



## **Educating for the Future: Empowering the Human Mind and Redefining Values and Citizenship in the Age of Technological Disruption\***

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### **Abstract**

*What are the goals of education, and how should they be interpreted in our time? The challenges posed by the emergence of technologies like Artificial Intelligence demand a renewed reflection on the nature and scope of the educational process, in order to address the question of how to educate the human mind to cope with these problems and opportunities. The aim of this paper is to explore a framework for the relationship between education, values and new technologies within the present social and economic context. In it, the role of rationality, emotions, empathy, creativity and the possibility of developing a broader concept of “mind” for empowering human beings and helping us to better understand ourselves and the world will also be examined. In essence, the paper contains a summary of the main ideas discussed in the Fifth Altius conference on “Educating for the Future” at the Oxford Union,<sup>†</sup> which took place between September 28 and 30, 2018.<sup>‡</sup> Due to the Chatham House Rule*

\* This paper is an edited version of the report on the Fifth Altius Conference at the Oxford Union. It is written on behalf of the Altius Society at Oxford, with the collaboration of Altius scholars Ashkaan Golestani, María Alegría Gutiérrez, Pamina Smith, Joshua Tan, and Sven Wang. The Altius Society wants to express its special gratitude to Ashkaan Golestani for his valuable help in editing the text, and to Garry Jacobs (who has participated in the last three Altius conferences as a speaker and attendee and whose questions have greatly contributed to the debates) for his suggestion of publishing this report in *Cadmus*.

† The Altius Society at Oxford (<https://www.altius-society.com/>) was founded by Carlos Blanco Pérez and Alexandre Pérez Casares in 2012 with the aim of becoming a global forum where senior practitioners, academics, and political figures, as well as young promising scholars and professionals gather to discuss the most relevant strategic trends of the 21<sup>st</sup> century and their impact on the future of our societies and economies. Based on the ideal of intellectual cooperation across academic disciplines, the past themes of the Altius conferences at Oxford have been “The future of democracy in the Western hemisphere” (2014), “The extension of life” (2015), “The brain of the future” (2016) and “The future of communication” (2017). Throughout these years, Nobel laureates, Fields medalists, and world-renowned philosophers have spoken at the Altius conference in the Debating Chamber of the Oxford Union.

‡ Among the speakers at the Fifth Altius conference it is worth mentioning the names of the following: Sheldon Glashow (1979 Nobel laureate in Physics), Peter Agre (2003 Nobel laureate in Chemistry), Oliver Hart (2016 Nobel laureate in Economics), Sir Richard Roberts (1993 Nobel laureate in Medicine), Howard Gardner (Professor at Harvard University), Rose Luckin (Professor at University College, London), Jeffrey Sachs (Professor at Columbia University), Manuela Veloso (Professor at Carnegie Mellon University), Anne Watson (Professor at the University of Oxford), Simon Blackburn (Professor at the University of Cambridge), Andreas Schleicher (Director of the PISA report), Archie Brown (Professor at the University of Oxford), Mikołaj Dowgiałewicz (former Polish minister for European Affairs), Peter Atkins (Professor at the University of Oxford), Miguel Angel Moratinos (former Spanish minister for Foreign Affairs), Olivier Crouzet (Dean of Studies at École 42, Paris), Lady Barbara Judge (former Chairman of the UK Pension Protection Fund), and David Berry (Professor at the University of Sussex).

*requirements, attribution has been avoided. Thus, the report is focused on the presentation of the most relevant concepts and arguments expressed by the speakers and exchanged with the audience. In any case, the report is not exhaustive and it does not necessarily reflect the order of events followed at the Oxford Union. Rather, it is aimed at exposing, in a concise manner, the principal themes that were explored during the conference and the key practical suggestions drawn from different sessions.*

## **1. Introduction**

### ***1.1. The Role of Science and Education in the Future of Democratic Societies in the 21<sup>st</sup> Century***

Minorities have clearly had fewer education opportunities throughout the history of humanity, which has enhanced economic differences amongst these groups. Science and Education, particularly on STEM (“Science, Technology, Engineering, and Mathematics”) subjects, have the power to “equalize” and create “social elevators” which are the key to transforming and improving the Democratic Societies of our century. This compelling concept was explained through an exploration of the history of education in the US, throughout which economic inequality correlates directly with access to Science and Education.

The Independence of the US from Britain led to the foundation of Harvard, Columbia, Yale and several other universities, some of which were directly founded by the Fathers of the Constitution. Although the goal of these institutions was to provide opportunities, in truth, these opportunities were restricted to white males who had wider access to education, at a time when slaves could not even read.

Shortly after, the Moral Act was signed and the National Academy of Arts and Sciences was created, but opportunities were still restricted for Asians and African-Americans, who started growing in number during the 1890s. Even when Jews started migrating from Europe in the 20<sup>th</sup> century, opportunities took a while to be open to them.

A few years later, thanks to Martin Luther King, segregation was finally abolished and minorities had access to university education. However, the representation of these minority groups was scarce in most university degrees, particularly the ones which led to higher future earnings (i.e. Minority groups represented 50% of the population in 1965 but only 2% of them enrolled in the medical sciences).

Even today, African-American students have much worse preparation opportunities for SATs, which leads to smaller ratios at university, particularly in business-related and high-demand careers, thereby enhancing economic inequalities. Still today, the median household income is double for white people than for African-Americans, and the value of property owned is 7 times greater for whites.

