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Business education in the era of the metaverse

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Executive summary

The landscape of business education is undergoing a paradigm shift, with radically new digital spaces (and the drastically improved access to it) taking center stage in this transformation. As digital technology advances at a rapid pace, it presents both opportunities and challenges for educational institutions, which must strike a delicate balance between elite signaling, quality, and accessibility. The growing fragmentation of the business education market, marked by an increasing number of prestigious institutions, underscores the urgent need for globalized access to content. This document delves into the current state of digital technology, focusing on three core developments - the metaverse and augmented/extended realities; generative AI; and Web 3.0 - and their potential to revolutionize the future of business education.

The first Section of the document addresses the central dilemmas faced by business education. On one hand, there is the tension between maintaining the prestige and quality of elite institutions, while simultaneously ensuring widespread accessibility. On the other hand, the market is characterized by fragmentation, with over 100 elite business schools vying for students, even as content becomes increasingly globalized. This section establishes these challenges as the foundation upon which the exploration of digital technology will be built, delving into topics such as management as a profession, three major waves of transformation, the transformational role of technology, a new way to think about mission, and the magic of "what if," ultimately focusing on multiplying impact.

In Section two of our whitepaper, we emphasize the central role of digital spaces and the metaverse, as well as two other key digital technologies shaping today's educational landscape: next-generation AI and Web 3.0. We begin by retracing the development of these broad tech areas up to the present moment, examining their current state and expected future advancements. Furthermore, we discuss the major innovations related to each technology within the education sector. The metaverse, extended & augmented realities are unlocking unprecedented possibilities for immersive and interactive learning environments, facilitating previously unattainable engagement and collaboration among learners. Web 3.0 is fostering a radical shift in credentialization while enabling more decentralized, secure, and tailored learning experiences. Cutting-edge AI has transformed educational tools, paving the way for adaptive learning systems and individualized feedback.

We then move from diagnosis into vision and strategic planning. To do so, we first need to assess the forthcoming demand. Our analysis up to this point reveals a rapidly shifting landscape, necessitating an executive education that is both stable and flexible. We propose a skills map to navigate these changes, with the gap between current and desired skill levels dictating the focus of future education, divided between Core, Modular and Cross-cutting skills. Core Skills include visionary problem-solving for disruptive capacity, while Modular Skills encompass efficiency, exponential growth, disruption, customer and data centricity, curiosity, innovation, and agility. Cross-cutting Skills address the critical impact of digitalization on sustainability. It is our view that technological solutions should be evaluated based on their ability to meet these skill development goals, ensuring leaders can effectively adapt and succeed in the evolving context.

Following this exercise of skill mapping, Section 3 explores the broader, long-standing challenges of online education and examines the approaches currently being undertaken by businesses to address these issues. As digital technology continues to evolve, online education must adapt to ensure quality, engagement, and efficacy. We aim to provide an (admittedly ambitious) vision for this path forward, discussing potential strategies and innovations that could revolutionize the online learning experience. We propose three milestones of emerging technologies, and we attach specific developments that may go along each milestone, while taking a careful view into emerging private and public-private initiatives that allow us to anticipate these trends. Here, ours is an exercise in long-term vision that hopes to inspire a horizon to aspire to.

The crucial counterpart to every long-term vision is an immediate call to action. **Section 4 takes on that responsibility by performing a double switch: from a broader education perspective to a narrower point of view focused on business education, and by building a bridge in the short and medium term that makes it feasible to reach the long term.** It does so by presenting a comprehensive strategic plan for revolutionizing business education through harnessing the potential of digital spaces, the metaverse, and other digital technologies. First, we outline the key areas needing attention, pinpoint specific challenges within those areas, and suggest actions to tackle these challenges. Our strategic plan envisions a future where digital realms facilitate global access while simultaneously maintaining top quality and upholding prestige. By capitalizing on the multiplying power of the joint pillars that will define new digital spaces, we aim to make business education both hyper-personalized and hyper-accessible. The discussion encompasses various aspects of education, such as the impact on learning models and processes, aligning educational supply and demand, reimagining environments and roles, and nurturing an ecosystem-based model.

