see private capital playing a significant role in provision and technology as an enabler. Even in developed markets, there is a pronounced gender gap in the STEM subjects, which are typically associated with higher lifetime incomes.

- In the case of racial inequality, our economists note easier access to higher education for black students could have driven increased lifetime incomes worth $90-$113 billion. Again, a disparity in STEM subjects by race/ethnicity, which typically pay more than many middle-class jobs, is a factor weighing on racial equality in the U.S. and urgently needs addressing.

- From a Technology at Work perspective, our analysis suggests lower skill/lower education jobs not only tend to be those that are lowest paying and at highest risk of automation but are also those that require physical presence, meaning they are most affected by current COVID-19 related disruption. It goes without saying the provision of better, more relevant vocational education, through primary to tertiary, will better equip future generations with the skills they need to live fulfilling and comfortable lives. However, there is also an onus on governments and companies to provide for the current generation of workers whose livelihoods are at risk. Here, technology has the potential to play a very significant role in broadening access/increasing productivity.

The important role education plays in alleviating broader societal issues is also highlighted by its inclusion in the United Nations Sustainable Development Goals (SDGs). The SDGs consist of 17 goals which aim to address, by 2030, the biggest challenges facing humankind.

Sustainable Development Goal 4 calls for "inclusive and equitable quality education and promote lifelong learning opportunities for all" by 2030. Quality Education is linked inherently to all other SDGs, though specifically mentioned under: Good Health and Well-Being (3.7); Gender Equality (5.6); Decent Work and Economic Growth (8.6); Responsible Consumption and Production (12.8); and, Climate Change Mitigation (13.3). For more information on the UN's targets and indicators for SDG 4 please see our Education Citi GPS report from last year here (link)

What Does All of This Mean? Looking at Implications for Private Capital

Although it is tempting to say that "whatever the problem, more education is the answer" we have to be realistic about the limitations that are upon us. Although generally very supportive, governments around the world don't have unlimited resources to throw at education and, there are competing calls for what resources are available. In the hierarchy of needs, education is important but so is social welfare, R&D, healthcare etc.

With this in mind, we continue to have a positive view on the role that can be played by private capital in this enormous $6 trillion+ market. Private companies, and the investors who support them, can be fleet of foot where states and other non-governmental organizations may be more ponderous.

What is more, we see the post COVID-19 landscape as being particularly fertile as the traditional barriers to adoption — more often than not inertia, whether it be borne of habit or political persuasion — come down and stakeholders at all level of education 'grasp the nettle' with respect to the opportunity presented by online learning and edtech investment.

Figure 79. Universities: What Are Your Top Three Areas of Focus for Online Learning/Education Technology Investment in the Next 3-5 Years? Select Up to 3
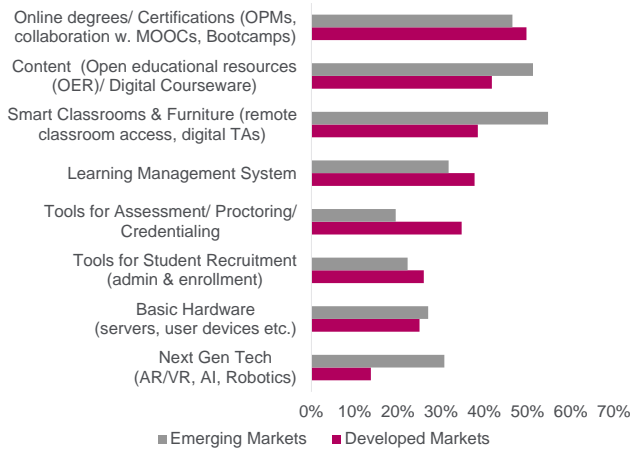
Source: Citi Research

Figure 80. K-12: What Are Your Top Three Areas of Focus for Online Learning/Education Technology Investment in the Next 3-5 Years? Select Up to 3
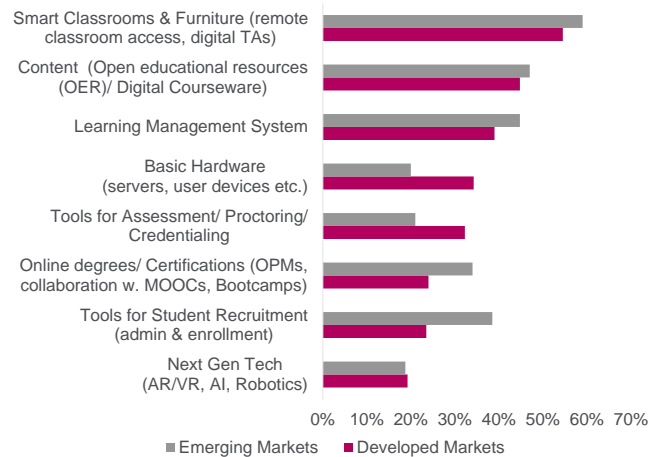
Source: Citi Research

In our previous Citi GPS report on Education we highlighted seven areas of focus for private investors in the education space. These are areas likely to play a major role in alleviating pinch points in the learning process. We do not intend to go in depth into each of these focus areas here again, and indeed the underlying drivers for our bullish thesis continue to persist largely unchanged. Below we briefly highlight the direct implications of our survey for each of these areas.

■ **University Services:** The biggest area of investment for universities, within edtech, is online degrees and certifications. This likely speaks to the need for building resilience/redundancy, additional revenue, productivity, and the opportunity to be able to cater to people who can't or are not interested in pursuing education on campus. All this plays into the theme of University Services, of which Online Program Management is one of the components.

■ **Edtech:** The second and third top areas of investment for universities are content and smart furniture. Multiple factors are motivating for content including the desire to reduce costs through open educational resources (OER) and to improve outcomes through more personalized learning from digital courseware. Smart classrooms and furniture will likely drive improved outcomes and this is also the biggest area of focus for K-12 respondents. Content is a close second for reasons largely similar to those we mention above for universities. The third biggest area of focus for K-12 respondents is Learning Management Systems (LMS). LMS is essentially the backbone which supports digitization of all other aspects of the education process be it delivery and submission of assignments, grading, data mining for personalization etc. While most universities already have some form of LMS in place, this is not the case with K-12. The pandemic has brought to fore the importance of this basic piece of technology.

Basic hardware (e.g., user device) was the fourth most important area of focus for K-12 respondents. Interestingly developed market respondents ranked it higher than emerging market respondents. Rather than implying that emerging market K-12 schools have better hardware, we believe what this signals is developed market schools have faced a more passionate debate about equitable access to online education.

Figure 81. Private K-12 Enrollment Expectations for Next 3-5 Years vs. Previous 3-5 Years
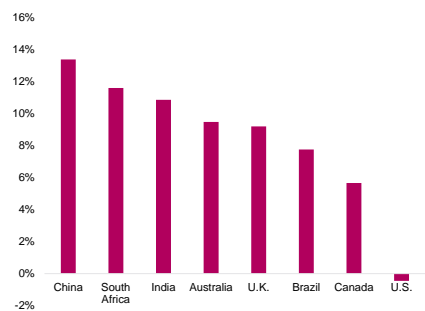
Source: Citi Research

- **Language Learning:** We also included language learning apps within content — top two for universities and K-12 — and in last year's Citi GPS report we had talked about this in the context of demand for language learning in China.

- **Supplemental Services in EMs:** As we noted in a previous section 80% of respondents expect students in their institutions will increase usage of supplemental learning tools. Particularly in Chinese schools, 94% of respondents expect usage of supplemental tools will increase. With the demand-supply mismatch for quality higher education infrastructure likely to persist this will be an incremental positive for after school tutors.

- **Private K-12:** While public K-12 schools dominate most countries, we expect private K-12 schools to benefit from rising affluence, aspirations, and the inability of some governments to provide quality education. Our survey of private K-12 institutions shows long-term enrollment expectations are robust with most emerging market respondents expecting double digit growth.

- **Higher Education Infrastructure in China:** In response to our question on 3-5 year enrollment trends, Chinese universities expect growth to trend at c.7%. We believe this is underpinned by: (1) increasing per-capita private education expenditure; (2) supportive government policies; (3) steady student enrollment growth; and (4) enhanced tuition-charging power.

- **Professional Learning:** While this topic was not featured on our survey, we believe current circumstances (remote working) will accelerate the ongoing trend towards digitization of corporate training.

Views from a Selection of Experts

Daisy Christodoulou: Author & Director of Education, No More Marking

For those readers who don't know you, can you give a little bit of background on yourself – how you came to be focused on education and your career so far?

I started out as a secondary English teacher on the Teach First program, and then worked for Ark, a large group of academy schools in London. I now work for No More Marking, a provider of online Comparative Judgement software that allows schools to assess writing more efficiently. My first book, Seven Myths about Education, is about the science of how we learn, and how a lot of what is recommended as educational 'best practice' is not backed up by the science. Since then I have written two more books, one about assessment and one about education technology

Can we switch gears to talk about 'No More Marking'? Can you talk about what interested you in the business and how the story has evolved since you joined the organization in 2017, taking the opportunity to give a slightly more precise grounding in what No More Marking does and what you think the long-term opportunity is?

At No More Marking, we provide online Comparative Judgement software that lets schools carry out more accurate and efficient assessments of their students' writing. I first came across No More Marking when I was working for Ark Schools as Head of Assessment. One of the big challenges we faced was standardizing assessments across all of our schools. I quickly discovered this wasn't just our problem — everyone involved in assessment struggles with it!

Normally, when it comes to assessment, you have a trade-off. You can set very reliable and accurate assessments, but they end up being full of closed, multiple-choice style questions. If you set more open-ended questions, you end up having to sacrifice quite a bit of accuracy. Comparative Judgement solves this problem. It allows you to set more open questions but still get very reliable results. It is based on the psychological principle that humans are much better at making comparisons than they are at making one-off judgements. If I show you two people and ask you who is taller, you will basically always get that right. If I show you one person and ask you how tall they are, you will not always get that right. So with our assessments, instead of asking a teacher to read one essay and mark it against a rubric, we ask them to look at two essays and say which one they think is better. Our software then combines thousands of these decisions and uses them to create a measurement scale for every essay.

I was fascinated by it as soon as I saw it because it solved such a hard problem in such an elegant and efficient way. One of the frequent criticisms of education technology programs is that they are solutions in search of problems. This was not the case with Comparative Judgement — it is a solution to a very real problem! I started working for No More Marking in 2017 and since then we have expanded and developed the writing assessments we offer to schools, and the support we offer in interpreting and acting on the results. We work with about 1,500 schools in England and a couple of dozen schools in the U.S.

Daisy Christodoulou is the Director of Education at No More Marking, a provider of online Comparative Judgement software for schools. Comparative Judgement is an innovative, reliable and quick way to assess essays.

Before joining No More Marking, Daisy was Head of Assessment at Ark Schools, a group of academy schools in the UK, and before that, a secondary English teacher in London.

She has written three books about education, Seven Myths about Education, Making Good Progress, and Teachers vs Tech.

In 2007 Daisy was the captain of Warwick's winning University Challenge team.

The fundamental problem Comparative Judgement solves is that of making reliable and consistent measurements of complex open-ended tasks. Interestingly, this is not just a problem that is faced by teachers marking essays. Most white-collar performance management systems face similar challenges, and the business literature is full of examples of companies where poorly-designed performance management has caused a lot of trouble!

In your books you have been a big critic of the disconnect between educational practice and learning research — the idea that some educators base their pedagogy on intuition rather than hard data. Obviously this has much broader ramifications for how teaching should work in practice, but where does this leave 'educational technology' broadly defined? Is tech under used in an educational setting or are the benefits overhyped?

Historically, education technology has been like one of those footballers who have lots of potential but never quite deliver. As far back as 1913 Edison was predicting the motion picture would transform schooling, but that and many later predictions just never came true. I think one of the reasons why is that edtech has been particularly prone to some of the misunderstandings about human learning that bedevil education more generally. The positive side of this is that if we can get the basic science right, then there is a huge opportunity for technology.

If technology is best used in conjunction with traditional teaching — its servant rather than its master — what does this mean in practice? If there are particular areas — like assessment — where you see huge value from using technology, does this also mean that there are some areas where technology is likely to be less effective than perhaps people hope?

My argument is that you have to look at what it is a teacher does in close detail, and then think about which particular tasks they do that could be best helped by technology.

There are some tasks, particularly those involving pastoral aspects of teaching, where technology is not going to be very helpful, or where, even if it might be able to help, there may be ethical or other considerations why we wouldn't want to use it.

However, that still leaves some very important areas where technology can help. The area I am most interested in is using data to help teachers make better decisions.

Often, as a teacher, you are making decisions about whether a student has understood something well enough, whether they need more practice, whether they are ready to move on to the next topic. That's an area where technology can really help. There are plenty of online learning platforms which have gathered data from thousands of students and are able to use this to give insights to teachers and students about what to study next.