This short history of the evolution of education in the US over the last few decades shows two key learnings for the way we should design education and social institutions moving forward. The first is that big changes do not come from groups, but rather from individual leaders with the courage and ability to take action. Second, much greater effort must be put into ensuring equal opportunities for different ethnic groups, particularly in fields such as

STEM which will be in high demand in the next few years and will yield higher salaries, since without those efforts, economic inequalities will keep growing and the future stability of our democracies will be at stake.

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*“To achieve true sustainable development, humanity needs to be empowered with good ideas and clarity of thought, politics should be about well-being, and the common good should be the priority.”*

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### **1.2. Sustainable Development by Design: Technology, Policy, Politics and Ethics**

Sustainable development, understood as the existence of a prosperous and fair economy which is sustainable for the environment, should become the world’s first and most important concern, as it is the only path towards the survival of our species. The current economy is clearly not sustainable and, although it has been able to deliver wealth, the wealth created is not equally distributed. The solution to this enormous challenge is both technological and political.

The technical approach includes asking questions such as, “what do we want and how to get there?”, and is in the hands of the thousands of brilliant engineering minds of our society. The problem comes mainly from our sourcing of energy and increase in complexity as the global population maintains its unstoppable growth rates. However, even if we are not yet there, we are not far from a potential solution: a smart combination of non-polluting technologies, including nuclear, hydro, wind and solar, coupled with changes in the transportation industry towards electric engines, is clearly the way towards a technological solution to our biggest challenge.

However, the main reasons we are not able to achieve a sustainable economy are not analytical or technological, but rather related to the political domain, where change is often slower and where the influence of lobbying can become an important barrier.

In this sense, ratification of the Paris Climate Agreement offers unique and valuable guidance for the implementation of Sustainable Development Goals as they frame the challenge and define ambitious objectives. It is important to remember that the goals are not plans of action, they are just objectives, so they need to be transformed into realities through careful implementation, with cooperation and expertise being critical at every stage.

The goals of sustainable development are ambitious because the challenges we face can become irreversible catastrophes. They may be divided into three main categories: Economic Development, Social Justice and Environmental Sustainability. While the three are connected, it is not easy to explain the connection between them. In order to solve the issues at hand, we need to identify the diagnostics, but even this alone is not enough. Good ideas need a “theory of change,” that is, a way to implement the change.

For instance, most people desire universal access to basic needs. However, this right cannot be realized simply through policy, as it needs a budget. Therefore, the battle of social

inclusion was framed as the battle against the rich and powerful, where it was claimed that “Wealth is addictive.” Such a view implies that social inclusion is about saying “no” to the rich and powerful, taxing them more heavily to fund national healthcare services, high quality public education, etc.

Nevertheless, in countries like the US, this change is difficult because the government is controlled by a small wealthy elite which lobbies for tax cuts. “The level of greed we are up against is unbelievable”, “It is a derangement of social life to have so much wealth at the top and so many tax cuts,” and other similar statements were put forward to show how undoubtedly corrupt the current political system is in favor of the rich at the expense of what the majority wants.

When it comes to the environment, it is largely a matter of changing the technologies of energy production. Sadly, even countries which seemingly support the use of renewable resources find that their hands are tied by the fossil fuels lobby. For example, in Canada, we see how wealth governs interests and how the oil industry calls the shots by controlling the vote in Alberta. Thus, while the country itself is technically becoming greener because it is reducing its use of fossil fuels, it is at the same time maximizing its sale of fossil fuels to the rest of the world in order to be able to economically sustain this change. This example clearly shows how the challenge is often more political than technical, and how change requires a lot of optimism.

We live in an age of complexity and many systems (energy systems, health systems, sustainable land use and ecosystems) will be involved if we are to achieve these goals. Therefore, we must consult experts from these systems and trust their guidance if we want to succeed in putting a political solution to this enormous challenge. Sadly, we face a phenomenon where experts are only valued when they can be used to make money and are otherwise depreciated in the public sphere if they pose a threat to powerful vested interests. For instance, expertise should have been able to undo Trump’s agenda if we lived in a society where expertise and science were respected.

The theory of change proposed lies on the assumption that most people are normal and not addicted to wealth accumulation. They do, however, want decent lives and access to basic amenities. Therefore, the SDGs are aligned with human nature, but are acting against a powerful world minority. *To attain true sustainable development, humanity needs to be empowered with good ideas and clarity of thought, politics should be about well-being, and the common good should be the priority.* The final solution will require a lot of activism and political influence, supported by professional expertise from different spheres to work together and implement technical solutions.

## **2. Education in a World Driven by Artificial Intelligence**

### ***2.1. Re-conceptualizing the Purpose and Methodologies of Education in the Artificial Intelligence Era***

There are two fundamental questions regarding the role of AI in Education:

1. How can we teach young and old people to be ready for a society disrupted by Artificial Intelligence?
2. What value can Artificial Intelligence bring to education?

Regarding the first question, if done in the right way, there is little doubt that Artificial Intelligence can bring extraordinary benefits. Because the human-human connection remains fundamental, the goal is to blend human interaction and artificial intelligence in the best possible way. In order to achieve this blend, one needs to “re-conceptualize” intelligence and identify the aspects that are/are not covered in Artificial Intelligence. Only then, can one ask: how does one educate kids to use Artificial Intelligence in the way it is intended to be used?