After detailing the "what to do" approach, we proceed to identify the key stakeholders that must be mobilized in order to actualize our vision, and more specially, we provide an approach to activate them. The metaverse, dWeb, and XR technologies are converging to form a new ecosystem that can revolutionize the education sector. To successfully deploy this complex system, three essential factors must be considered: vertical integration across the stack, interoperability between platforms and chains, and a smooth migration plan from old systems to new. However, the most significant challenge lies in coordinating the efforts of various stakeholders, including universities, governments, and companies, which have traditionally been centralized. To truly benefit from this technological transformation, there must be a willingness to adopt decentralized content, operations, and financing among buyers of educational services, the establishment of interoperable web3 learning standards by academic institutions, and the development of products that meet these standards by big tech and startups. This requires overcoming the inherent tension between centralized and decentralized entities to harness the full potential of these emerging technologies.

We wrap up with the last and deepest tier of our strategy: learning methodologies. The educational landscape is already undergoing significant transformation due to the introduction of these disruptive technologies, which are challenge traditional methodologies and demand the reevaluation and reconstruction of educational paradigms. Our vision requires a shift towards personalized, individualized learning experiences that cater to the unique needs of each student, promoting a culture of collaboration, and fostering a sense of belonging and shared purpose among students. Educational institutions must strike a balance between leveraging digital tools for information access and fostering the development of robust memory skills in students and professionals. As virtual humans take on more responsibilities in education, it will be crucial to consider the ethical implications and potential challenges associated with delegating these inherently human roles to AI entities. These changes present a tremendous opportunity for societies to leapfrog and become equalizers. However, the speed of this social process is difficult to predict, and for better or worse most of the innovations will come from unregulated areas of learning.

These four sections follow a logical order but the content laid out here is devised so it can be consumed piecemeal as well, directing the reader towards a certain tool that will hopefully help him or her thinking about the challenges at hand. That is why we provide a detailed index to give the whitepaper a toolbox dimension along with its more narrative spirit.

All in all, the present whitepaper aims at serving as a starting point for opening a space of experimentation, where we aim to amplify the mission of business education beyond the "cage of rankings signaling" and embrace the transformative potential of digital spaces. It is at the same time a ‘provider of vision’ and a ‘provider of tools’, marrying hope and ambition with specific ways to think about how to reach these horizons, where tensions between elite signaling, quality, and accessibility can be addressed through the power of these new digital spaces and by fostering collaborative efforts among various stakeholders in the business education ecosystem.

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Part A

Diagnosis and current landscape

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Intro. Business schools –the urge to democratize access

To thrive, business schools must balance competing, entrenched tensions: between signaling quality and access; and between market fragmentation and content access globalization. New disruptive technologies could be a crucial lever for the future.

Management as a profession

Let's travel back in time. It is the 1950s and we are middle managers with aspirations to become C-level executives at one of the major industrial **corporations in Europe or the US.** We have been previously trained in engineering and finance and our knowledge about the main product that our company manufactures is astonishing. However, we lack an integrated view of the company, and for the most part, we believe that decision-making in our organization is not an evidence-based process. If we go backwards a couple of decades, we might even see how major decisions about a takeover, a merger, and a product launch were made following gut instinct from those in charge. This reality describes most companies, even in the most advanced parts of the world, until the last few decades. This is why, in 2010, Rakesh Khurana, a former Dean from Harvard Business School, wrote about the history of business schools in his book *From higher aims to hired hands,* in the following terms: "university-based business schools were founded to train a professional class of managers in the mold of doctors and lawyers"[1]. However, in an unsettling tone, he added: "… but business schools have effectively retreated from that goal, leaving a moral hole at the center of business education and perhaps in management itself". What did Rakesh Khurana mean and why is it relevant when it comes to the impact of the metaverse in business education?

1. Khurana, R. (2010). *From higher aims to hired hands: The Social Transformation of American business schools and the unfulfilled promise of management as a profession*. Princeton University Press.