I think when you personalize learning based on student responses, it can be very valuable. There are plenty of learning platforms which adapt what a student sees next based on the responses they have given previously. I think that kind of personalization is extraordinarily powerful, and something that is always going to be difficult for a human teacher to do.

Where I am more skeptical about personalized learning is when it is based on faddy ideas, such as learning styles. This has been quite a popular idea within edtech — Clayton Christensen was keen on the idea of personalization based on learning styles, as are some of the learning platforms backed by the big tech companies.

Unfortunately there is no evidence that learning styles exist! Of course it is true that people have preferred ways to learn, but there is no evidence that teaching to their preferred style helps them to learn better. It's similar to the way that we all have preferences about what we'd like to eat, but we shouldn't assume that eating based on our preferences will always be the healthiest option.

Obviously when we talk about all of this, there is a temptation to base one's perspectives on what we experience in our own home market and our own background (and in your and my case, the system here in the U.K.), but if we look at the global educational landscape it is far from monolithic. To what extent do you think what is needed in different markets is different and how does this impact the role potentially played by technology in your mind?

In the U.K. and most developed countries, you have universal schooling, and so most edtech is trying to supplement or enhance in-school provision. In countries that don't have universal schooling, some edtech platforms are essentially trying to provide basic schooling. There are certainly ways in which the latter platforms can end up providing quite powerful data and insights for teachers in all countries. For example, Mindspark, an Indian platform, have contributed to some very interesting academic papers about how young children learn maths which I think have relevance for maths teachers everywhere.

Can we talk a bit about COVID-19 and associated disruption? Firstly how has this impacted the trajectory for No More Marking in the short term? Secondly, what do you think the longer term impact will be both for your business and more broadly for the education industry? Has this fundamentally changed the landscape in your estimation or do you think, once the initial disruption subsides, we will return to the status quo ante?

At No More Marking, we've still been running our scheduled assessments. Students can submit work online and teachers can judge it online, and that's been a great advantage in the current situation. More broadly, we have seen teachers and students engaging with all kinds of digital tools that they wouldn't have used previously. We spoke to one deputy head who said that before COVID-19, 15-20% of staff at her school had never logged into their online learning platform. Now everyone at least knows how to access it!

However, what's not yet clear is what long-term impact this will have. I think we have also seen that it is much harder to replace the physical in-person element of education and assessment than it is in other sectors. We've seen working from home explode, but — in the U.K. at least — we haven't seen home schooling explode. I think everyone has become much more aware of the importance of the structure and motivation that physical schools and human teachers provide.

In areas such as online retail and working from home, it seems obvious that COVID-19 has accelerated trends that were already happening. It's made us realize that technology is a lot more powerful than we thought.

I don't think that has been the case with education. Rather, I think COVID-19 has probably exposed some of the weaknesses of edtech, and shown us all the things it cannot yet do. However, that in itself could still end up accelerating its progress in the longer term if it means that we have a clearer idea about where the gaps are and where to direct our energies.

Thinking about the longer term outlook, what are the trends and technologies that you are most excited about on a five year view both for your own business but also the educational landscape more broadly?

I think in the edtech world and in education more generally, there is a greater focus on evidence, research and data than ever before. Fads like learning styles which have dominated the past few decades are being debunked, and many of the new schools and companies that are appearing are based on a much sounder footing. At No More Marking, we are a part of that in a wider sense, as we make it easier for schools to access robust assessments and to see if some of their innovations are having the expected impact.

It's also interesting to see how older ideas are being resurrected and combined with technology to provide new services. For example, the Comparative Judgement algorithm we use was first developed in the 1920s, but it required so many calculations that it wasn't really practical for a teacher to use it. By developing it as a piece of software we've been able to make it a feature of a school's assessment calendar.

Another interesting example is spaced-repetition, which is the idea that in order to learn things, you need to space out your revision over a certain amount of time. People have been experimenting with this idea using index cards in shoeboxes for decades, but now most online learning platforms will use some kind of spaced repetition algorithm to help personalize your revision.

You can take some of these older ideas, plug them into a piece of software, and end up with something that is very useful and user-friendly.

Daniel Cordaro: CEO & Co-Founder, The Contentment Foundation

Dr. Daniel Cordaro is the Founder and CEO of The Contentment Foundation. An Edmund Hillary Fellow and former faculty member at Yale University, Dr. Cordaro led three of the largest cross-cultural studies on human emotion ever conducted in the field of psychology, which are featured in the textbook Understanding Emotions. Dr. Cordaro has spent the last decade of his career studying what it means to live a flourishing life and sharing the findings with schools around the world. His research teams have studied over a dozen cultures across the globe, including making first contact with an isolated community in remote Eastern Bhutan.

Dr. Cordaro earned his Ph.D. in Psychology and M.S. in Organic Chemistry from UC Berkeley, and later spent two years as the Director of Wellbeing at the Yale Center for Emotional Intelligence. While there, he and his team inaugurated a new area of research on contentment by publishing some of the first original research on what it means to cultivate unconditional acceptance of the present moment.

Can you talk a little bit about your background? Can you talk a bit about your experiences prior to founding the Contentment Foundation and how that informed your interest in health and wellness within the education sector?

In 2011, I committed to learning about what it means to live a flourishing life from a psychological perspective, and began diving deeply into a scientific lineage with which I had no formal experience with — but what I would later find out I was training for my entire life. After a series of remarkable and serendipitous events, I was invited by Dr. Paul Ekman, one of the most influential scientists of the past century, to take on the humbling role as his final mentee. After two years of hard work, paying my way by teaching university level chemistry at University of California, Berkeley (UCB) to afford my internship with Paul, he recommended me into UC Berkeley's Psychology Ph.D. program.

I spent the next five years publishing the three largest studies in history on cross-cultural human emotions, decoding the universal language of expression around the world. Throughout my travels, I began to deeply understand the nature of human suffering, and what ancient wisdom traditions around the world had said about what it means to live well. I began to practice the root of these traditions, and I started to become clearer, more grounded, and increasingly more capable of managing life's most intense situations — including the loss of many loved ones due to severe mental and physical illness.

In July 2014, the National Bureau of Economic Research published a paper that changed my entire life. As I read through the data, my entire childhood and unusual career track came into context in a single instant. It was an ambitious study, the first of its kind, and the goal was to quantify the psychological wellbeing of every city and region in the United States of America. This was a massive undertaking, and there were thousands of regions on the research agenda. The cross-university research team scoured the nation for every type of wellbeing data you can imagine. They took into account mental health issues like rates of suicide, depression, stress, and anxiety. They looked at levels of psychological health, happiness, and positivity. They even looked at some behavioral outcomes like rates of drug addiction, violence, and abuse. They even controlled for level of income, so that access to finances wouldn't skew the outcomes. Scanning down the list of cities ranked from most well to least well, the results hit me hard. At the very bottom of the list of hundreds of cities — the region with the least access to mental health resources and highest rates of mental illness — was my hometown in Scranton, Pennsylvania.

At that time, I had just been brought on as one of the youngest faculty members ever hired by Yale University, which came with a lot of responsibility and a healthy dose of impostor syndrome. My international research in sustainable human wellness was beginning to take off, and people would ask me why I was so interested in positive psychology. All research is me-search, and now I had the understanding of how I arrived at this place in my career.

Can we talk about The Contentment Foundation? What is the mission for the organization and how do you go about putting it into practice?

The Contentment Foundation was born from a request that changed the entire course of my career. It turned out that there were a few schools near Yale who had students and teachers struggling with mental health issues — bullying, depression, stress — which have sadly become commonplace in schools today. Since I held the title of Director of Wellbeing and was conducting research on human wellness, they asked if my team could produce a few lessons that could potentially help the schools navigate their mental health concerns.

I rallied my team, who was scouring the past 5,000 years of human wisdom traditions and the past 100 years of psychological research for patterns regarding the practices that reliably lead to indestructible wellness. We wrote up a few lessons and shipped them off, and a few weeks later, we received rave reviews from the educators who used them. They wanted more, and I was happy that our research could be put to good use.

We rallied again, this time raising the funds to bring together 50 of the top educators, writers, child development experts, positive psychologists, designers, and programmers. We asked a radical question: "If we could wipe the slate clean on the status quo of educational transformation and produce a program that actually works, what would we need to build?" A few months later, the first version of the Four Pillars of Wellbeing was born.

For four years, we tested, revised, collected data, and published the outcomes of the transformative power of the Four Pillars to change schools and organizations from the inside out. It was a massive project, but when we formally came out of stealth mode on June 15, 2019, we found ourselves in exactly the right place and the right time on planet earth. Today, The Contentment Foundation offers child and adult-centered wellbeing curricula to schools internationally. Our foundational learning platform, The Four Pillars of Wellbeing, is available as a whole-school transformation for teachers, students, and organizations everywhere

There is no doubt that supporting wellbeing and helping teachers/students develop social-emotional skills is very important, but is this something that is only relevant within developing markets and private schools or is there a broader base of demand for what the Contentment Foundation does?

Each geography we operate in starts from a different place, and even within a country, the resources available to one part of the population over another can vary wildly. Our mission is to significantly improve the mental health and wellness of one billion people within one generation, and that means we have to look at as many parts of a given society as possible.

There is a preconception this work is for the preserve of the rich. A first world problem. The truth is that suffering is universal, and the effects of mental anguish has tremendous costs to governments and nations around the world. Existential threats like climate change, can only be addressed if people understand themselves well enough to be able to empathize with others and start to explore how their actions affect the wider world.

The greatest impact we can have in the world is by supporting the next generation of children. This is why The Contentment Foundation primarily focuses on school community transformations. We work with the entire school ecosystem from the classroom to the home so that there is a seamless transition of our work across all areas of life.

We base everything we do on heavily-studied practices that are agnostic to tradition, value system, or spiritual practice. Science leads the way and allows us to integrate into multiple cultures around the world.

What role does technology play in your offering not only in terms of delivering the content but also ongoing monitoring and assessment?

We have developed elegant technology solutions that allow all people access to all of our resources 24/7. This dramatically drives down the cost of our program, and our work is typically around 10% of the cost of the average school program, and it offers 10x the resources and tools. If a school lacks the resources to use digital technology, we get it for them through our donor networks. We provide data analytics tools to every school we work with, and we collect efficacy data on every adult who uses our program.

We reach individuals through our foundational learning platform, which spreads the Four Pillars of Wellbeing digitally to schools. In this sense, technology plays an important role as it is what equips teachers with the knowledge to disseminate wellbeing in the classrooms. As teachers go through the Four Pillars of Wellbeing on the platform, they unlock new classroom lessons that they can bring to their students. Because most of what is done is digital, it allows us not only to scale the reach of The Contentment Foundation, but also monitor and assess the impact we have through surveys conducted with the teachers. Every onboarded school answers a school-wide survey in which they respond to questions on their personal wellness. We are collecting the largest dataset in history on the wellbeing of children, teachers, and school staff internationally.

Looking beyond the financial outlook, how do you think the COVID-19 crisis will affect attitudes to mental health and wellbeing in the context of schools around the world? Could there be a broader pool of demand for your services beyond K-12? Higher education for example?

COVID-19 is causing disruption to human life on earth that has never been seen before on such a massive scale. While the virus is known for its flu-like symptoms, the pandemic has additionally been detrimental to human mental health, as it has created fear and trauma on a global level. Around 40 million infections have taken place, but at the same time six billion are now suffering from acute daily fear, stress, depression, and constant uncertainty about what tomorrow will bring. Only those who have cultivated practices related to psychological resilience, emotional intelligence, mindfulness, and collective compassion will have the skills required to navigate this unprecedented disruption to human life.

The Contentment Foundation faces a very different problem today than we did five years ago. Now, the international demand for our work has far exceeded our team's capacity to meet that demand, and we are looking to solve our scaling problem through partnerships and initiatives who believe that mental health, wellness, and positive action are critical to the success of the next generation. It is not simply for the global crisis we are facing now, but for those that are on the horizon.

There are many grand challenges humanity is facing right now, and they each cause compounded stress and anxiety for the planet. But the last thing we want is humanity becoming so depressed that they become apathetic. There's a numbing quality that happens when you experience so much bad news constantly, and if we stop caring, finding creative solutions will be impossible. We need skills to move through these challenges and work together as a common humanity to solve them.

In order to change the world, we need to first become the change within. Unfortunately, the scale of problems humanity is facing is so massive, the current generations are unequipped to handle them psychologically. The challenges are seemingly so big, so intimidating, that many have retreated behind their devices waiting for someone else to solve it. The only way forward is within, to help the next generation develop the compassion, self-awareness, and mental resilience required to do what no previous generation has done before.

We hope to serve a generation of citizens and leaders from countries around the world to have tools of personal flourishing even in the face of great adversity.