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*“Artificial Intelligence should empower us to think more about who we are, what it means to be human.”*

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It is well known that there are two sides to human intelligence: the emotional side, and the rational, scientific-minded side, both of which are important in education. Artificial Intelligence can only help in relation to the second side, and even then only partially. Thus, we should not compare Artificial Intelligence to human intelligence; rather we should see it in a different light, with non-human (human-complementing) features.

Given the strength of Artificial Intelligence algorithms, one could build an Artificial Intelligence with all the knowledge of a student. Thus, Artificial Intelligence is a catalyst which should push us to move away from ‘academic’ intelligence to more sophisticated, purely human types of intelligence. *Artificial Intelligence should empower us to think more about who we are, what it means to be human*, understanding where knowledge and evidence come from, etc. We need to teach intelligence as something that goes beyond the knowledge of facts, in order to understand our emotional processes and the underlying reasons for everything we are surrounded by, at a “meta-level.”

So far, we have been focusing on teaching things that are measurable afterwards, and therefore not at this meta-level. However, if we want our students to succeed in the era of Artificial Intelligence, we need to start creating that ‘meta-intelligence’ that will enable them to become truly useful individuals who go far beyond what Artificial Intelligence can achieve.

Regarding the second aspect, that is, how Artificial Intelligence can help teachers, we should see Artificial Intelligence as an incredibly useful tool which can help them focus on the value-added part of pedagogy. By building, for instance, an Artificial Intelligence tutor who can tutor academic knowledge (numeracy, literacy, etc.) just as well as humans, we can free our human teachers so that they can focus on what they are best at, including emotional intelligence, beyond-academic intelligence, trans-intelligence, etc.

In the future, Artificial Intelligence systems could also learn about our students and teachers, and evaluate and improve the learning process. It can help us understand ourselves and our emotions during the learning process.

## 2.2 Artificial Intelligence-Human Interaction and its impact on Education

The notion of autonomy is crucial for Artificial Intelligence. This in turn includes three pillars:

1. Perception
2. Cognition
3. Action

The autonomous mobile robot CoBot, developed at Carnegie Mellon University, was presented as an example because it fulfills all these three aspects. Crucially, it has its own mobility, which computers and smartphones do not possess. Hence the Artificial Intelligence it has incorporated needs to process *real-time* data (giving an answer in a month is not enough), and sensory data (voices, images), in order to make decisions and move around the University.

CoBot has a sensory system which allows it to know the distances to all obstacles around, like Google cars and other autonomous cars do. Moreover, it takes into account uncertainty in its decisions. But as they gather more information, they are able to become better, uncertainty decreases, leading to more confident decisions.

However, as it is well known, Artificial Intelligence has many limitations. The first is that, in most Artificial Intelligence applications, the system encounters cases in which its training is insufficient, thus requiring humans to help to ensure the decision is right. Hence, a new approach of “symbiotic autonomy” was proposed as the best way to keep developing Artificial Intelligence solutions in the world: every time the uncertainty is too big, the Artificial Intelligence system should ask for help. This new way of human-Artificial Intelligence interaction was again shown with the CoBot example, making it clear that there is still a long way to go with the development of Artificial Intelligence.

Another usual limitation of Artificial Intelligence is its lack of transparency. Indeed, as Neural Networks and other algorithms are still “black boxes” from which it is often hard to obtain information, it is very important that Artificial Intelligence systems “verbalize” their “thinking”. The inside of a robot such as the CoBot is cryptic, hence one needs to translate the autonomous experience of robots to natural language. *Verbalization* is one project in this direction that has been developed in Carnegie Mellon and is also presented as a crucial development for Artificial Intelligence systems to be able to expand to other industries.

These developments of the Artificial Intelligence-Human Interaction trigger the need for new skills, including decision making and data skills. For instance, the “Kindergarten” curriculum should include data skills, such as being able to interpret uncertainty, distributions, and data-based decision making. This, in addition to simple arithmetic, will make our kids ready to interact with Artificial Intelligence in the world, as experience has shown that people who absorb these basic data skills are good at adapting and making good use of Artificial Intelligence technology. Furthermore, children need to understand that Artificial Intelligence can assist and provide help in making choices in real life, as well as grasping the importance of ethics with respect to its development.

### ***2.3. The Data-Intensive University: Blending Artificial Intelligence with Higher Education***

We live in a world largely influenced by data, where a lot of data is collected and processed every day. At the same time, we live in a world of shortening attention span, which makes it harder and harder for any educational institution, but particularly for universities, to educate and conduct the research needed to fulfill their missions. In light of these transformations, how should universities evolve? The “Data-Intensive University” was proposed as a framework for higher education to adapt to the Artificial Intelligence and data era.

Many traditional concepts of the university should be challenged: the chapel or the library is no longer the center of the university. Classically, university is a place for the teaching of knowledge, as well as for the creation of new knowledge. In modern university, this clear interpretation is lost.

The biggest change in the concept of university was the change from pre-industrial revolution universities to modern ones, where experimental research became much more important, and was combined with the concepts of the English college and the American Research University. After the “theoretical” and “experimental” paradigms of research, in the last years of the 20<sup>th</sup> century and the beginning of the 21<sup>st</sup>, computational power again introduced another important change on how research was done at universities.