Three major waves of transformation

Business schools, since their inception, and in a variety of ways, have undertaken three massive missions when it comes to their role in society. In the 1950s, the period where our initial story started, business schools had the mission to create a new professional class in the vein of how Rakesh Khurana framed it ("in the mold of doctors and lawyers"). Constituting business as a profession required codifying knowledge as well as developing new standards of conduct.

This was the focus of business schools until the 1980s, when imbuing students/managers with a global mindset became the new mission. China had turned a new page in terms of commercial openness to other countries, supply chains were becoming more global, commerce started to flow at an unprecedented rate. These trends likely lasted until very recently.

In the last few years, globalization overlapped with a new wave: digital disruption. The confluence of Moore's Law, Wright's Law, and Network effects—the three main building blocks of the digital economy—has created a unique scenario of acceleration of disruption. According to Upfront Ventures, the cost of starting up a tech-based company decreased by 100x between the 1980s and the 2010s. As investor Naval Ravikant, puts it, we are living in the age of infinite leverage, as you can observe a compounding effect almost infinitely. To understand this concept, just consider how companies like Airbnb and Uber leveraged on computing power (cloud) outside their boundaries, or the tech stacks based on code libraries others had already written, as if you were assembling existing blocks of Lego, and finally, on assets sitting outside their balance sheets (apartments or cars). With the irruption of increasingly relevant AIs (generative AIs), this trend is only getting bolder, since building something new, even in the creative realm, can start with infinite iterations by a generative AI that can do anything from idea brainstorming, designing a creative process or writing code for us. Counterintuitively, starting a business is easier today because you do not need to start from scratch. New players have mostly focused on disrupting specific chunks of business models that already existed and that had an algorithmic nature. For instance, when Uber entered the mobility space, it did not become disruptive to the "joy of driving" or the "emotional of feeling of freedom when driving". Uber disrupted the idea of "taking you from point A to point B". This is why new digital players have had a relatively easy time disrupting a variety of industries. Regardless of product or industry, in many cases, the job was to make a chunk of an existing business model more efficient, faster, or cheaper, and repeat this pattern across industries. Companies like Grab, in Singapore, made mobility times more efficient, but then went into deliveries (food, shops, packages), hotels, payments, loans for affiliated merchants, and finally, became a fully-licensed bank.

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Within this context, it is no secret that most incumbent companies have had to develop emergent strategies to cope with digital disruption. In every disruptive process, new players usually compete outside the traditional boundaries of the industry, creating a new market share from scratch. Many times, the disruptor does not encroach on the incumbent's market share, but rather uses increased efficiency to attract new users. In other words, when Uber entered the mobility space, although taxi rides decreased by 20-25%, the entire "taxi market" increased

in the number of rides by 60-65%, with ride hailing companies like Uber or Lyft taking most of that growing share. As a consequence of this redefinition of the competitive landscape, incumbents need to reassess their strategy. Even decades after the irruption of Netflix in the content industry, an incumbent leading company like Disney is still figuring out how to balance its ability to keep what works from its core business, while at the same time exploring new growth areas like a streaming service. Apparently, new players don't face this dilemma, as the lack of a legacy to be preserved gives them a superpower to focus on what matters. This is why there is no alternative for an incumbent organization but to transform its business (from the business model to the corporate culture, opening room for experimentation). But transformation demands new capabilities and management skills. And this is where business schools have a new mission to develop.

Something has gone wrong

In the midst of this process of evolution of business school mission, spanning various decades from the 1950s, something went wrong. When drilling down, it can be observed that the system failure lies at the intersection of two words: fragmentation and globalization.