When you look at the broader educational landscape, what are the trends/technologies you are most excited about and that you think could impact your business into the medium term?

We live in an era when many people are experiencing isolation. I recently met a 13-year-old boy who had a thousand friends on social media. He said: "I'm very popular at my school, but I don't feel like I have any real friends." Now when I was young, I had around 10 really good friends, but I felt a deep connection with them and never felt isolated. Across nearly all metrics of human connection, social media has eroded the rich communities people used to have.

Virtual communities are not the same thing as traditional communities, and we need to figure out how to bring back community and face-to-face interactions into our lives so we don't feel so isolated. The second thing is our relationship with technology. Our iPhones, laptops, the pings and push notifications — we live in one of the most distracted times in history. And when our minds are trained to be constantly distracted by technologies, we find it hard to attune ourselves to our present moment.

Herbert Simon captured this idea perfectly. He shared, "In an information-rich world, the wealth of information means a dearth of something else: a scarcity of whatever it is that information consumes. What information consumes is rather obvious: it consumes the attention of its recipients. Hence a wealth of information creates a poverty of attention and a need to allocate that attention efficiently among the overabundance of information sources that might consume it."

Mindfulness, or being able to hold your attention on a particular thing, is an important component of contentment. The longer you can stay focused on a task, the longer you can stay in optimal flow states. Mindfulness is a very important skill that we're losing because of these technologies. Don't get me wrong — I love technology and all that it's made possible. But we need to look at our relationship with it for the sake of our own mental health.

So rather than explore trends and technologies of the future, I hope this may inspire you to explore your relationship with technology today, and hopefully the discovery of how it can amplify wellbeing - rather than erode it. The most exciting technology is the one built inside all of us, and the future of humanity will depend on the extent to which we decide to activate it.

Ben Nelson: CEO & Founder, Minerva

Can you talk about your background? Can you talk a bit about your experiences prior to founding the Minerva Project and how that informed your interest in the education sector?

Ben Nelson is founder, chairman, and CEO of Minerva which he founded in 2011 with the goal of nurturing critical wisdom for the sake of the world through a systematic and evidence-based approach to learning. Nelson has, since, built Minerva Schools at Keck Graduate Institute into the most selective and effective university in the United States, and has developed a business to share Minerva's unique approach with other like-minded institutions, corporations and governments.

Prior to Minerva, Nelson spent 10 years at Snapfish, where he helped build the company from startup to the world's largest personal publishing service. Serving as CEO from 2005 through 2010, Nelson began his tenure at Snapfish by leading the company's sale to Hewlett Packard for $300 million.

Nelson holds a B.S. in Economics from the University of Pennsylvania's Wharton School, where he created a blueprint for curricular re-form in his first year, the principles from which he drew to frame Minerva.

There are two relevant elements to it. One is what got me into education and one is more about what made me believe I could pull something like Minerva off.

I have always been interested in education. I was interested in it when I was in high school and then when I got to college, I became enchanted with this idea of reforming higher education emanating from a course I took in my first semester, freshman year.

The basic premise was illuminated by what a liberal arts education is, which has nothing to do with poetry and everything to do with being able to educate citizens who have liberty — hence liberal arts. And that means citizens can know how to think and know how to lead a balanced society. Maybe one day they are a shopkeeper and the next day a senator or one day being a farmer and the next day being the judge.

But you can't learn how to pivot like that if you just learn how to be a farmer or just how to be a shopkeeper — you have to be able to learn the broadly applicable transferable skills.

So, I was a little bit dismayed at the fact our entire system of government is dependent on the type of education that doesn't exist and figured this can't last very much longer. And so if we are going to have a free society — and that is just in the United States let alone the rest of the world — you really have to change the way you educate people.

And that passion became very real for me as an undergraduate. I spent my four years trying to fix my university, but failed because there was no real interested party who was willing to look at the long term vs. the short term and I gave up.

So, I went into the business world and a couple of years after graduating I stumbled across a startup called Snapfish which was in stealth mode at the time. And I joined the startup as just an individual contributor. Within a year I became the CFO. Four years after that I became the CEO. It was an amazing ride.

When I took over as CEO of Snapfish we were a relatively small player in the world of online digital photography. We were not by any stretch of the imagination the largest player in our space in the United States and we had just launched a service in the U.K.

By the time I was finished being the CEO five and half years later, we were five times larger than our next closest competitor. We operated in 22 different countries. We were the third largest e-commerce site in the world from a transaction volume perspective and did 42.5 million transactions in 2009. And in addition to our direct business, we powered partners like Walgreens, Costco and Walmart.

And it taught me a number of really, really important lessons:

■ Number one, that being a technology company is way better than being a manufacturer. We had a bunch of competitors who owned physical digital printing plants but we owned nothing. We could go to vendors in other countries and have them fulfil for us more effectively and more efficiently.

■ Two, it showed the benefits of operating globally. In the 22 countries we operated in, we had 21 different companies that were our biggest competitor in the different geographies. So we were international when the rest of the world was very much not.

■ Three, we built all of our technology in house. Anytime we wanted to say "oh we should outsource this, that, or the other" we eventually wound up having to insource it because the stuff that was out there was no good.

■ Fourthly, and perhaps the most important insight, was that if you want to be successful at doing something — especially if you want to be successful in a channel business — you have to be direct. Again this is completely counterintuitive but it is important. Consider enterprise software: if you're a company selling enterprise software but who doesn't have a relationship with the customers using the product and giving you feedback directly, that's when enterprise software can end up being awful.

■ We had an extremely successful direct to consumer site, which is why Walmart and Walgreens and Costco came to us and said "we want what you have". And this was a big "aha" moment for me as well.

Shifting gears, can we talk about Minerva Project but also Minerva Project as distinct from Minerva Schools? Can you give us a bit of background on each and how they are interrelated?

When I was thinking of what I wanted to do with my life after 10 and half years at Snapfish — we had sold the company twice — I felt that it was a good time for me to do something different. And even though I had an amazing decade and a really formative time in my career had been spent at Snapfish, I couldn't imagine spending another decade of my life selling widgets.

It was great, I enjoyed it but I felt that if I was going to be as lucky as I was in the execution of Snapfish in something else, I should do something that made a positive impact in the world and, of course, I was always really passionate about higher education and those two kind of came together.

I was also only 35. And in my family, we work until we die and we normally die at 91 so my thinking was that if I can devote 50 years to an endeavor, what should that endeavor be? Given that fixing higher education was something that takes time, I started constructing a broad plan to do that.

In the world of education, the fulcrum is undergraduate education as it has a unique set of elements.

■ Number one, it is internationally interoperable. You get a degree from an American university and you can go to any country in the world and that degree means something. You can go to graduate school anywhere around the world and you can get a job anywhere in the world.

- Secondly, all of high school is geared towards getting you into an undergraduate education program in almost any culture. There are, of course, various tracks that skew students towards vocational learning, but ultimately undergraduate education is the gold standard and it is what people are reaching for in high school.

- As for graduate programs, they really are subordinate to the undergraduate program in the sense that where you gain your undergraduate degree determines whether you are admitted to a particular graduate program or not.

- Another characteristic of the undergraduate education market is that it is massively hierarchical, in the sense that there is a tiny sliver of ultra-elite universities, which the entire rest of the world looks up to, and tries to copy and emulate, which makes absolutely no sense. It would be akin to a public school in Northeastern Brazil, saying, "Hey, I wonder what Eton is doing? Let me copy that". Not only would they not think of doing that but it doesn't make any sense to do that. Why would you take some overly rich, endowed educational institution that can afford things this institution can't possibly afford and try to emulate it in a context that doesn't make any sense?

What is worse, is the elite universities' reputation is largely based on the perceived quality of the education they deliver, but there is relatively little evidence to substantiate this. Why? Because the practitioners — those people who they hire in order to educate other people — don't get assessed, don't get hired, don't get promoted, don't get rewarded in any way on the quality of their teaching.

In fact, what they do get promoted/hired/respected for — the quality of their research — shows a negative correlation with quality of teaching.

In that insight was a catalyst. We can actually create an institution even more elite than Oxbridge or the Ivy Leagues that can serve as a model for institutions of higher education all over the world. But that model will show it is focused on the efficacy and efficiency of education.

All of a sudden, the rest of the world of education can look up to a different leader and reform along that way, and we can create a cooperation that actually enables transformation for those institutions.

So that was kind of the "aha" moment but I realized to do that requires a little bit of time. It's not a bad adventure to set off on when you're starting in your mid-30s and expecting to work on it for a few decades.

It has been noted that the Minerva undergraduate program is the most exclusive on the planet. To what extent is this a scalable opportunity or is this just a showcase for the online program offering?

The Minerva School at KGI is the ideal substantiation of what Minerva education is all about.

From the pedagogy, the curricular approach, the experiential education, the admissions policy. All these things are based on the premise that if you were to try and create the world's greatest university, what would you do?

Would you say "I am going to take the students and sequester them in a prison on the hills for four years", or are you going to say: "I actually want you to go and live and experience the world"?

Would you say "I'm going to charge you a quarter of a million dollars to read books out loud to you, that you can get online for free"? Or are you actually going to work with students to develop transferable knowledge and skills in a social environment?

Because, even though universities are the gatekeepers of social mobility, currently 50% of elite universities' students are the children of the people already in power, and have all the wealth and access.

We want to create a process which really gets the highest potential students as opposed to the richest in the mix.

- First, what kind of example do you set? You can't just create a really excellent school for rich kids. That's not socially beneficial.

- Second, with the positioning we have, if we delivered anything below our ideal, we would just get destroyed because the knives would be out. And perhaps rightly so.

So we had to create an institution that much more ethical and that much more self-healing and iterative.

We have to get better and better and better every day, every year. Simply because our mission requires us to do that in order to have the kind of influence we want to have.

When we look at the online program offering which you make available to other institutions, what marks Minerva Project out as being different is that you are focused on it being a branded offering rather than white label — what is the thinking behind this? Has this slowed take up of the offering because you are challenging the brands of the institutions you are purporting to serve?

We found that one way in which my experience with Snapfish was very different from our experience at Minerva.

When I look back at Snapfish, we were a very loud and aggressive direct to consumer organization and when Walgreens and Costco and Walmart came to us they said "We want what you have, but the Snapfish brand will be nowhere". We used to insist on having the Snapfish brand recognized in the 'terms and conditions' for intellectual property reasons and even that upset them.

In the world of education, however, we found the exact opposite.

I initially assumed with our strong sense of mission and talking about the Minerva approach to education and wanting to influence the landscape, potential partners would not want our brand. They'd want to do it themselves. The reality is the exact opposite. The universities insisted on demonstrating they have a partnership and relationship with Minerva.

Let me give an example to demonstrate this. I went to school as an undergraduate at the Wharton School, which is a very prominent business school in Pennsylvania, which probably counts as one of the top tier business schools in America alongside Harvard and Stanford.

In nearly every class I took at Wharton, somehow Harvard got paid. Why? Because we were using Harvard Business School case studies. And practically every business school in the world uses them.

Now this makes a lot of money for Harvard but the stranger thing is that Harvard's main competitors buy them with the Harvard brand all over them. In the world of higher education even institutions like Wharton want to be associated with Harvard.

And the same applies to Minerva. We are setting ourselves out as the world's greatest university and have now begun to demonstrate that. We have produced results no other university has, and we do so in a way that is substantially different.

If Harvard had, for example, a unique freshman year and went to other universities and offered their approach but without the brand, no one would buy it. But if they said you can say you are offering the Harvard freshman year, I suspect 90% of universities would raise their hand immediately.

Our approach represents a dramatic shift in curricular/pedagogical form and we've come to realize it is both in the university's interest to say "yes we're offering a Minerva program" but also in our interest to ensure that when the consumer, that when students and employers come across a student that is educated in this way, that they know to differentiate because it means something.

Maybe Minerva is not a household name like Harvard yet, but in the world of innovation in education, and based on the success we have had with Minerva School, the 'Minerva Inside' offering has become very powerful. It means something and it is an important differentiator.

You recently announced the creation of the Minerva Baccalaureate High School Program. What is the background to this and how does it fit into the broader Minerva mission?

Our plan has always been to transform education basically from high school all the way through to executive education. Our assumption is it will take a decade before we get there but we're actually dramatically ahead of where we thought we would be when we started a decade ago.

High school is an example of that. Everything we do, in fact our whole mission, is around nurturing critical wisdom for the sake of the world. The concept of education from the transmission of knowledge to the nurturing of wisdom. It is patently obvious as to why transmission of knowledge should be a human right: it is free and it doesn't require a lot of human intervention, especially in the world of AI.

You know I could argue already that teaching maths in a social environment is kind of crazy: it could be computer to human right, etc. But how to think through the components of mathematical quantitative thinking isn't an exact world. There are different pathways, there are different ways of thinking through solutions and optimizations of problems.