Finally, we have come to a moment where data has become the 4<sup>th</sup> paradigm of research (theoretical, experimental, computation, data-intensive). In the tech age, where data is readily available with increasing rates of production, *we need a data-intensive research university running data-intensive science, which can help us advance our knowledge of the universe and the human being.*

Universities as they existed previously have created wealth, but there is great inequality. For the data intensive university to become better than the previous version, today we need to ensure equality of access to computation and data sources, as the value of Artificial Intelligence does not generally lie in the algorithms but rather in the data itself and the possibility to compute it. To tread this path towards the data-intensive university, important investment in digital infrastructure will be needed, otherwise universities will not be able to keep up with the data-based research done at private companies.

## **3. The Long-Term & Philosophical Perspective**

### ***3.1. The Minds for the Future***

Although the main psychological studies developed by Howard Gardner point to seven and even nine different intelligences or cognitive capacities in the human brain, *when thinking about how to design Education for the Future, policy makers can work with the broader concept of “mind” rather than the seven intelligences.* Developing a “mind” entails combining several of those intelligences in a way that suits a specific job and gives the person the capacity to be employed, interact with the world and become productive for society.

When thinking about the future, there are five minds which need to be fostered in younger generations through education if we want them to succeed in the coming future. These are the “disciplined mind”, the “synthetic mind”, the “creative mind”, the “respectful mind” and the “ethical mind”.

The “disciplined mind” is related to the gaining of expertise in an area of knowledge and therefore relies on memory and systematic effort to be developed. The “synthesizing mind” is one that will enable people to cut through the clutter in these times of information overload and to be able to extract key important messages that really matter from any kind of communication. The “creative mind” is the one needed to be able to create new knowledge, new products or new processes, and will be a key differentiator from machines in the era of Artificial Intelligence. The “respectful mind” is related to empathy and tolerance, and is increasingly needed at a time of globalization in which, finally, minorities are starting to reach greater levels of equality. Finally, the “ethical mind” helps individuals to take a step backwards and understand whether their work and actions are consistent with their values, and to be able to distinguish the good from the bad.

Of special emphasis should be the power and importance of the synthesizing mind and how it could be fostered through education. In the era of fake news, shorter attention span, social media and massive content and information consumption, there is no doubt that developing this specific mind is a requirement for any individual to succeed personally and professionally.

Great synthesizers come from any area of knowledge and expertise. For instance, Picasso’s *Guernica* is a great visual synthesis of the Spanish Civil War and captures the essence of the 20<sup>th</sup> century. Further, synthesis comes in many different shapes and formats: TED talks, tweets, textbooks, etc.

However, it is important to realize that not all syntheses are good, and therefore this dimension of the mind must be taught and learnt in the right way. The first requirement for achieving a good synthesis is to establish a clear goal. Then, information must be gathered, often in larger quantities than what is actually needed. At this point, different methodologies exist, including narrations, maps and metaphors, useful for any project aimed at synthesizing.

When teaching the “synthesizing mind”, educators need to bear in mind the different threats which can affect a synthesis: too broad, too mired in details, improper conceptualization, improper execution, inappropriateness for a certain situation, insufficient attention to feedback, aspiration for creativity, etc.

To synthesize for the future, words such as “inter”, “multi” and “meta” need to start appearing in these syntheses, as the growing complexity of the world requires higher levels of abstraction and combination to create meaningful syntheses which can lead to the right conclusions.

In the 21<sup>st</sup> century, Apps are one of the best ways to synthesize, as they enable us to avoid remembering facts which are not necessarily useful, such as routes or calendar appointments. There are many apps for synthesizing, so we just have to make sure that the app we choose is appropriate for our synthesis.

The only big question regarding synthesis in the coming years is whether Artificial Intelligence could become capable of generating better synthesis than us.

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*“There exists something beyond human rationality which science cannot answer.”*

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### ***3.2. On ‘Truth’: A Philosophical Look at Biased Reasoning. Preparing Future Generations for the Information Avalanche***

We live in the era of “post-truth”, a time in which facts are less relevant for swaying public opinion than appeals to human emotion.

Today we live in a world where objective inquiry is being attacked. We live in a world where it is easy to make objective inquiries, but people no longer undertake them, even if it just requires asking Google.

There are vulnerable populations who are particularly undefended in front of the “post-truth” era: young, naive inquirers. We need to emphasize the importance of educating children, fostering their critical thinking and enabling them to distinguish fake news from real news.

“Post-truth” is associated with postmodern philosophers like Richard Rorty and Jacques Derrida, who emphasized the omnipresence of “strategies of interpretation”, many of which aimed to lead one to truth.

A lot of politicians still push for content in education, but this is a huge error. Education should be mainly about acquiring the capacity to reason and infer, so that children can learn what they still do not know, and they may become capable of discerning the good from the bad and the true from the false. Epistemology and reasoning, for instance, should become part of the curriculum.

### ***3.3. Staying Rational –The Perils of Religion for Human Advancement***

A well-known science professor, also a prominent atheist who sees religion as an impediment to the full investigation of reality, used his speech as an opportunity to assert the ascendancy of science.