Business education is one of the most fragmented industries. Consider the top business schools, let's say, those ranked by the Financial Times. Could you name another industry where the "top players" are a list of 100 of them? These are less than 1% of the industry, which initially, seems like a good selection of the best, but they are still 100!. At the same time, consider this: in every industry, fragmentation makes a lot of sense when the market is essentially local. Imagine you own a restaurant (there are millions). As a restaurant owner, you could outperform other restaurants without trying to attract a global audience. Of course, if you are listed in the "top 50 restaurant list", or are a Michelin-starred restaurant, you are in a different category, but even in this case, you can largely succeed by attracting a local or regional audience. The main reason for this is that restaurants sell "rival" products and experiences. In economics, rival goods are those that can only be consumed by a single user (i.e., if I eat my pasta, nobody else can eat my pasta). This type of goods has obvious constraints becoming a global product or service. Because of these physical constraints, it makes sense for certain industries to remain more localized and, consequentially, more fragmented. The opposite argument is also true. Think of the global strategic consulting industry, where a few players dominate (BCG, McKinsey, Bain, etc.). A multinational industry with just a few global players. A BCG or McKinsey report works for many readers, managers and even companies at the same time. Even if a consulting process is customized for each specific company, the main patterns and lessons can be translated across the board in a global, unconstrained process. In other words, fragmentation works well for a locally-driven context, while non-fragmented is better in a global context.

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However, in business education, there are at least 100 "top" business schools in a market that turns out to be super-global and fully mobile. This makes the whole potential supply of business school programs relevant to the choice (the 100

schools matter!), unless there are specific barriers for students. This is something rarely observed in this industry, as you can basically find students from all over the world in every single MBA program. Therefore, if you are a prospective student to an MBA program, you will need somebody to clarify the competitive landscape and the market supply. Otherwise, the transactional costs of searching for the best choice will be too high. Moreover, a decision to study in an MBA program turns out to be one of the most important throughout one's career. It is a costly decision in terms of tuition, also in terms of forgone salary (opportunity cost), and also in terms of costs of (possibly) moving to a different city, state or country. How does the business education industry solve this conundrum? This is why business school rankings exist: a tool that reduces transactional costs for both students and recruiting companies, transforming business education into a "signaling" industry. Signaling—in the fields of biology and economics, is the process by which individual actors use a specific characteristic to explain their general fitness—applies in business education to a higher degree than many other industries. Being ranked as a top school, probably among the top 20%, signals general fitness, meaning a school that will open doors throughout one's professional career, always bringing better options and possibilities than the alternative of having studied elsewhere, and therefore translate into higher earnings throughout our entire life. For a recruiting company, signaling works great too: recruit a graduate student from a top-ranked business school, and I will be reassured about their abilities in specific soft skills, analytical skills, and work ethic, having being used to work long hours every day to solve case studies and other business school challenge-based projects.

> "The problem with signaling and the rankings is that it engages business schools in zero-sum game dynamics.

The problem with signaling and the rankings is that it engages business schools in zero-sum game dynamics. Everybody aims at the top 20, or top 20% of the ranking. Research from an AACSB (one of the main accrediting bodies) in 2014 found that schools at the top 20% benefited from a reputational flywheel: better ranking than the rest, more student attraction, higher student quality (measured by standard tests as GMAT or GRE), better internships, usually at big investment banking or consulting firms, higher salaries at the end of the program, higher salaries 3 or 5 years out, and therefore better ranking. Additionally, this high ranking is many times based on some pre-deterministic variables, as a school's historic reputation, prestige, and credibility, which can stem from the long legacy of a university's history, often a century old. (Ivy Leagues and Oxford-Cambridge are examples of this).

Rankings signaling engages schools in replicating the best practices of their other high-ranking competitors, which can cause a reduction in industry diversity and the ability of smaller schools to compete on differentiation. As this becomes a never-ending process, the top schools (20%) end up benefiting from winner-takes-it-all dynamics, attracting students with higher cognitive abilities, higher social connections, obtaining higher exit salaries, and reassuring the school they obtain a high rank. According to GMAC, this is one of the reasons why total enrollments have increased in the top schools in the last decade, while they have decreased in the overall business school industry.