And that social learning is very important and it requires a setting led by an expert in the subject who can focus on a student's intellectual growth. And as screwed up as our higher education system is, that kind of mentality – a very subject matter based approach – influences what high schools do.

Despite the fact there are many high school models out there, there are only three dominant pre-collegiate English language based programs in the world: the Cambridge A-levels; the Advanced Placement regime in the United States; and the International Baccalaureate.

The youngest of the three models is 52 years old and all of them teach to a test in a subject matter. In short, the high school preparatory world doesn't prepare students for an integrative, wisdom-grounded education, which is obvious because that's not what universities have been asking for the last 50 years.

Our realization is that many amazing students come from all over the world to Minerva not really prepared for what we do. And we identified a number of bridge courses that have helped, but what we eventually realized is we couldn't address this piecemeal. Our analysis was not so much that we needed to fix the institution or the individual high school, it was the curricular regime — the A-level, the AP and the IB — that needed to be fixed.

This is where the Minerva Baccalaureate comes from.

It brings systematic thinking/wisdom-centered education not exactly in the same form as what we do at the undergraduate level but actually as a precursor to it. It's a three year intensive program and if you do it on an accelerated basis — in the American model between grades 9 to 11 and in the U.K. model from years 10 to 12 — you can actually do the first year of our undergraduate program in your last year of high school.

So, it can be done as a three-year program, as a simple pre-collegiate Minerva program, or it can be done as a four year program with the easier Minerva baccalaureate attached to a year of college-level study getting you prepared for advanced studies once you get to the university.

As a digital first company, I suspect your organization was always going to benefit from the broader adoption of technology in an educational context but can you talk a bit about how the COVID-19 crisis and associated lockdowns has changed the outlook for the business and the nature of the conversations you are having both with students and potential university partners?

COVID-19 has been a fascinating, multi-directional pull. It's undeniable that on a net/net it has been an accelerant to what we're doing. We would not have designed and launched a high school program this year if it were not for COVID-19. That much is crystal clear.

At the same time, when you look at university education and if you look at high school, we don't enter into relationships with institutions just because of COVID-19. When somebody comes to us and says we want "technology" because "we want to bring what we do offline, online", we tell them "go use a video conference".

It turns out there is no filter in a video conference that makes a university lecturer terrible. The reason an online class is so terrible is not because of the technologies, it is because of the class. They always have been awful. We all remember they were awful. The reason we think fondly about the two or three professors we had as undergraduates that were really great, is because the 30 or so others we had were terrible.

When you walk through the cobbled streets of Oxford and you see beautiful buildings and go the pub and you see friends, you tend to gloss over the drudgery of class. But when your entire university experience is just the bad parts, you are not going to be very happy but you can't blame the technology.

A lot of universities are giving the wrong message: they're somehow thinking "Oh well, you know, once we get back, everything will be good again". This is possibly overly optimistic.

The other part is a lot of universities think of technology as a very small cost item. Video conferences are practically free. But this is a mirage. We have engaged with a number of elite institutions who have come to us. And one has said they desperately need Minerva and we explained what this would mean: we've got to train your professors, we got to redo the curriculum, and we've got to provide you a very rich technology environment.

But it costs a lot of money from a technology perspective as well as a lot of human capital. You've got to pay for the platform and the people to make it work. And some universities get this but not all.

We have had cases where the academics were clamoring to work with Minerva but where the conversations were held with their IT department and we have to communicate this is not an IT implementation, this is a curricular transformation.

It turns out that in an environment which is extremely wealthy and charges an enormous amount of money for tuition, the amount of money is allocated for in-school technology is somewhere around a tenth of 1% of the tuition charge. We say to institutions that they need to spend about 2% of the tuition charge in order to create a dramatically better education than you do offline.

The problem is when you go to the IT department and you say 2% of tuition, they think you are out of your mind. So, in some regards, this has been a big accelerant but in other regards there a number of universities drawing the wrong lessons.

They are not thinking about fixing education and are viewing COVID-19 purely through the lens of business continuity. They think everything they used to do is so great, and the fact students are grumbling and complaining is a demonstration the extant was wonderful, and the online delivery is awful. What they don't understand is the awful part is the education. It is a distillation. All the other trappings of going to college are fun, but the education component of the service needs to be fixed.

That's the challenge we have to work through over the coming years.

In short, COVID-19 has meant the scales have fallen from a lot of people's eyes but the interesting thing is it has done this for students and their parents, but not for many university administrators and professors.

The same thing is true in high school. A lot of parents are now seeing what they are paying for in private schools as they watch their kids on a video conference-based classes and are horrified.

COVID-19 has been eye-opening for a lot of the population but some universities don't appear to have realized this and they could be in for a very rude awakening. A 10 or 15% shift in consumer behavior against the backdrop of a high fixed-cost base could be devastating for a university.

This all said, some enlightened university administrators are starting to see or listen or hear, which is encouraging.

When you look at the broader educational landscape, and in particular the higher education landscape, what are the trends/technologies you are most excited about and would recommend investors and other stakeholders keep an eye on in the coming years?

In the world of education, people always think about education technology as being very different from the traditional technology sector. In some respects — the time, the market, the slow moving nature of the customer base — it is true, but the sector is gigantic. It is a $2.4 trillion industry.

You should see the number of companies basing their entire business plans on digital photography. Sure the education market is slower to adopt and it will take more time to evolve, but if over time we could get the same sort of scale as we did with Snapfish, we would be looking at the largest company in the world.

Clearly this is not realistic near term, but what it underlines for me is the importance of having a truly proprietary business model. And this comes back to the debate about B2B vs. B2C.

B2B offerings, like a LMS, have the benefit of being embedded and you have a predictable business model but ultimately the service itself is not proprietary. On the other hand, if you can create a branded product like Harvard Business Case Studies, it has a totally different profile in terms of pricing power and margins and you can exploit this for decades.

Now, imagine if you combine those two things. Imagine if you had the Harvard Business Case Study brand equity, combined with a technology, and a pedagogical approach, which is actually dramatically better.

Now, in a gigantic market — $2 trillion+ for higher education — if you have something that is high quality, branded, and non-commoditizable, then you have something that's pretty exciting.

And in the landscape of education it is pretty rare but it does exist. There are a few of these businesses out there but they are few and far between and sometimes they can disappear as fast as they come.

One example for me was bootcamps which is an area that grew really fast but fell short in just one way. They sort of got it half right. They were branded but the product itself — coding in three months — is somewhat commoditizable.

One area I am interested in is whether this experience could be made more compelling. Imagine if you could create a totally different approach to teaching coding which is not done anywhere else and is underpinned by research and offers a fresh approach to pedagogy and technology. This could be very compelling and differentiated.

I think you have to get a look for those types of gems. I'm very bullish about those types of approaches to education.

I am somewhat bearish about simply offering a commodity service even if it is a big market opportunity longer term. I think that world gets squeezed. It's a challenging market to generate great margins unless you've got a highly differentiated and highly branded offering and this is what I am focused on.

Mark Pemberton: Co-Founder & Co-CEO, Studycat

Mark is responsible for sales, marketing and partnerships at Studycat. He drives strategy from Studycat's HQ in Tainan, Taiwan managing the global team. Mark develops Studycat's international strategic partnerships and networks. He is a frequent speaker and edtech conferences around the world. Mark is recognized as a pioneer and thought leader in game-based language learning.

Mark's twenty-year teaching career began in Taiwan in 1994 at the Sesame Street Group. In 1999 Mark Co-Founded Studycat with a vision to create fun and effective game-based digital learning solutions.

This led to the creation of online virtual worlds and eventually the creation of the award-winning direct to consumer apps series - Fun English, Fun Spanish, and Fun Chinese. This successful series has led Studycat to connect and engage 12m families in over 100 countries.

Mark led development of 'Studycat for Schools' a Cambridge aligned English Language Teaching system built for Private Language Schools which was a semi-finalist at the GSV/ASU Elite Cup

Mark graduated from Warwick University in Philosophy & Politics in 1993. Mark's passion for education began as a teacher at the age of 23 and he has dedicated his life to education, specifically game-based language learning ever since.

Can you talk about your background? Can you talk a bit about your experiences prior to founding Studycat and how that informed your interest in the education sector?

I grew up in the south of England and after graduating in Philosophy, I traveled extensively in Europe and Asia, eventually settling in Taiwan. Back in the early nineties in Taiwan you had to speak the language to have any quality of life so I enrolled at a university to learn Mandarin. To pay for my studies I got a job at an English language school. It was a major international franchise so I was fortunate to go through extensive teacher training, which was quite rare back then.

Teaching kids in a fully immersive English environment was a real challenge. I found the way to succeed was to really gamify the environment and make it genuinely fun for the kids. I have always loved games so this came naturally to me and I got great results. Seeing an opportunity, I decided to set up my own franchise.

Two things led me to found Studycat in 1999; (1) the size of the opportunity and addressable market that would eventually turn to digital solutions; and (2) the lack of product market fit. Curriculums that were being used for kids to learn English were not fit for purpose.

Tell us about Studycat — when and where was the group founded and what, in your view, makes it stand out in the markets you serve?

We started out as a bricks and mortar language school and our unique selling proposition was fun, creative education that engages kids and connects homes and schools. We encouraged parents to come to classes and provided them with daily practice for the kids to do at home. We gave parents cassette tapes and creative worksheets. Early edtech!

We developed our own curriculum, built around an imaginary cartoon world full of color and stories. By 2002, we were using simple vocabulary games on computers in the classroom and on CD-ROMs for homes. It was incredible to see how engaged the kids were with anything computer based, however simple. We had the perfect test-bed and were delivering education online by 2004.

One of the things that makes our products stand out is the engagement factor. We know our curriculum and content work because we saw the results when we were teachers. If you can motivate children to want to learn, you can give them a solid foundation for success. Language learning is often about time on task, and if kids engage in it 10-15 minutes a day and have a positive learning experience, then they are building proper foundations for language acquisition. I have always believed in positive education through play.

Alongside the engagement factor, we knew that we needed an evidenced-based approach to developing learning solutions. We applied what we'd learned as teachers to the content of our solutions, using pedagogical tactics to make the information as 'sticky' as possible, from scaffolding information to spaced repetition. Content was aligned to the Cambridge early learners' curriculum to make sure that gameplay could result in genuine knowledge. These small teaching hacks make the difference between an app that's good for kids to play and an app that actually helps them learn a new language while they have fun.

I find it humbling that we've had over 12 million downloads, and that our students span over 100 countries. Our consumer business has been organic to date and our switch to subscription monetization in 2019 has been a successful one.

What is interesting about Studycat is that you seem to straddle both B2C and enterprise markets in that you sell both directly to consumers but also into schools. What is the thinking behind this and what challenges/opportunities does this bring?

We do indeed have twin engines, as we like to say. It was an easy decision for us as we ran schools ourselves and we recognize the increasing need for digital solutions in language schools around the world. We also knew the major publishers were challenged in this area, whereas for Studycat it was in our DNA.

Another factor in the decision to develop a school solution was we were getting a lot of requests from teachers who were using our consumer apps; approximately 10% of our 12 million downloads were teachers. It confirmed that the demand for an enterprise solution with classroom management and reporting features was significant.

This takes us back to our earlier experience of connecting homes and schools. Our brand is connected learning, which means connecting the school to the home so that language acquisition is accelerated. Building Studycat for Schools took us around two years and a lot of investment, but this year it really started to gain traction, with major contracts in Japan, Vietnam, Korea, Greece, Turkey, and Russia. I like to say it's a school in your pocket because the entire system is mobile based. It has powerful Interactive Whiteboard Solutions for all major platforms including Microsoft, Apple and Android, but the system is also designed to be cast to a big screen from a mobile phone.

Once the teacher has bound a class through an invitation tree or QR codes, the connected learning data flow is established and the learning and reporting outcomes become seamless.

In terms of cross-pollination and how various markets respond to our consumer versus school solutions, it is probably too early to say. We have, however, managed to disrupt the traditional publisher/distributor mindset that books were of value and the tech was a freebie. We have been able to lean on our premium consumer model to say parents are prepared to pay and they expect quality solutions. Language schools increasingly need to adopt technology to stay relevant as these markets converge.

The last benefit to mention is perhaps one of the most important; data. Having solutions for both the consumer and enterprise market gives us access to huge amounts of data and the duality helps us see the power in connections between home and school. Having data from so many children and schools across the world means we can discover even more about how children learn, enabling us to transcribe the best of a great classroom experience into an app. This sort of insight is like gold dust from a business point of view and we've been able to use it to make the app and the classroom solution even smarter. We spoke to a father in Finland recently and were delighted when he said that to call them apps was a bit of an understatement; he described them as a holistic learning solution. That sort of feedback lets us know we're on the right path.