The deepest understanding is to be found in the sciences, he claimed, which cast their penetrating gaze into the fabric of society. We stand in awe at the wonders of the world, which only science allows us to better view and understand. It is essential that we share our knowledge of the workings of the world, that we encourage to search for insight. There is nothing in the world that the scientific method cannot illuminate, and it is essential that science be at the heart of any future vision of education. Progress in science springs from imagination, but imagination alone is insufficient for good science. Technological innovation is another essential factor.

In contrast, religion was presented as the ultimate fake news, though some think it is one of the great modes of understanding, and a way of providing purpose in the world. Religion closes minds and inhibits deep understanding, providing interpretations of the world that are very easy to accept blindly. Some religions blatantly refuse to accept a true understanding that comes from science. Religion, he continued firmly, contaminates minds, constitutes the antithesis of science and scorns the power of human understanding. Religion is for brains too puny to achieve understanding, whilst science is a true and abundant source of understanding.

In describing his vision around the future of Education, all scientific advances are welcomed, to the extreme that the sooner robots eliminate teachers, the better. Perhaps the professor, himself the author of many renowned chemistry textbooks, was now fatigued by many years of teaching, and had consequently begun to advocate a vision of academia where researchers are left to discover without the burden of teaching.

Members of the audience challenged some of the speaker's bold assertions, suggesting discoveries often come from intuition, and that there exists something beyond human rationality which science cannot answer, mainly relating to the origin of the world and the destiny of human life.

## **4. The Political Economy of the Future**

### ***4.1. Was Milton Friedman Partially Wrong? Economic Prosperity, Welfare and the Role of the Private/Public Sectors. A Leap Forward in Governance.***

There is a key assumption about the way that a business should operate, which is commonly accepted and which few people challenge: that profit should be maximized. This assumption is the basis for Friedman's argument that companies should maximize profit in the interests of shareholders (the so-called fiduciary obligation), whilst ethical questions should be left to individuals and governments.

For instance, Friedman argues that companies should not give to charities but they should have the shareholders' interests entirely at heart. If they make more money, the shareholders should have greater dividends and they can choose what to do with that money, giving to charity if they so wish.

A counter-example was then given to break down Friedman's argument. Imagine, for instance, you are a shareholder of Walmart. Walmart has, at times, sold high capacity magazines in various stores in the US, of the sort used in mass killings. This may well be good for profit. If it is good for the bottom line, then Friedman would argue that we should let Walmart sell guns, maximize profits, give more money to shareholders and, if they care about gun control, they can give their dividends to gun control organizations. The key point here is that it is far more costly to undo the consequences of gun control than to prevent it in the first place. The same point can be made about the pollution of a lake, where the cost of cleaning up the lake far exceeds the cost of preventing its pollution by technology in the first instance.

One of the speakers argued that consumers are willing to take into account the negative externalities of consumption, in their own consumption decisions. For instance, when

buying chicken from a free range farm, they are clearly considering social factors. We clearly internalize externalities in our private lives, and we act on our ethical concerns in consumption. Hence, if we are prosocial in our private lives why would we not want the company we invest in to become prosocial as well?

The point is that Friedman's view is quite restrictive to the case of separable activities, where we can separate money-making and ethical activity. Because these two are inseparable, companies should maximize shareholder welfare, not market value. Thereby, a radically new interpretation of fiduciary duty for a company's board and for mutual managers was given.

Moving onto the practicalities of the argument: how then can a board maximize shareholder welfare in practice? How can the board find out what shareholders want? The board cannot possibly consult shareholders about every decision, but shareholders should be able to vote on corporate decisions with major social consequences. Indeed, technology makes it easier to consult shareholders. Imagine an app that allows shareholders to swipe one way or another, thereby integrating social welfare considerations into company decision-making. Or consider an index fund that looks like any other index fund but says that it will vote against guns and ammunitions. Or imagine a freedom fund that will fight against dictatorial regimes. This is profit maximization, subject to social welfare constraints by shareholders.

Current legislation in the US makes it difficult for social issues to be put up for shareholder vote. The SEC has formally not been so sympathetic to this suggestion. The only protest option is thus divestiture, but this could put the stocks into the hands of people who are not socially conscious, who will pollute more, and are happy with benefiting from gun sales at the expense of the victims of mass shootings. Meanwhile, companies often justify their immoral actions by referring towards their fiduciary duty to shareholders to make as much money as possible.

#### ***4.2. Beyond Economic Development: the Role of Civil Society and the Private Sector in delivering Economic Advancement***

The Open Society Foundation is one of the largest private foundations in the world with an annual budget of \$1bn, which is disbursed mostly in the form of grants to civil society, in service of their mission "to build vibrant and tolerant societies whose governments are accountable and open to the participation of all people."

This Foundation has a new global program focused on economic advancement, where they measure the impact of their investment funds not in terms of profit, but social and economic outcomes. In doing so, they have faced the question: what is the role of economics and what is the role of civil society in achieving its objectives?

There is certainly a consensus around the idea that we are at a deeply problematic and confusing moment in history, a time of huge promise and great disappointment: we now have greater technological capability and economic resources at our disposal, than at any time in human history, and yet we see signs all around us that the traditional sources of societal solutions—politics, philosophy, religion and economics—have all failed spectacularly to deliver their various promised lands in the 20<sup>th</sup> century.