Another of the side effects of this dynamic is that top business schools have kept, for the most part, their mission strongly rooted in the "elite" space of business education. As the ranking signaling favor certain characteristics, like exit salaries,

these correlate very strongly with higher scores in GMAT or GRE exams, which correlate with certain social and educational backgrounds prior to business school. In a research paper published at the Higher Education Policy journal and led by Prof. Josep Maria Lozano from Esade titled "Avoiding the Iron Cage of Business School Rankings" (2018), the authors advocated for business schools to widen the scope of their missions beyond the "cage of rankings", that constrained them into the "elite" segments of society.

The transformational role of technology

In the last few years, we have seen technology impacting different industries. One of the reasons behind the acceleration of transformation is the ability to recombine different technology platforms in a way that would have seemed like science fiction in the recent past. The fact that all technology platforms are made by "0s and 1s" makes them extremely modular: we can combine them as if they were blocks of Lego. Combine AI and IoT for autonomous driving, or DNA sequencing and AI to enable the next generation of vaccines, or energy storage and blockchain for a new model of energy consumption.

Across centuries, the main role unleashed by technology has been to make abundant what used to be scarce. The combustion engine vehicle made mobility and long distances accessible for millions of people, and contributed to create new industries, like tourism. Cloud computing has made computing power accessible and abundant for entrepreneurs, making startup creation and disruption a new normal. AI has made personalization at scale possible and highly accessible in the realm of advertising, and probably, in the near future, will contribute to make personalized education possible too. Currently, players like Khan Academy have already achieved most of this. Salman Khan recently introduced new generative AI tools that will enable teachers to create new content and courses in a more systematic way. Technologies create accessibility, turning old scarcities into new abundancies. In the process, they also become triggers for the creation of entire new industries in a way not envisioned before the application of technology itself. This is the importance the mantra "we don't know what type of jobs will have the most traction in the future", and the reason why the type of skills and competencies we should develop at university fall more in the realm of "critical thinking". Merely learning specific technical skills can rapidly become obsolete.

If technologies create accessibility and abundance, could new applications and combinations of exponential technologies contribute to expand a business school's mission?

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A new way to think about mission

Business schools, as most organizations, are constrained when it comes to their decision-making processes. Generally speaking, we feel captivated by the convenience of consensus. It feels good as managers to have meetings where everybody agrees. In order to make sure this will happen, we unconsciously collect data-based evidence, benchmarks and other market-related data that will be hardly questioned. As Roger Martin, former Dean at the Rotman School at the University of Toronto, puts it, "truly rigorous thinkers consider not only what data suggests". While the senior leadership of most organizations usually focuses on the "what" and the "how" (the "next steps"), we should allocate more room for deliberately asking "what if" instead of what, to aim for 10x instead of 10%, and to ask "what needs to be true for this to happen", instead of simply going for a linear "how". In other words, organizations should optimize more often for the long term, instead of continuously optimizing for the short term. The long term is a timeline that gives organizations permission to experiment with new ideas and accept failure as an invaluable source of learning. With more uncertainty down the road, it will be more relevant for managers to set and manage different options. Since no one has a crystal ball, creating those options and preserving them long enough in order to test their feasibility will become increasingly relevant. Every option starts with a "what if" question. The art of "prompting" or asking "what if" is one of the avenues where humans will add value on top of generative AIs. I recently asked ChatGPT to design an executive education course under a list of specifications that would have supposed a headache for any human facing that program design. However, by launching the right prompt, ChatGPT was able to share a number of options in terms of design, without even getting slightly tired or bored in doing that type of work.

Considering this framework, what if we became more playful when it comes to formulating business school mission? What if, instead of continuing the retrenchment of business education in the realm of the elites, we considered how to have 10x more impact on society? What if business schools took responsibility for tackling global challenges like the mismatch of skills between universities and industry?