Another benefit of having both consumer and institutional products is you get different insight from each sector that can inform development across the board. The consumer market demands very high engagement and very slick onboarding, for example. This is less important in the institutional sector, and the focus tends to be on how the curriculum is aligned and scaffolded. You take best practices from both sectors and end up with really strong product offerings.

One of the benefits of being a technology company is the business in theory should be fairly scalable. How easy has it been to move into contiguous markets geographically? And is there an opportunity to expand the business by adding in new subjects/languages or targeting new potential learners (e.g., older children or even young adults)?

I remember a consultant looked at our business model and said "Wow, scalable on a dime!" It is true to an extent, but achieving that scalability when you are bootstrapped isn't actually that easy. We relied on app store discovery for many years. Apple and Google allowing companies like us to move to subscription models was a game-changer. Localization into 35 languages done properly is the key to global consumer success. For our institutional sales we rely on a blended approach: direct to schools and through distributors, dependent on the territory and the complexity of sales and regulation in that territory.

Another big advance for us was to create a fully transactional website (studycat.com) which allows us to both sell direct to consumers and, more importantly, enables us to affiliate with large parenting networks.

We currently have language learning solutions in the consumer space for English, Spanish, Chinese, French, and German. Studycat for Schools is an English course aligned to internationally recognized assessment standards. In terms of what we might develop next, we are considering Chinese or Spanish for Schools, but for now we have such a large addressable market that we need to focus on scaling what we have.

Continuing on the theme of 'direct to consumer' education companies, what is striking is that as a general rule there appear to be many more successful B2C education companies in Asia Pac than in the rest of the world. Is there something specific about the Asian markets that make them more fertile for B2C development in your view or should we see global education B2C players begin to emerge?

It is an interesting question. Living here for so long has given us insight into the Asian markets and it's clear that the drive Asian parents have for their children fuels the B2C market in certain countries. China is a complex market, in part due to the regulatory environment, but its speed of mobile adoption and digital payments is remarkable. Japan and Korea are excellent markets for Studycat and we hope to develop these further through strategic partnerships.

Europe is a fragmented market and the language localization and optimization means a lot of heavy lifting, but markets like Finland, Norway, Italy, and Spain perform well. One interesting data point for us was we lost traction in the German market when we moved to a subscription model. It's interesting how different monetization models can impact conversion in markets.

The U.S. market has huge potential for us; it's so large and subscription friendly that we see a lot of upside for our B2C services, particularly with our Fun Spanish and Fun French products.

In Latin America, markets like Brazil and Columbia are also adopting quickly, but you have to localize micropayment solutions through telcos and that can be complex. As a small company we need to be focused as well as opportunistic.

How has the COVID-19 crisis impacted Studycat in terms of user behavior/engagement and therefore business trends? And how much of this behavior change do you think will stick?

Like most edtech companies our boat has risen with the tide. We saw our consumer business grow significantly as parents looked for home learning solutions. I think the biggest impact was on the private language schools as they realized that having nothing digital was no longer a sustainable position. I believe this behavior change will stick. I don't know how, as a board or a management team of a private language school, you can look parents in the eyes and say that 'old school' is fine. It wasn't fine before COVID-19 and, if you want any form of learner continuity, it certainly isn't fine for the next 12-18 months.

Studycat for Schools in its first commercial launch year has landed major global contracts. To be honest, without COVID-19 I don't think all of those adoptions would have happened in such a short timeframe. Digital solutions went from a 'nice to have' to 'a must have'.

Ideally, the teachers and school administrators will see what great tools are available and embrace edtech rather than fear it or see it as a threat. It never was and never will be. When good edtech is used well, it is an enabler of many things that we need now more than ever. With equitable access, edtech can be a leveler, it can allow effective communication between homes and schools, and it can give teachers and schools insight, through data, into the strength of their provision. Most importantly though, it helps children learn on the devices they love. Younger generations have grown up in a world dominated by tech. If schools don't leverage this inherent interest to improve learner outcomes, it doesn't just mean they're missing a trick, it means they're becoming anachronistic.

When you look at the broader educational landscape, and in particular the edtech landscape, what are the trends/technologies you are most excited about and would recommend investors and other stakeholders keep an eye on in the coming years?

I think the theme of convergence will continue. Learning beyond the classroom walls will continue because schools will likely be slower to change than parents. My own kids learn languages and they learn coding, but I am not satisfied with how these are taught in their schools so we supplement with home-based solutions. I know I'm not alone in this, so schools really need to start looking at how they will stay relevant and not become a step back in time for our kids. Kids learn faster than we currently teach, in my opinion.

For me the greatest potential of edtech is adaptive learning. Personalized learning paths powered by machine learning that can really accelerate knowledge gain in a positive way. Studycat for Schools has some very simple, elegant machine learning to help kids practice trouble words and this, along with voice recognition and voice activated game play, is where we are going to innovate next.

This notion of one shoe fits all is just not true. I see this with my own two children. One hates to read and learns everything through listening and speaking and another is a bookworm and absorbs everything through reading. Although learning styles have been roundly debunked, it is true that no two kids learn in the same way. It is the job of educators to unlock the learner's potential rather than having some antiquated prejudice about how children should learn. The quicker educators drop this mindset the better.

We will see a proliferation of virtual and experiential learning through augmented reality (AR) and virtual reality (VR) and that is really exciting. Giving children the actual experience of walking around Ancient Rome or sailing down the Nile will be far more engaging than reading about them in a textbook. Contextual learning will accelerate education, simply because it brings it to life.

We've got to be honest: the classroom with 30 students and a teacher talking at the front isn't the best we can do for our kids, and the quicker that changes the better. It really does waste the children's time and talent. Bring on more innovation in edtech. Funding this innovation is a priority because it is the private sector that will drive this change and innovation, and we really need it!

Dan Sandhu: CEO, Sparx

Dan has been in Education/Edtech for over 10 years as Founder, Investor, and Executive. He has set up, invested, and supported education teams in the U.K., Canada, India, Australia, Latvia, Romania, and the U.S. Prior to this, Dan built a number of Tech and Services businesses in the U.K. and internationally. Dan is currently on the Leadership Council for the Centre of Universal Education at the Brookings Institution (Washington) and on the Executive Council of BESA (U.K. education lobbying and trade body).

Can you talk about your background? Can you talk a bit about your experiences prior to founding Sparx and how that informed your interest in the education sector?

I've been in education and edtech for over 10 years now. I started as an investor but I have been a founder, an executive, a Chairman, and a non executive. I've been really, really fortunate that I've been involved in setting up, investing, and supporting education teams in the U.K., Canada, India, Australia, Latvia, Romania and the United States.

As a result of this, it has given me a great exposure, not only in the sub-sector which I am in now — which is secondary education – but everything from early learning through to higher education/university and lifelong learning, as well as sectors which are adjacent to curriculum education such as assessment and vocational education.

So, this includes some quite significant companies out in Asia, where there's millions of users involved, and it includes a school feedback business in Latvia. I was involved in a higher education business in Toronto, and an assessment company in the U.K.

Prior to that, I was involved in a number of tech and service businesses. I was involved in setting up a technology services business in the U.K. and out in India. I recruited about 2,500 people in India and a similar number in the U.K., and that was acquired by part of United Utilities, a FTSE 100 company. I also ran software businesses for large private equity funds and set up businesses backed by a venture capital or private equity in the vocational education space.

What that does is give you exposure from both sides of the world: both the 'impact' side and the 'commercial' side of education technology. And it is a really difficult mix — and I am going to emphasize this — it is important to understand that education needs to be both: it needs to be commercially supported, but needs to make an impact. And, and a lot of companies, businesses, individuals, sit in either camp because it's really difficult to get your head round that.

You can't just build a business which is impact only because you will not survive commercially. At the same time, you can't build an education business which is commercial only as you will not be making impact. And because you are not making an impact, your learners will not continue with you. And therefore, you will not be commercial. It's a vicious circle. In education you have to build a business which is commercially viable and impactful and to be commercially viable you have to be impactful.

I've been really fortunate that I've currently been on the Leadership Council for the Centre of University Education at the Brookings Institution in Washington, which allows me to contribute towards the global debate around Education Development and the policy framework the Brookings Institution puts out on how to drive educational improvements and foster educational debate. I'm also the Executive Council of BESA (British Educational Suppliers Association), which is the U.K. education lobbying and trade body.

So that set me up really well for Sparx where I can use all that experience and learning both in the U.K. and internationally, and really put my heart and soul into that.

Let's talk about Sparx: can you talk about the genesis of the group and its background in school-level maths?

Sparx started off, and was set up by the founder, with a view to making a really tangible difference to how mathematics was taught both from the perspective of the learner, i.e., the student, as well as from the teacher.

How can we make Maths easier to teach and easier to learn?

It sounds like a simple problem to solve but we spent a lot of time undertaking research not only on solving the problem but also building an evidence base, to make sure there's evidence to support, everything we do.

Sparx was started in 2010 and we spent the first six years in heavy research, working with schools day in, day out. As a result, we developed a number of products within the Sparx family.

The essence of this was that we put the learner at the heart of everything and we repeatedly ask ourselves: "Does this make a difference? Are the learners learning?" Because if we were just a 'product' where there was no assessment of the outcome, we wouldn't survive.

So we actively undertake research. We use external research partners to make sure we can provide independent evidence of efficacy. We need to avoid smoke and mirrors and we are very transparent. All of our case studies are on our website.

At the moment we are focusing primarily on maths for the secondary school market. So we have school products, which are currently in over 1,700 schools and help over 1.4 million learners across the U.K. We're in 20 countries globally as well at the moment but it is early days in terms of international footprint with schools or school groups. We've recently launched Numerise, which is a direct to consumer offering supporting independent learning.

In terms of some of the backdrop to Sparx, we are backed by Oxygen House, an impact-led family office. We've been really fortunate that to have pulled together a world class advisory panel, which includes: Rebecca Winthrop from the Brookings Institution; Tim Oates, who's worked very closely with the U.K. Department of Education as a senior advisor; Joe Ludlow (ex Nesta Investment Director); and Julian Huppert, ex Google DeepMind advisor .

One of the things you wanted to talk about was understanding where the genesis was of the group. The mission for us has never deviated and is obviously at the heart of everything we do.

Our mission is around making sure we can use our research-led technology to make a tangible impact on the outcome of learners and to motivate learners and empower teachers. If we succeed we will improve the life opportunities of over 5 million learners in the coming years.

Can you also give us a sense of what the HegartyMaths combination in 2019 meant not only for the group but also teachers and students as customers?

So I took over the role of CEO in early 2018 and we went operationally and commercially live in 2018, but as we were growing it was very clear that we wanted to accelerate our rate of growth via consolidation.

There are some great operators in the market and one of those operators was HegartyMaths, led by Colin Hegarty. I am a great fan of Colin. He is a great young entrepreneur and he has built a great footprint of schools.

What we wanted to do was make sure we could scale our business and find like-minded individuals and companies to be part of the family. With this in mind, we acquired Hegarty in late 2019. And together, the power for me laid primarily in the team: the Hegarty team had a totally aligned vision to us, they are very impact-centric, their mission was all about making a difference.

What that's done is that it has accelerated the rate at which we've grown, it's given us a significant footprint and Colin's recently joined our board as U.K. Schools Director. And what it gives us in the U.K. schools market, in particular, is a leader who understands the market, has built a business in that market, and will allow us to evolve Hegarty and Sparx to grow together to make a substantial difference in the schools market.

One thing that is striking about the Sparx model is that, until recently at least, it has been an enterprise model in the sense that you have focused on selling the platform in to schools. Can you talk about why you focused on this approach to begin with?

I think it's really important. There are two ways to look at this: one is impact, the other is from the commercial side and the business side.

From an impact perspective, it is important to remember that the level of numeracy skills are so low in the U.K. it's almost (possibly the wrong word to use these days) of epidemic proportions.

Four in five adults possess what is viewed as a low level of numeracy. This has a significant impact. That poor proficiency in numeracy has a direct impact on social mobility, on employability, and on productivity. There's a report that has quantified the cost of this in terms of productivity for the UK at about £20 billion a year.

You take that on one side and then you look at teacher workload and teacher workload. On average in the U.K., any given teacher is spending 16 hours at least per week at home just catching up on the workload. 80% of teachers are considering leaving the profession. 63% of school leaders say teacher recruitment and retention challenges have an absolute negative impact on their ability to deliver curriculum.

So those are the kind of statistics driving the Sparx team. These are the reasons why we want to make sure we are in schools to make sure we could use our understanding of teaching and learning maths, combined with technology, to make a difference.

Now if you look at that from a commercial perspective, it would have been very difficult for us to have gone into the consumer/B2Cc market without having a real solid base.

We're at 1,700+ schools in the U.K. That is coming up to nearly half of all secondary schools. That gives us the confidence to say that we have exceptional content, we have an exceptional pedagogical model.