As a society, we have moved from the problem of insufficiency (not having the raw materials or resources to address our problems), to the problem of ignorance (not possessing the knowledge or technology to address our problems), to the problem we now face of ineptitude (where we possess both the resources and knowledge, but are unable to organize ourselves to solve our problems). Education, and in particular the problem of values and citizenship, is a key method through which we can go about addressing this ineptitude. There is a consensus that economics has something to do with the majority of the problems we face today, although we may disagree on the degree to which its contribution is critical.

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*“We have lost the notion of economic growth and development as being of instrumental value—that it is only useful in the measure that it enables and serves the development of human capacity and the advancement of society.”*

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In light of the loss of the kinds of security provided by robust welfare states, by steady jobs, public goods, etc., we try to recreate a lost economic paradise. But what if this solution proves too simplistic a way of seeing things? Are we confusing the loss of things such as decent wages, or robust public goods for the loss of what accompanied them: a sense of belonging, a sense of shared purpose? We are prone to that confusion because our understanding of what the economy is and should be, and its role in shaping human well-being, has become increasingly narrow and insulated.

We experience a global disillusionment, but the North and the South have come to this by different paths. But irrespective of these paths, we have come to a point where economic development is largely seen as a development of intrinsic value, an end in itself and an absolute good. *We have lost the notion of economic growth and development as one with instrumental value—that it is only useful in the measure that it enables and serves the development of human capacity and the advancement of society.*

What we require is not just re-connecting economic growth or even inclusive growth with democracy. What has been lost is an older and deeper way of thinking, relating to how economic relationships and new technologies connect to not just economic anxieties but to a sense of belonging. We have a moral duty to build a coherent society where our economic decisions are in accordance with our ideals, and our aims are matched by our actions. In this framework, our task is to not just reduce economic insecurity, but to address how the economy feeds into how people feel as citizens, how they understand their rights and responsibilities, how they commit to tolerance or dialogue and understanding even as they feel a sense of power. And thus, our goal should be the advancement of society rather than the development of economics for its own sake.

The reason why the Open Society named their program as the *Economic Advancement* program, not the *Economic Development* program, is that their focus would remain

on those forms of economic activity that enhance a much richer sense of social welfare, one that especially includes meaningful opportunities for community, social and political participation. In the Stanford Social Innovation Review published recently, Mark Kramer included this quote from the Universal House of Justice: “social change is not a project that one group of people carries out for the benefit of another.” One of the great problems of traditional economic development projects in the development infrastructure has been to treat their target communities as passive beneficiaries rather than active protagonists of their own development.

Without participation, without the active voice of civil society, no amount of growth or economic development will address the problems discussed at the outset. Without meaningful participation of the kind that can be facilitated through engagement with civil society in various forms; without discourse that recognizes the agency and voice of all people; and without education of the sort that we envisage here that focuses on values and morals, we will have only economic development, and not economic advancement, and we will find no solution to the current crises that we face.

### ***4.3. Education and Economic Prosperity***

Academic research on economics has undergone a drastic shift in the past few decades, evolving from a theoretical type of science, similar to mathematics or physics to a more empirical science, largely based on statistics, using methodologies coming from clinical trials.

In the project ‘Deep Impact’, machine learning has been used to classify academic work on economics. Machine learning achieved 87% accuracy in this classification, compared to the 85% accuracy of human classifiers. Out of the top ten cited papers in the 70s and 80s, there was only one empirical paper, now there are up to six. For instance, labor and development economics have gone from 60% papers presenting empirical contributions to 90-100% basing their findings on empirical analyses rather than simply theoretical proposals.

This trend shows that economic research has changed a lot and has become more grounded in the world. It is also reflected in the fact that other fields, ranging from psychology to medicine, have started citing economics literature far more often, clearly due to the empiricism of this new approach.

However, this change in economics research has not reflected in the way economics is taught at schools and universities. In the ’60s and ’70s, complicated mathematical models, including multilinear regressions and similar ones that were supposed to model the economy, were commonly taught in economics. This type of thinking is still very present in today’s way of teaching economics.

This is very different from empirical work researchers do today, which likely starts with specific causal questions and then uses statistical methods to answer them. For instance, in the ’70s, economists would attempt to model the school system with complicated regressions. Thirty years later, in 2002, Dale and Krueger wrote a paper focused on the effects of college characteristics on post-graduate earnings.

Therefore, one can easily conclude that there is an important need for change in the way Economics is taught if we want an easier transition from Economic studies to Economic research.

#### ***4.4. Role of Public Investing in Developing Skills and Innovation***

Based in Luxembourg and now 60 years old, the European Investment Bank (EIB) is the biggest multilateral development bank, twice as big as the World Bank, which is increasingly focusing its efforts in developing human skills and innovation as the pillars of its strategy. The role of this type of institution goes beyond pure financing to the stimulation of crowd behavior to invest in the right type of products and projects.

The biggest challenge of this institution and others which seek to finance innovation is to do two things at once: to fix issues of recession on the one hand, and to finance the R&D necessary for innovation to appear, on the other.

The investment situation in Europe is quite dramatic. Despite the good news of economic recovery, European investment is 10% below the investment levels of 2007, and their American counterparts are especially lagging in digital investments. There is an annual investment gap of €130bn, compared against the pre-crisis level, and to reach the EU goal of 3% of GDP invested in R&D, an additional €140bn is needed per year.