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The magic of what if

In a consensus-driven decision-making process, as we described above, companies usually do the job of taking the current organizational capabilities to the future, in a process of simple linear extrapolation. It's only when we are forced to think in a non-linear way that opportunities (and threats) are unleashed in new orders of magnitude. Moran Cerf, a neuroscientist from Israel, says that sometimes, we need to cheat our brain in order to come up with extreme cases, positive or negative. Our brain, crafted in the African savannah thousands of years ago, doesn't have the ability to embrace the extremes of low probability events (for instance, potential disruptions, or potential positive upsides), as it needed to save energy to survive in "real danger" situations. As a consequence of this dysfunction, we need to force ourselves (to cheat our brains) to reeducate our perspective on specific problems and to see opportunities or threats that we wouldn't see otherwise. When we ask "what if" and force ourselves to improve by 10x (or 2x) instead of asking "what" and just optimizing for the short term in an incremental way, we are unleashing a certain magic that takes us to new boundaries.

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For one, forcing us to have 10x more impact, gives us permission to think about how to reach our non-customers, those that, generally speaking, would have never considered to become our clients or even clients of a specific category or solution altogether. For instance, those who don't fly are non-customers to an airline, while those who fly with a different airline wouldn't be "non-customers", but "potential customers". In business education, those that study an MBA program in a different business school are "potential customers", while those for whom a top MBA program will always be unaffordable could be categorized as "non-customers".

"What if" and 10x also force us to think beyond products. With "what" and 10%, we usually stick to our products and love to add features on top of them. We add a new course to an MBA, or a new study tour in Silicon Valley. We innovate by addition, but rarely think about subtraction, about going to the essence, to first principles. "What if" and 10x force us to rethink from scratch and to interpret reality from a lens of problems, challenges, or motivations. Theodore Levitt used to say that it's making a hole what matters, not the drill per se. Clayton Christensen, the "father" of the disruptive innovation framework, applied the "jobs to be done" theory to innovation. It's only when we understand the actual job to be done, the underlying motivation of why customers "hire" our product or service to do a job for them, that we are ready to make an impact. In that regard, business education is not a portfolio of programs, but a social response to specific jobs to be done that customers are demanding. Accessing knowledge is a different job than learning in a social context, and also different from getting a diploma that creates a powerful signal throughout my career. Although we generally see our businesses as bundles, different jobs and motivations are entailed within each business.

Multiplying impact

Wrapping up our thesis, we believe that a business school's mission has overvalued the job of getting a diploma, while actual learning has been undervalued. As ChatGPT and other generative AIs become more present in our daily lives, access to knowledge and useful content will increasingly become a commodity. Even curation and basic levels of creativity (synthetic creativity or creativity that can be codified) might become new commodities. At the other end of the spectrum, signaling might be overrated. As we have learned, signals are an explanation to asymmetric information. Michael Spence, a Nobel prize winner, explained in 1974 how market signals, among those, business school degrees, are fundamental for the efficiency of job markets. The information asymmetry lies in the inability of a recruiting company to have a whole perspective of somebody's skills and performance in a job role in a specific timeline, reason why narrower characteristics, like degrees, are sought after as a shortcut to one's future performance. However, as AIs become more relevant and accurate in matching potential tasks and projects with everyone's skills, informational asymmetries should start decreasing, making signaling less relevant.

As access to knowledge, content and its credentialling become more abundant, actual learning and its socio-emotional dimension will become new scarcities down the road. At the end of the day, as automation and algorithmic solutions enter more realms of business and society, new value will be found in what remains uniquely human, where AIs can augment our capabilities by becoming the new "copilots". Along these lines, we found that during the 20th century, technology succeeded in replacing millions of physical jobs where human strength had clear limits in comparison to machines (agriculture, mining, construction, etc.). In the last quarter of the century, cognitive repetitive jobs were also replaced by technology, for instance, in the space of retail banking and insurance. We believed to have reached a safe haven where cognitive, non-repetitive jobs would not be replaced by technology, but generative AI has opened new possibilities. As soon as basic or synthetic creativity, found in many cognitive jobs, is optimized by AI, value will shift towards more conceptual levels of creativity and socio-emotional skills, and specifically, how we fuse the latter with cognitive skills. In other words, how do we communicate empathically? How do we express in a convincing way the emotion that a good startup pitch entails? How do we become more emotionally resilient in the face of adversity and uncertainty?