Now we are now going into the consumer market but it was really important to make sure we got the schools piece right both because we then know it's impactful and also because we wanted to address the challenges in the teachers' workflows.

Figure 82. Economic Impact of Education
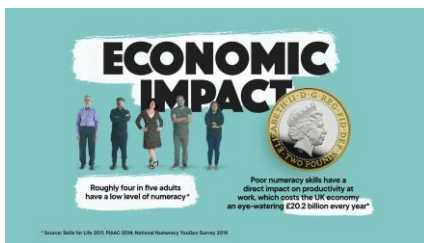
Source: Sparx

Figure 83. Teacher Overload Pt 1

Source: Sparx

Figure 84. Teacher Overload Pt 2

Source: Sparx

And if we look at the international move that we're doing right now, that's actually being driven by school groups as well rather than going to the consumer marketplace.

What role does data play in building up comfort and confidence in the pedagogical approach both for enterprise and the consumer offerings?

We have a lot of data points we've gathered over the years, both while we were in research mode and during active learning. And as we scale, everything is based on data.

We like to make decisions based on data. It's important because you've got to have evidence, you've got to be able to demonstrate efficacy. You cannot use smoke and mirrors. You cannot work on assumptions or anecdotes, it doesn't work.

There's no point saying "x y and z celebrity uses my platform, therefore it's wonderful". Really, you've got to be able to say "schools use our platform and this is the impact it is having" and to do that you have to gather data.

This is children's education you're dealing with. You can't stick AI on an investor presentation and raise money, with no AI. There's a moral imperative to make sure decisions are made on the basis of data and that's very cleansing; it makes a difference.

Earlier this year I founded something called the Edtech Evidence Group, which is supported by a group of core edtech companies. Although it has been somewhat sidetracked by COVID-19, the aim is to provide a platform for edtech groups to publish their efficacy data to give schools comfort — a kitemark almost — that they are dealing with efficacy based edtech companies. This is critical in building a solid platform of trust for the industry to grow off.

Can you talk a little bit about your aspiration in B2C – what have been the barriers to creating a direct to consumer offering in the past and are these beginning to change?

A consumer product is something we've always wanted to create and it's been in development for a while. We were very wary of going ahead with that market too soon, before we got our credentials and credibility right in the B2B space.

What happened is that COVID-19 made us realize we need to expedite this. What was initially scheduled for late 2020 was moved forward by a few quarters to April 2020, because we knew parents were at home, and there was a point during this epidemic, where over 1.6 billion students/children were schooling at home. That gave us the impetus to say that "we need to support these students and parents".

We launched the beta version of this in May and the full product was launched in September. Even during the beta version we had tens of thousands of students using the platform and over 3.5 million questions answered by learners from 80-odd countries.

And the content base is the same as the enterprise offering. The barriers really were internal barriers: our time and focus.

We had to shift focus quickly, but it was really great to see that we could do it because there was an imperative. There was a market imperative driven by what was happening with COVID.

Figure 85. www.edtechevidence.com

EdTech Evidence Group

Source: Citi Research

In one of our previous Citi GPS pieces we interviewed different consumers around the world about their attitudes to education and this showed the propensity for developed market consumers to pay for supplemental education services was fairly low and was much higher in developing markets. Does this fit your view and is there a significant opportunity D2C outside of the U.K. in your view?

I've been in education edtech for a while and I've always held to the view that the U.K. market is a wonderful launch pad but if you want to be a serious education player, the scale of the U.K. market is just not large enough, in terms of schools or the volume of learners. So, therefore, it was inevitable that we would have to go international.

In the B2C space, particularly of course, it's a numbers game. Where is the market? Where is spend discretionary and where is it non-discretionary?

I think you're right: the aspirations of parents in some other countries are slightly different. There is an imperative to use education as a springboard out of either poverty or to do better.

I think sometimes aspiration is missing in developed education in developed countries, shall we say? In economically developing countries there is a much higher regard for secondary education.

So, inevitably, both in terms of our aspirations for the schools product and our aspiration to the consumer product, the international element will play a bigger role in the coming few years.

By your very nature you are an edtech company, but how has the COVID-19 crisis and associated lockdowns changed the outlook for the business and the nature of conversations you are having both with students and potential partners? And do you think some of the change we have all grappled with in recent months will stick?

Well, it goes back right to the beginning of COVID-19. In the U.K., we didn't have a shutdown for a while and we saw some of our international schools, particularly in Europe, shutting down. That was our impetus for creating specific platforms. We created a free version of Sparx Maths for the virtual classroom.

We initially did it for our own schools internationally and very soon released it for any school. Very quickly in the first four weeks, we had over 500 schools from over 80 countries registering for that free platform.

It's great to see because we were helping not only our teachers and learners but also some schools across the world and a number of them obviously have joined the Sparx community since.

In terms of the wider question, I think the use of technology over lockdown has been a revelation in education. I would hope more so for parents than schools, but inevitably schools who were skeptical may have realized this is now no longer a 'nice to have', it's required.

As we move forward in these tragic circumstances, both in the U.K. and globally, it is inevitable there will be more lockdowns. This has not gone away. So I think people are getting themselves geared up for more home-schooling or schools shutting down or teachers delivering remotely.

I think it's been a positive experience, and I think schools find themselves using more and more technology with everyday tasks. But the challenge, going forward for schools and home learners, will be to understand which products out there have real value. Which products can demonstrate evidence of impact in the longer term?

Time is valuable now, not just money. Time is valuable. If children are away from school, they're taken away from learning time, so it becomes really important the tools they use don't waste their time, and the evidence provided is very powerful.

So, will there be lasting impact?

I think with the parent body, definitely! I think with home learning and edtech at home, I think there'll be lasting impacts.

With schools, at various stages, in various parts of the world, it will be different. In some parts of the world this was a great way, in such a tragic environment, for technologies to be introduced. They are at a different end of the cycle.

In more mature economies and more mature educational economies, where technology is already embedded, this would have been a time when the schools realized what really works and what really doesn't. So I think there will probably be refinements of those areas.

It takes government level changes in how teaching is undertaken for there to be sustained changes. I just think the adoption level will change, and hopefully the reality of the assessment of those technologies will change. I think it brings into sharp focus what evidence base and what credibility one needs to have the confidence of the school leaders.

Is there scope to move beyond the core secondary maths focus into contiguous areas — either different levels of maths (primary/pre-school) or even different subjects (e.g., English)?

It's a good question. We talk about it all the time. We want to have a long-term view of what our strategic framework is.

At the moment we are focused on secondary mathematics. It's really clear for us because that's where we make the biggest impact. That's where we've set very clearly what our objectives are.

But in the mid to long term, of course we are looking at other areas be it primary or further/higher technical maths, but we've stayed close to mathematics.

Other subjects loom on the horizon as opportunities. We haven't considered them yet because we are so focused on maths. I think it's important to make sure we scale on where we have our biggest strengths, which is maths and within secondary, and that's I think where we'll be preoccupied for the coming few years.

When you look into the future, what are you most excited about for Sparx in the coming months and years and would recommend investors and other stakeholders keep an eye on?

I think even ahead of COVID-19 hitting us all, we were focused on three key things.

Firstly, making sure we have a solid sustainable U.K. base. It may be a small market but it's really good to excel in your home market. It is a very powerful position with the platforms we have and the products we have — Sparx Math and HegartyMaths — and we have made really good headway with 1,700+ schools — that is coming up to half the U.K. secondary schools using our product.

The second for us was making sure we take all that learning from the U.K. and take all that schools' learning and look at the international schools market. We are starting with international schools, taught in English and teaching an English curriculum, but moving quickly to local curriculum over the next few years.

And the final thing was to make sure we take all the learning from our content and our learning from pedagogy, and put that into the hands of the consumer with Numerise.

So those three: U.K. market, international market and Numerise are the key strategic footprint. And that allows us to make sure we can execute and have a real tight focus.

Numerise has the potential to become the Duolingo of mathematics, so let's see where we can get to on that and just making sure it's available to learners around the world is a strong aspiration of ours. And that ultimately leads back to us thinking: what do we do to make sure we improve the life opportunities of learners?

Tom ap Simon: Managing Director, Pearson Online & Blended Learning K-12

Tom ap Simon, Managing Director, joined Pearson in 2004. Tom has been successful in leading many different aspects of our various businesses. He has held several leadership roles including Interim President of the Growth Markets (Pearson's emerging markets businesses).

Prior to becoming Managing Director, Tom was SVP Finance for Growth Markets from 2014 to July 2017. In that role Tom focused on reshaping the Growth Markets business to simplify the portfolio by exiting a number of sub-scale and unprofitable businesses or businesses with limited strategic fit. This led to a much sharper strategic focus within the Growth division, leading to year over year profit growth and significantly increased margins.

He also spent five years overseeing mergers and acquisitions in the U.S. for Pearson, which gave him a strong understanding of different trends in U.S. education. As Managing Director, Tom handles Pearson OBL's strategic vision, management, and the day-to-day execution to deliver the best possible services for the schools and programs we support and families we serve.

Tom has a Masters in Economic and Politics from the University of Edinburgh.

Can you talk a little bit about your background in Pearson as well as your current role as MD of Pearson Online & Blended Learning? Can you tell us a little bit about the assets you oversee?

I have been doing this role for the last two and a half years. It's an incredible role as we are supporting over 100,000 children in 43 schools across the U.S. and working closely with a number of school districts to support them in their online learning. It's a huge responsibility and great honor.

We operate three businesses: Virtual Schools, District Partnerships, and Pearson Online Academy. Our core competitive advantage and value proposition is to provide high-quality online learning in K-12 at scale. That encompasses everything from providing curriculum, assessment, a technology platform encompassing a Learning Management System, Enrollment System, and a Student Information Service, providing special education services, policy support and marketing and enrollment services. In Virtual Schools, by far our biggest business, we partner with not-for-profit school boards to provide them with those services under the Connections Academy brand. In District Partnerships, we help school districts across the U.S. as they transition to online learning, providing them high quality, asynchronous online content and technology. And Pearson Online Academy is our private virtual school.

Can we dig into a bit more detail specifically on virtual schools? To further set the scene can you give us a potted history of how the market has evolved? How big it is today in terms of student numbers relative to the broader market but also which parts of the market are yet to be addressed?

For context, the industry's been around for about 20 years in the U.S. It started off in the early 2000s when you had education management organizations — now called education service providers — who started to provide a turnkey solution for virtual schools. When Public Charter School legislation came forward there was an opportunity for us to partner with non-profit Charter School boards to directly operate public school-funded virtual schools.

We started off in Wisconsin and Colorado in 2001 and 2002 and our most recent new state was opening in Missouri this year. There are 31 states across the country which have now authorized virtual schools and there are two main national providers, ourselves and K12 Inc, with roughly 50% share; other players tend to be state-based.

When you think about numbers — and this is looking at it pre-COVID-19 — there were roughly 400,000 children in the U.S. in a virtual school. This compares with the overall U.S. K-12 student population of around 55 million kids.

The states we have been authorized in account for roughly 44 million kids out of the 55 million K-12 students in the U.S. So, effectively, the market is at around 1% penetration of the 44 million kids that in states that we've been authorized in.

Digging into the detail, in some of the more mature states, you have roughly 2% of the state's total K-12 population in a virtual full-time school. Many states are below 2% and some are below 1%, so it's a relatively niche market but one that was historically growing at roughly 8% to 10% a year.

Taking a step back, obviously all these numbers are pre-COVID-19, but the point I would make is that you have a very low base today in terms of penetration but it is already a meaningful market. Roughly speaking, you can think about virtual schools generating around $5,000 in revenue per student, although this varies enormously state-by-state (all the legislation is driven on a state-by-state basis). This suggests that the virtual schools market in the U.S. is currently worth around $2 billion per year.

We will come onto the impact of Covid-19 in a second, but can you talk about what some of the motivations are for parents to consider virtual schools for their children in normal times?

We provide a solution to families where the traditional bricks and mortar model wasn't working. That could be a family who needs more flexibility. It could be that the academic setup isn't right for the kid: it could be that you have a gifted kid who is progressing at a faster rate than the public school could support or the reverse. It could be physical or emotional health or safety related. Or it could be location.

And so, when families talk to us about what they enjoy at a virtual school, they talk about the flexibility, the safe and nurturing learning environment and the increased involvement of the parent.

On this point, the role the parent plays is really important. They play a specific and dedicated role as the 'learning coach', working in partnership with the certified teachers that work in the public schools. So we have a deliberate role and set up for parents, as well as specific materials for them to help prepare their children to learn. The schools we operate are part of the U.S. public school system and all of our teachers are certified in the state they teach in, but we have a much bigger role for the parent and many parents really enjoy that role because they're not doing all the teaching on their own — they have that support from the teachers and the school. They are doing it in a way which is part of a well thought out curriculum and where they get the support the teacher provides.