There is a special division of the European Investment Bank dedicated to the growth of SMEs. It is important to find a way to sustainably finance them, so as to enable those companies to focus on their growth rather than on chasing investors.

There are many important projects being supported by the EIB, including the European research infrastructure (CERN), as well as private companies including Spotify and Skype, or public projects abroad such as the Ethiopian telecom network.

On the borrowing side, the EIB helped develop the market for green bonds and is currently helping build social awareness around bonds fostering the SDG objectives, including access to water, education and health projects.

As far as the SDGs are concerned, it is important to build an environment for sustainable investments and make efficient use of many financial instruments. Amongst the greatest contributions of the EIB and other supra-national institutions such as the IMF, is the mitigation of financial volatility and a focus on the sort of needs that are most urgent. The African continent has to become a center of particular focus as it has a lot of challenges to face. If nothing changes, nine out of ten of the poorest people in the future will live in Africa.

There is enough money in the world and it has been demonstrated in many cases that making money is compatible with having a good impact: it is just about making it flow in the right way.

## **5. The Pedagogical Perspective**

### ***5.1. Reinventing Education: École 42, a Digital Transformation in Education***

École 42 is a computer programming school based in Paris created and funded by French

telecommunications billionaire Xavier Niel. The mission of École 42 is to help address the lack of IT professionals in the world through an innovative teaching model based on collaboration and project-based learning.

The school does not require a degree for entrance (approximately 40% of students do not have the French equivalent of a high-school diploma) and it fully funds the tuition of any accepted candidates; these are selected through a blind application process involving online tests and a peer-learning exercise known informally as “the pool”.

The school grants students the flexibility to complete the course at their own pace, but many receive employment offers mid-program and choose to pursue formal work without finishing the degree. According to the leadership of École 42, the number of jobs and internship opportunities extended to students is roughly double the total number of the student body. École 42 does not yet collect data to assess ethnic, gender, sexual, and socio-economic diversity, but this is very much on the agenda going forward.

With the establishment of similar schools in Brussels, Amsterdam, and Moscow, École 42 hopes that other cities are inspired to implement this educational model to strengthen the digital economy of their countries.

## ***5.2. Assessing the Quality of our Education***

In the era of Artificial Intelligence, students need to be able to extrapolate knowledge, not repeat. Content is important, but being able to design experiments is more important. It is really all about competencies. Indeed, within the PISA (Program for International Student Assessment) Global Competency Framework, which the OECD has developed, qualities such as empathy and creative thinking are of essential relevance.

The PISA assessment values the capacity to think like a mathematician or scientist. To perform well in a specific test takes several months, whereas to teach someone to do well on a test of multiple competencies such as the ones discussed can take several years. When we look at the PISA results, we see a correlation between greater stability and better educational results. Policy coherence is very important for education. Countries with greater systemic coherence rank higher.

PISA is still at the beginning of its framework development for creativity and cognitive science. There is a real need for teaching empathy, with some countries doing better and some doing worse in this respect. Empathy is absolutely essential to education right now, and the learning environments we create can make a huge difference in our willingness to engage, to work as a team, and to empathize with one another.

Whilst competencies like creativity or empathy are much harder to quantify, their measurement is key to the future of education, as things that are easy to teach and easy to learn will be learnt by Artificial Intelligence. Meanwhile, it is more important than ever to teach and learn complementary skills which machines cannot learn, and which only humans can thus provide.

The example of literacy is very illustrative in this distinction between what Artificial Intelligence can learn and what humans should be educated on. A few years ago, literacy was simply a case of extracting information, but Google now does that for us. Now, literacy is more a process of transposing viewpoints, discerning tensions and dilemmas, and distinguishing truth from falsehood. Being able to think for oneself is the sign of moral and intellectual maturity.

What is increasingly important is the capacity of students to anticipate and look forward, and to think about new ways of working, rather than just absorbing knowledge. The practices of anticipation and reflection are highly valuable. However, the time students have is limited, hence the need to balance between breadth and depth of curriculum. Further, assessment technology is improving our possibilities massively in being able to formulate a system that best serves the next global generation.

Across different countries we see different strengths and other capacities somewhat lagging behind. For instance, China and Japan came out very strong on individual problem solving skills, but then scored low on collaborative problem solving. What is also interesting is the difference between countries' own assessments of their ability and their actual performance. For instance, when we survey teachers in the United Kingdom, they believe students ought to be taught to think independently, yet Britain is at the very top of the list of countries when tested for rote memorization, with Switzerland, Poland and Germany memorizing the least and fostering an attitude of independent thinking. Indeed, more generally, the United Kingdom has the largest gap between intended and implemented practice. China, surprisingly, actually falls somewhere in the middle of this measure.

The above information shows how the data we gather often contradicts our beliefs. Our stereotypes are further contradicted by cases such as Singapore. *We might think that educational systems that are very content-focused lack procedural quality, which is to say, the ability to understand methods, rather than simply regurgitating information.* If a course is very high in content, there is a risk of lack of procedural quality. In Singapore, however, the educational system is better than average in terms of content, but even better relative to the average, in its procedural quality. Another interesting insight from the data was that greater poverty of resources is not the be all and end all. For instance, the lowest 10% of the performers in Shanghai in mathematics outperformed the top 10% in the US. The results from the OECD data also caused great shock to the German educational system, clearly revealing a certain neglect for students of lower income and immigrant backgrounds. There is huge room for improvement in this area, with the revelation of such clear data-driven findings enabling a more urgent response.