How could business school create pathways for mastering these new scarce skills in a more meaningful, impactful way? What if we leveraged on the metaverse and AI as the next computing platforms? Could we create simulated environments where the learning process, in terms of experience and acquisition of skills, becomes more reliable and meaningful than in traditional settings? Could business schools reach billions instead of millions and contribute to narrow the mismatch of skills of the future? This white paper is not an answer to these questions, but a starting point to open a space of experimentation, with the aim to amplify the mission of business education beyond the "cage of rankings signaling".

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02
The landscape of technological opportunities ahead

Currently we are witnessing not only an increase in the speed of technological change, but a race, even a war according to some qualified voices. Markets hurry to explore many of these potential opportunities, but let's keep in mind that technologies are also socially constructed.

AR/VR and the metaverse

ROAD TO HERE: GOOGLE PAYING THE COST OF PIONEERING

Augmented Reality (AR) and Virtual Reality (VR) are not novel concepts, as their origins can be traced back to the inception of head-mounted displays (HMDs) in the 1960s. These technological advancements saw significant progress in the forms of arcade games and home gaming consoles during the 1980s and 1990s. Additionally, tablets and smartphones have contributed to the proliferation of AR and VR experiences by emulating the intended effects.

A notable milestone in the development of AR and VR was the Google Glass project. This ambitious endeavor sought to bring forth a new era of immersive experiences, thereby demonstrating the potential for large-scale implementation of these technologies.

Google Glass emerged as a groundbreaking wearable technology project initiated by Google's research division, Google X. Its primary objective was to seamlessly integrate augmented reality into the everyday lives of users. The device incorporated a head-mounted display resembling eyeglasses, which facilitated real-time access to information, communication, and navigation features.

Upon its initial release, Google Glass generated significant excitement and interest from both consumers and the tech industry. However, it faced several challenges that hindered its widespread adoption. Key concerns included privacy issues, as the device's built-in camera raised questions about potential surveillance and unauthorized recording. Additionally, safety concerns were raised due to the potential for distraction while using Google Glass in certain situations, such as driving.

The high price tag of the device, which made it inaccessible for many consumers, further limited its success. Consequently, Google decided to discontinue the consumer version of Google Glass. Despite these setbacks, the project was not deemed a complete failure, as it found niche applications in enterprise and industrial settings. Industries such as manufacturing, logistics, and healthcare benefited from the hands-free access to information and communication that Google Glass provided.

The legacy of Google Glass has been influential in shaping the trajectory of wearable and augmented reality technologies. Its development paved the way for further innovation in the field, sparking interest in creating more sophisticated and accessible AR devices. Today, various companies continue to explore the potential of AR and VR technologies, building upon the foundation established by projects like Google Glass.

WHERE WE STAND NOW: THE METAVERSE AS THE PRIMARY SPACE

The true catalyst for augmented reality (AR) and virtual reality (VR) capturing widespread attention can be attributed to the launch of a metaverse vision.

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Like the majority of technologies that have or want to have an impact, during their creation and consolidation process it is difficult to define them since this will imply setting limits, leaving things out that, in the future, may end up being part of their definition. Sawhney and Goodman recently made a definition that may be a good departure point:

> **“The metaverse is an interactive virtual world that allows people to “live” a second, digital life that complements the physical one. Participants can purchase land, attend concerts, shop for virtual goods, and attend meetings. The metaverse offers activities and experiences, not just information and content”[2].**

The metaverse is therefore envisioned as a shared digital space that integrates both AR and VR, allowing users to interact, communicate, and collaborate in immersive environments. This ambitious concept aims to revolutionize the way people engage with technology and with each other, blurring the lines between the physical and digital worlds.