Parents are reflective of the general population at large. The median household income of our parents is $75,000. They are about 38 years old. The have a couple of kids and 40% of them have a college degree.

You are somewhat reliant on the 'Charter School' movement continuing to progress. Do you have a sense of what demand might be if full school choice was made available across all states? And what are the other main barriers to take up in your experience?

Looking at the former, I think you could extrapolate the numbers we have talked about. We are currently at 1% of 44 million kids so 1% of 55 million would suggest an increase to about 550,000 in fairly short order. But that assumes you can get to full authorization in states like New York or New Jersey, which have historically not shown much support for virtual schools.

The best way of thinking about it is that 44 million students are in states that have authorized virtual schools, so what is the right penetration of the market post COVID?

We're not sure what that might look like at this stage, although there is clearly an increased acceptance of online learning and that's borne out by some of the studies we've done, and that will I think increase over time.

Also, I think it's a bit of a generational point. With Millennials becoming a greater proportion of parents, this will also drive increased acceptance of online learning. The other point I would make is that, with major shifts happening in terms of people working from home, it means there's more acceptance of online learning and a greater pool of the population working from home, which are two big barriers.

One other point to make on the barriers to adoption is around creating category awareness. If we think about the U.K., virtual schools are very much associated with 'homeschooling'. In the U.S., even if we are 20 years into the development of the category, we still see a similar phenomenon so a lot of what we are doing is educating consumers about their options.

This leads on to one final point, which is the perceived 'stigma' associated with educating your children at home. There is nearly always a degree of hesitation around taking children out of the traditional school system. There's a degree of anxiety. So what we see is parents doing an awful lot of intensive work around understanding what the model means and what it's like. But there's still a concern they will get it wrong or be judged by their families for what they've done. So, we see that as parents go through the enrollment process, there's a degree of anxiety they are experiencing before they finally enroll.

Presumably there are things virtual schools need less of (physical space etc.) but in the same breath presumably student/parent support becomes commensurately more important. Can you talk a little bit about the similarities and differences between 'virtual schools' and traditional schooling both in terms of the student experience but also in terms of what this means for the financial model?

Let's start with the student experience. It's a completely different model.

It's a self-paced, fully-virtual model done in the student's own time and set to their own schedule. So, yesterday, you could have done Math, Jo could have done English, Teddy might have done Science and Anjali might have done Social Studies. There is a huge amount of flexibility — it's based around your schedule as a learner and as a family, which is very different from the fixed timetable you'd see in a typical school

If you think of the traditional school model as very much a 'one size fits all' model, this is the exact opposite. Each kid can study on their own schedule and in their own time. That's the first point.

The second point is the parent takes a very active role as a learning coach. We support the parent and the parent has a very clear role in this model, which is obviously very different from some of the 'emergency remote learning' that has been taking place in recent months. Parents have an active involvement in their kids' learning every day.

And I think the third point is a really interesting one, which is that teachers say they build a stronger rapport with students and their families because they're spending more time on a one-to-one basis with them, which means they (1) get to know the families better because the teacher is working hand in glove with the mother/father as a learning coach but also (2) they have one-on-one time with the student, which actually allows them to build that relationship directly.

So, if you take a step back: the student has a different experience, the parent plays a different role, and the teacher plays the same role, but very differently. Communication skills leveraging technology are really important for teachers. Data is really important because we have a lot of data in terms of how the kids are learning.

The role of curriculum and technology is very different. If you think about a normal school environment, the teacher is curating the student experience using a textbook as the backdrop. In our model, by contrast, we have an asynchronous curriculum. So that online curriculum is the bedrock for much of the teaching and learning. And then the teacher and the parent are engaging, when needed, to support the kids' instruction.

It is very different because, our curriculum has to be much more engaging and dynamic if we are going to get those students excited enough to pay attention, keep them engaged, and personalize their learning.

It's also important to remember, it's not just about the students. It's also about teachers and parents. If you think about the traditional school model, it was very much set up for an institutional approach, which is around the teacher doing the teaching at school with a limited role for the parent — mainly with oversight for homework.

We are set up for a much more deliberate role for parents in that they're involved and we support them on a day by day basis.

And I think that runs completely counter to what you've seen with much of the work over the last six months where educators have done their best to support families and students working from home. The key point is they are not set up, by definition, to play that supporting role for all the stakeholders and they are overwhelmed.

Think of a typical Help Desk model, for example, that supports teachers when they're having trouble with a technology device or a platform. That help desk model is not set up to help Jo, or Teddy, or Anjali, or you, or me when we're dealing with some of those issues from home.

Our approach by contrast is completely holistic: we have an integrated learning management system, student information system, and enrollment system backed up by a variety of communication tools, whether they are video or email. It's a very different way of providing a different student experience as well as parental experience.

On the financial model, it is important to remember that we are a school. That means much of our costs are driven by teachers and this is almost always mandated both by the state and then the age range.

To give you an example, in Tennessee the average class size for an early elementary school — grades K through 3 — cannot exceed 25 students per teacher. In other states, like Florida, there are no defined pupil-teacher ratios imposed, but we need to publicly disclose what they look like. So, we have a lot of costs which are driven by teachers, and that's mandated both by age range as well as state-specific mandates.

Clearly teachers don't have to do some of the other things that bricks-and-mortar teachers do — they are not taking attendance in the same way, they're not monitoring in a cafeteria, they're not doing a school bus pickup line — so the sort of ratios you'll see in a virtual school will be a little higher than your brick-and-mortar model because we make less demands on the teacher's time.

What both teachers and parents have said is they enjoy the relationship they're able to build with the teacher on a very personal level, because they're getting that direct experience.

The other thing I would think about is that we have significantly more costs from a technology and curriculum perspective than a bricks-and-mortar school. This said, there are some benefits of scale. Because we provide a holistic experience and because we have scale, we can make sure that all of those different elements mesh and mesh well for the school.

Where a bricks-and-mortar school may be buying textbooks from a range of different of courseware providers and putting them together with different providers from an assessment perspective, we are able to focus on providing a much more holistic experience, bringing all of the educational technology and curriculum elements together including elements like social and emotional learning as well.

Can we talk a bit about the impact of COVID-19? There has clearly been a spike in interest in virtual schools (41% enrolment growth in the third quarter). Do you think this demand will stick, or is there a danger interest will fade as COVID-19 concerns (eventually) fade away?

I think what you can safely say is that we're starting from a very low base. Pre-COVID-19 we had less than 1% of U.S. K-12 kids in virtual schools. If we look at some of the research we've done, it suggests that 45% of parents think online learning is the right route for them until a vaccine is available, but 5% said that even after the pandemic ends, they plan on keeping their child in a remote or online learning program.

Even if we discount that 5% by a huge amount it would still represent a major uptick in the market and penetration of virtual schooling.

We see this in other data as well: 81% of parents and students said they have had academic success online. And 43% of the students said they performed as well online as they did in bricks-and-mortar schools with 38% said that they did better.

When you're talking about a base of 1% it doesn't take a huge leap of imagination, to say that, even if those are numbers amplified at the peak of the pandemic, there's now significant scope for behavioral changes in terms of fundamental acceptance and interest in the category.

A second point I would make is that a year ago consumers did not really understand the market well. One of the biggest challenges we had in the U.S. was actually building category awareness. Our data suggests category awareness has gone from 70% a year ago to 90% today, which is a huge increase year-over-year for something like category awareness.

I think we are seeing this fundamental shift in consumer awareness both in terms of what we do and appreciation for the benefit from it.

Now, that's not to ignore the fact that 'emergency remote instruction' is what the vast majority of parents are getting in the U.S. and that is clearly a challenging educational experience. We need to be clear as to what the value proposition is for virtual schools and how that supports families and students.

How easy has it been to bring capacity online?

We operate 43 schools. We have in the past set up a school from start to finish in 50 days, but generally speaking, it takes 18 months to get all the necessary state approvals, which means that capacity within a year has to be addressed by existing schools.

If you are opening a new school, you are typically starting with 200-300 kids in year one. Our more mature schools are now at the 8,000 mark in terms of size. So that gives you some idea of how big these schools are and it takes the schools five to seven years to reach that size.

If you're a school and you're growing from 200 kids to 1,000 kids — and some of our newer schools were growing from 200 to 2,000 students this year — you can imagine the stress that puts on the school's infrastructure.

With 200 kids you need a principal. With 2,000 kids you need a principal, you need two or three assistant principals, one each for the elementary school, middle school, and high school. You need a whole host of teaching staff. You need a bigger special education and school counselor staff. And all of them have to be trained in virtual education and that's a steep learning curve, so it's tough.

It means it puts significant stress on those schools as they are growing. They are having to 'drink from a fire hose' as they are looking to hire the right teachers, put in the right infrastructure, and build the right culture while also making sure they continue to deliver high-quality instructional outcomes.

The reason we were able to build capacity is because we have a good relationship with the school leaders and we were clear as to what we would need to work with them on and agree what capacity we could increase with them over the course of the school year.

Most of the capacity to satiate the increased demand came from our existing schools. However, through all of this it is important to remember the schools we support are online public schools. And we are subject to the same graduation requirements as any other public schools. We are subject to the same rules and regulations provided by the states, which in some cases means we cannot increase beyond a certain size — those caps are typically put in place to ensure academic quality. And in some states, we have caps and because the states don't want schools — virtual or otherwise — to grow above a certain size. That is a legal cap, so there's not much we can do about adjusting it or changing it unless the legislation in that particular state changes.

Can we briefly touch on the B2B vs. B2C in the context of virtual schools? Is Connections Academy an exclusively 'consumer facing' brand or do you provide virtual schooling on a white label basis? And in this context, is there any meaningful difference between the two models in terms of student experience (including outcomes) and financial profile? Is one a more attractive 'business' than the other and could you do one without the other?

If you think of our core competitive advantage, it is providing a high-quality, online K-12 education at scale. And there's a whole host of different things you need to do there.

You need to understand the curriculum. You need to understand the technology. You need to understand the academic support. You need to understand how to market and enroll. You need to understand the policy legislation and policy environment. You need to be able to hire teachers and all the rest of it. So, there's a whole range of services we provide.

The Connections Academy brand is basically a fully virtual school offering that we provide to the 43 public schools. Clearly, there are a number of school districts across the U.S. who are working out how to provide a high-quality, online offering to the kids in their school district but they don't necessarily want the full 'turnkey' solution.

For what we call the 'district customers', we are seeing a wide range of requests to help support a district's online learning experience. In most cases we work with teachers and educators that are provided by the district, and we support them by providing curriculum, platform technology, and training — because typically their curriculum will not be an asynchronous or an online curriculum, it will be a synchronous curriculum designed to be delivered in a classroom. But we also have district partnerships where we provide a full-scale offer — content, platform, and teachers — to help them meet the demand for online education. This can be across the board or segmented by grade — for example K-5 taught by district teachers with Pearson curriculum and technology, and 6-12 taught by Pearson teachers with Pearson curriculum and technology.

In these partnerships, we can provide districts with curriculum, the technology, the services, and the teachers so that districts can provide the academic support to their students in an online setting, benefiting from the scale we have in that space.

Can we bring in the Pearson Online Academy to the discussion, which is your private virtual school? Is this just addressing a different part of the market the public school variant can't reach or is there a fundamental difference in the offering public vs. private?

There is a clear distinction in terms of service offerings we provide with Pearson Online Academy. It is, however, addressing a different target market.

On the one hand, we are trying to capture some demand in some of the states we don't have a public school option. But more fundamentally it's a different type of consumer we're targeting, one who is interested in purchasing that school offering. For example, we attract a number of international students who are interested in a private education without geographical restrictions. Pearson Online Academy also provides students with career-focused, highly individualized learning plans that maintain flexibility around course pace, which can appeal to certain types of learners.

One of the things we've done recently, which I think is quite interesting, is we have signed up with some of the big healthcare benefit providers like LifeCare in the U.S., which basically provide a whole range of educational service offerings.

Companies have typically done that in the post-secondary space but we are providing the opportunity to go to the Pearson Online Academy through them, today, at a discounted rate. Here we are thinking about the employers as a different route to market, because clearly many employees around the country are still grappling with how to support their kids at this difficult time.

So far, we have talked exclusively about the outlook for virtual schools in the U.S. Is there a significant international opportunity for virtual schools and, if so, how is this different from the U.S. outlook?

K-12 education is deeply local. To assume a one-size-fits-all model developed in the U.S. will work around the world is not going to work. I think where there are similarities around providing a high-quality technology platform and using Pearson's expertise in K-12 curriculum and content around the world, and then tailoring that to provide specific virtual schooling opportunities to governments or charter schools or their equivalents.

I don't think this is necessarily a private school market only. Far from it. The roots of what we do grew out of the public school space.