### ***5.3. A Learning Revolution through Technology***

In a Scandinavian class, a test was made in which all students answered class questions and performed assignments on their own personal school laptop. The program they used fed live data back to teachers, who in turn, were able to infer achievement, performance and effort from this data. Is this the future of Education?

Indeed, at the Altius Conference, several illustrative stories similar to the one above were described to show how teachers can be empowered through technology to better educate their students. For instance, a Finnish school teacher renowned for the success of some of his methods enables students to give answers with their smartphones to certain questions which they read off an interactive whiteboard. The data is fed back personally to the teacher, who can see what answer each student has given and why. What is so interesting about this teacher's attitude is that, if a student falls behind, he is able to question the exact nature of 'behind'. Everyone is different, after all, and what is important is not what has happened in the past, but rather where one is headed next. This teacher is of the view that we should delete the idea of competition from education. Instead, we should create environments where students can fail without fear. More importantly, technology is being used to enhance and make competition more excruciating, but not to reveal information that can help the teacher in personalizing each student's experience, and help him or her to achieve success on his or her own terms.

Also in the Nordics, this time in Denmark, a teacher artificially created two identity groups, which were given different beliefs or values that they had to defend in the context of a class debate exercise. The teacher only intervened in this discussion with open questions, rather than with the idea of trying to drive a correct answer in the debate. Schools are the only public spaces left in which we can undertake an inquiry into our shared beliefs with others. In a world engulfed by technology, we ought to ensure that these public spaces remain a part of our educational experience, alongside the emotional intelligence and open-minded thinking that surely result from them.

What all these examples clearly show is that, *with thorough research and investigation, technology can enhance and recreate our educational systems, whilst the use of technology has to go hand in hand with certain values that would ensure the development of qualities and skill-sets that technology, on its own, cannot deliver.*

We are also to be admonished for being wary of educating solely with technology, as there are many aspects of education which Artificial Intelligence cannot substitute and where human contribution is key. Furthermore, it is the work of our generation to elevate the teaching profession, and to work on developing the political and cultural environment required for educating the next generation responsibly, in a way that would hopefully foster a more equitable world, not just a technologically more enhanced one.

#### **5.4. Education for Mathematics and Science**

It is clear that, in a world changing this fast, the role of Education must be to produce creative, flexible thinkers. We have seen, in recent years, an increase in the demand for STEM-educated people, which makes the teaching of mathematics and science essential for the development of future generations.

In this sense, there are several trends in the teaching of mathematics and science which are worth analyzing:

- An increasing focus on reasoning and inquiry in both mathematics and science

- A focus on problem-solving learning, which is thought by most to be a good pedagogical procedure
- The increasing development of digital tools, particularly to teach mathematics
- An adaptation of the teaching of mathematical concepts, clearly impacted by the increasing relevance of Computer Science
- Growing differences in the motivations and attitudes towards studying mathematics and science beyond the compulsory age, with much greater interest among people with higher socio-economic status, as it is clearly related to higher future earnings

Indeed, Conrad Wolfram described mathematics as the anchor subject for computational thinking, which positions it as key to the development of younger generations who live surrounded by technology and digital tools.

However, one might wonder what politicians could be thinking when they design the mathematics curriculum, which is still too focused on mathematical computation. Instead, it should be focused on mathematical literacy, which is the capacity to formulate, employ and interpret mathematical reasoning, to describe, explain, and predict well-founded judgments. In the same vein, our curriculum still lacks a lot of scientific literacy: reasoned discourse and explanation, design of scientific enquiry, interpretation of data, etc.

*This distinction between learning to think and learning content is the key to the future of Education.* In the current “shadow ecology of knowledge”, a situation in which children and young adults are sharing knowledge in an unstructured way, from using technology to watching YouTube, it is more important than ever to teach young people critical thinking and reasoning.

## 6. Final Remarks

The aim of this paper is not to provide the final solution to a transcendental problem, but rather to open the minds and spirits of the readers to important questions and create in them a need to solve them.

The work required for implementing the very innovative methodologies, competencies and curricula we envision is enormous, and it involves a great and heterogeneous variety of actors and institutions. Moreover, the urgency for a change in education is being put forward, as the longer we take to reform the system, the more people will fall behind the technological revolution we are experiencing.

Major questions arise in light of the analysis of these transformations: how to educate and empower citizenship; the need to redefine human values; how to develop critical thinking and understanding in our contemporary societies; the future of educational institutions amid the rapid economic and social transformation enabled by technological disruption; training and instruction to prepare for increasingly complex economies and societies; the prospects for a new paradigm of national and global governance... All these questions point to a central theme: that of the empowerment of the human mind, to build on the benefits of the Age

of Artificial Cognitive Machines, while overcoming the challenges of large scale automation and the disruption of communication technologies: the ‘machine’ as a means to augment rather than substitute human potential.

The problem of ethical values in education is certainly one of the most relevant issues for future discussions on the nature and scope of education. Indeed, the standing questions are what kind of minds we need in order to address the emerging challenges of this interconnected world, in which abundance of information does not necessarily lead to an adequate development of human capacities, and whether we will bring about a new renaissance in human thinking.

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