My sense is it should be linked in terms of the technology and curriculum expertise and the virtual schools expertise Pearson has, but it should be tailored for each market opportunity based on the characteristics of those markets.

So just as the academy model flourished in the U.K., there's potentially an interesting opportunity in the U.K.

As we look forward, hopefully to a future beyond COVID-19, what are the exciting trends or developments you think will have a particular impact on your business and you think investors should keep an eye on?

There are a couple of things that jump out. The starting premise is an interesting one. If we go back six months, virtual schooling was a very niche business.

But in the past six month we have gone from 400,000 kids learning online to over 50 million learning remotely in the U.S. alone. COVID-19 has been a huge accelerant of online education in K-12. And this has impacted every school district in the U.S. at some level. Now in the future, I don't think it'll be necessarily as widespread as it is today with COVID-19, but it doesn't seem to me we'll be going back to the days where an online program is viewed as an afterthought or considered a luxury.

In short, I think online education is being embedded. And that's a huge opportunity.

I also think it is important to consider this from the family's perspective, which is that online learning has not only been more accepted but is now seen as more accessible. And with more people working from home, we think we will see more families saying "Yes, we can learn online. We can make this work."

In short, we think the online experience will take broader roots in K-12 than it has in the past and we have seen that model grow very significantly in higher education over the last 10 to 15 years.

The third point I would make is we need to be really clear on what a high quality, online education looks like. We operate schools and we are in the academic results business. We shouldn't forget that. I think the efficacy, what the best practices look like, the support, the high quality instructional leadership, are all important factors and we need to continue to innovate in the field of online education.

This is a difficult thing to do. It is not easy to make an online school successful. You need a great school leader, you need great teachers, you need support from the Charter School board, and you need the right policy environment.

When it does come together, we know it creates an incredible experience for students and families. But you have to remember, they didn't have a choice and that we are providing them an option they wouldn't have otherwise had.

I think the implications of the current situation being a huge accelerant of online education is something that shouldn't be underestimated.

Let me give you a simple example from a technology trends perspective. Pearson's MyMathLab products have been hugely successful. We are looking at incorporating those in our new high school math courses that are coming out later this year.

That's amazingly powerful because you're taking a proven assessment engine with 20 years of experience and a great track record, and you're embedding that into the K-12 market. I think simple things like this are a good indicator of how much opportunity there is in leveraging existing technology already within Pearson in a virtual K-12 setting.

Yu ZHU: CEO, DFUB Technology Company

Can you talk about your background? Can you talk a bit about your experience before coming to DFUB/Koolearn and how that informed your interest in the education sector?

I was born in Chongqing in 1986 and entered Tsinghua University through a physics competition to study as an undergraduate. During my college life, I also worked as a part-time tutor to teach K-12 students on 1-on-1 basis, which gave me a sense of accomplishment. While I was studying towards my PhD degree at Tsinghua University I worked as a part-time teacher. I ended up giving up on my PhD studies in September 2010 and joined the private education sector as a full-time employee as I believed that China's K-12 after-school tutoring market was set to enjoy huge growth opportunities in the next 10-20 years.

There are three reasons I made the move into private education. First, looking across the experience of other developed countries, I believed as China's GDP growth accelerated, education spending by Chinese parents would become a larger share of their household expenditures. Second, I was attracted to the company culture, which was open and freed. Finally, private education was fairly new and the company I started with was just starting their business and focusing on overseas study tutoring so there were a lot of teachers with English majors. I thought at the time there would be a need for more teachers with a background in science to improve the talent mix for future subject expansion. I think I made the right decision.

I helped to develop the U-Can business (tutoring middle-high school students) in Beijing in 2011-2016. I established the DFUB business in 2016 and I continue to act as CEO today.

Can you talk a little bit about Koolearn — what the group does and which segments it is exposed to — but also about DFUB? Can you give us some particular insights on the opportunity in K-12 and what DFUB does differently to address this opportunity?

Koolearn provides online tutoring courses to students covering a full spectrum of ages in three segments: college, K-12, and pre-school education. DFUB is part of the K-12 segment and is a location-based live interactive platform for students in lower-tier cities with limited access to high-quality education resources.

For DFUB, the business model and development direction has remained steady since the beginning. As early as 2016, I saw there was an opportunity to look at which education products would be appreciated most by customers. We found that parents in China highly valued advanced education, which means they're focused on getting their children into a good middle school, high school, or university. We believe China's focus on advanced education is different from other countries. In the United States, for example, university admission takes into account achievements such as sports and other activities, not just exam results. However in China, admission is based primarily on exam results from key subjects for high school or university entrance examinations.

I think a successful educational product should satisfy three elements. The first one is personalization, which can improve the effectiveness of teaching. Localization of content being taught is important in China as different regions can have different teaching materials and content. This issue was reflected in large online classes in 2015-2016.

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Born in 1986, he obtained a bachelor's degree in Engineering from Tsinghua University in 2008. He also has a Master's degree in Management from Peking University.

The second element is the concentration of students. How a teacher delivers content can impact a student's concentration level. For example, if there is a high interaction level between teachers and students, any lack of concentration can be detected and corrected. From the beginning, we chose online education software which is suitable for interactive, small class courses.

The third element is the results of a student's study program, which drives us to caring about study effectiveness and following-up with students after class. Today, tutors can meet some of these needs.

Above all, we need a tutoring service with the features of "localization" + "interactiveness" + "small classes where the lecturer can provide more guidance". In 2015-2016, large online classes were popular, and there were almost no online small classes in the market. In order to achieve better teaching results, DFUB directly provides interactive, online small classes and we believe small classes should be the ultimate format of the future business model of K-12 online education.

Can you talk about what makes the DFUB offering different both in terms of the experience of the platform (is it better technology or better teachers?) and in terms of target markets (tier 3-5 cities vs. tier 1 cities)? What role does the physical network of centers in various markets play in your value proposition?

I view online education as a series of closed-loop teaching services. It is not only about teaching students in the classroom, but also about the review and guidance after class. We do not develop live steaming systems, but we do develop other content. I don't view technology as a unique barrier to online education. As long as you have money, live-streaming platforms and teaching service platforms can all be developed. Parents still think the teacher and teaching content are more important than the platform.

We chose tier 3-5 cities as our target market, mainly because of the lack of excellent teachers in these places. Our teachers have more advantages for two reasons. First, they receive training from a proven training skills program. Second, our teachers can offer better services after class. We believe the most important aspect of DFUB's development is to develop teachers, especially over the past four years.

Normally we think about technology-first business models as being fairly scalable but if one of the key selling points for DFUB is the small class sizes and the customization/localization of the product, does this mean the economies of scale are less significant?

I believe economies of scale are important for us. As we discussed earlier, we choose a localized, online, small class teaching model to offer students better tutoring services. Moreover, thanks to our parent company, we have strong teacher recruitment, training, and management capabilities, which makes us more competitive in this sub-segment. Each of our teachers can cover 150-200 students on average in one quarter. To become a teacher with DFUB an applicant needs to meet very high requirements, including academic qualifications and adequate training. Actually, recruiting and managing qualified teachers is very difficult, so the Internet companies don't like to do it. Given my experience with offline teacher training and management, we are competitive on how to train a large number of teachers. Once we complete our teacher training, it will be difficult for other competitors to catch up.

Can you talk more broadly about the market opportunity contiguous to your core offering? Obviously Koolearn itself has offerings in university, pre-school and institutional/professional education but is there scope to take what you do in K-12 and extend it internationally? Are there any routes in China you could take, e.g., into the institutional/private school market?

In terms of business expansion, we have been testing the expansion of DFUB in Hong Kong where there are children already using our services. The large class, online model is more suitable for a unified market, while we are following the small class online model, so both the big market and the small market are the same for us because we can do localization.

As far as we are concerned, we are not opposed to operating in different markets, but we acknowledge that our DFUB teachers in tier 1-2 cities may not be that competitive, and we don't want to directly compete with our parent company's offline business.

We entered the mature market of Hong Kong to gain experience, and will hopefully use that experience to gain advantages if we enter tier 1-2 cities in the future. Additionally, we are considering the demand for tutoring overseas, especially for those who want to study in China. However, our current focus is still on K-12 students in the near term.

How has the COVID-19 crisis impacted your business in terms of user behavior/engagement and therefore business trends? And how much of this behavior change do you think will stick?

I think the COVID-19 crisis has greatly accelerated the development of online education. According to my observations, China is ahead of other regions in the development of online education. For instance, the development maturity of online classes in Hong Kong seems far behind that in mainland China. Large online classes were first developed and emerged in 2013 and gradually matured in 2015-2016. Before COVID-19, the penetration rate of K-12 online courses was estimated at 10%+, but is currently estimated to be above 50% due to impact of the epidemic. In this way, students who are more suitable for online education can be screened out. The overall estimated savings in marketing costs could be Rmb100 billion ($15bn).

On the flip side, we also see some negative impacts from the epidemic. Because many children are taking classes that are recorded and broadcast online during the epidemic, instead of live-streamed classes plus teaching assistants, the learning experience may suffer. It will be more difficult to convert these students into online education users in the future as parents will prefer the offline study format.

In the short term, we do see rising numbers of users for online education and are receiving more customer recognition. In the medium term, I believe teachers and education quality are more important. In the long term, we need to more data to track whether student demand can be met and whether online education can solve the issue of improving students' studying results and performance.

When you look at the broader educational landscape, and in particular the edtech landscape, what are the trends/technologies you are most excited about driving your business/industry?

Whether the development of an industry is good or bad lies in the increase of talents and technology in that industry. Talents can learn faster and grow faster, which are better for online education development. The online live-streaming technology, which transcends geographical factors, is important. But it is also important to convey the correct values to students and broaden their horizons.

In the future, I would like to see technology development in a few areas. The first one is using technology to better match teachers and students and to match the most appropriate teaching resources to the students. Second, technology can improve the teaching efficiency by replacing part of the teacher's work. For example, an AI teaching assistant can adaptively allocate appropriate topics/exercise to students, which can greatly reduce the burden on the teacher.

Third, can technology play a better role in the process of teaching? Education used to be use handwriting on a blackboard, but now it is a PowerPoint. In the future, we like to see whether new technologies which can replace PowerPoint that better express teaching content and achieve better results. In addition to the role of multimedia, interaction between teachers and students can also be recorded, and students' concentration can be better improved.

Lastly, the in-depth study of the human's learning model can help to understand the results of learning by the behavior of teachers and students, which can be used to create better standards for judging the effectiveness of teaching.

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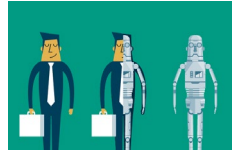*Flightpath of the Future of Air Travel*
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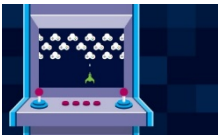*The Electrifying Path to Net Zero Carbon*
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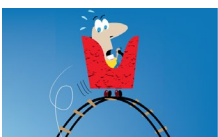*A Progress Report*
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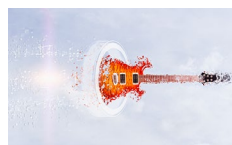November 2018

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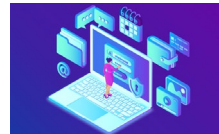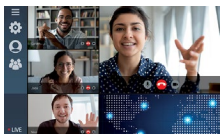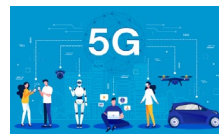
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EDUCATION

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TECHNOLOGY

Edtech spend is currently only 2.5% of the almost $6 trillion education market. / With 80% of survey respondents stating they intend to spend more on edtech going forward, we forecast edtech spending will rise from $160 billion to $360 billion by 2024 but see potential to $2.7 trillion as institutions move towards a hybrid face-to-face and online learning model.
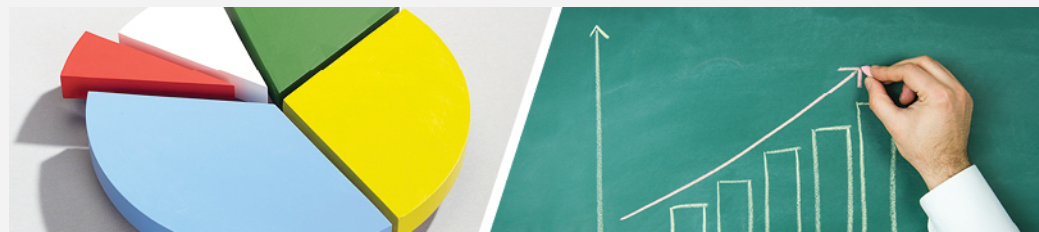
INNOVATION

During the COVID-19 period education institutions were required to immediately change how they operated with 96% of our survey respondents offering online learning. / In terms of engagement going forward, institutions expect around 50% of all daily study hours to be digitized over the next three years.