2. Sawhney, M. & Goodman, P. (2022). Kellogg School of Management, Northwestern University.

There is growing unanimity in what are the fundamental elements of metaverse and without which any solution or product that calls itself metaverse would not be accepted. As defined by Edwards Castronova[3], a Professor of economics and telecommunications at Indiana University, these three characteristics are:

- **Interactivity:** the user can interact with the metaverse and communicate with other users. Thus, their acts or behaviors can influence objects or users. Without the ability to interact we cannot consider it the metaverse.
- **Corporeality or Presence:** The environment that is accessed is subject to certain laws of physics, which implies that it seeks to have the same sensation as if we were in a physical environment in terms of the relationship with objects and other people.
- **Persistence:** Even if there is no user connected to metaverse, the system continues to work, without stopping. In addition, at the end of the sessions the positions they were in will be saved and they will return to the same point when reconnecting.

We can ask ourselves if the irruption of metaverse will be a one-off phenomenon, as has happened in the past with other technologies, or if it is the beginning of a disruption in different sectors of activity as a result of the consolidation of this technology. And while that is beyond the scope of the present paper (which focuses on analyzing the potential impact that it can have in the educational field, especially in the field of Business Education), it is useful to briefly consider its rise to prominence to understand its immediate potential to remain a fixture of the current edtech landscape. AR/VR received a media boost resulting from the presentation at the annual Facebook event (Facebook Connect) in October 2021, where the company explained its plans for the present and future with a clear and determined commitment to the development of the metaverse.

From that moment, the metaverse garnered significant attention and investment from major technology companies, as well as from the broader public. The concept sparked a renewed interest in AR and VR technologies, driving innovation and development in the field. This has led to the creation of more advanced hardware, software, and applications that facilitate seamless, immersive experiences. Furthermore, the metaverse has the potential to transform various aspects of society, such as work, education, entertainment, and social interactions. It is expected to create new opportunities for businesses, developers, and users by allowing them to create, share, and monetize content within these digital spaces.

The market followed suit. In 2022 the investment doubled compared to the year 21 with operations such as the purchase by Microsoft of Activision Blizzard for 69 billion dollars. Moreover, the data presented by the platforms already established around this technology are important: Roblox reported more than 58 million daily active users in 2022[4], Fortnite had more than 20 million in 2020 and generated more than 9 billion dollars in sales between 2018 and 2019[5 6].

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The leading player: Meta Quest

The significant acceleration of AR/VR technology adoption can be largely attributed to Meta's strategic initiative with the Oculus Quest. As of now, Meta has successfully distributed approximately 20 million headsets globally, demonstrating the substantial market penetration and widespread acceptance of this groundbreaking technology.

The Meta Quest is a virtual reality (VR) headset developed and manufactured by Reality Labs, a business and research unit of Meta Platforms. The history of this headset can be traced back to the initial development and iterations of Oculus VR devices. Here's an overview of the key milestones:

1. **Oculus Rift Development Kit (2012-2013):** After a successful Kickstarter campaign in 2012, Oculus VR released the first development kit for the Oculus Rift, a PC-based VR headset. This marked the beginning of the modern VR resurgence and Oculus's journey in the VR industry.

2. **Oculus Rift Consumer Version (2016):** The consumer version of the Oculus Rift was launched in 2016, offering a high-quality VR experience tethered to a powerful PC. This headset required external sensors for positional tracking and featured motion controllers called Oculus Touch.

3. **Oculus Go (2018):** Oculus released the Oculus Go, a standalone VR headset that didn't require a PC or smartphone to function. The Oculus Go aimed to make VR more accessible and affordable for the average consumer. However, it offered limited functionality and only 3-degrees-of-freedom (3DoF) tracking.

4. **Oculus Quest (2019):** Building on the success of the Oculus Go, the company released the Oculus Quest in May 2019. The Quest was a standalone, 6-degrees-of-freedom (6DoF) VR headset, meaning it could track both the user's head movements and the position of the controllers in the environment. This headset didn't require a PC or external sensors, making it a significant milestone in the development of accessible and high-quality VR devices.

5. **Meta Quest 2 (2020):** In October 2020, Meta launched the Quest 2, an improved version of the original Quest. The Quest 2 featured a more powerful processor, higher-resolution display, and a lighter design. It also provided backward compatibility with the original Quest's library of games and applications. Oculus Quest 2 was unveiled in 2020 but was then rebranded as the Meta Quest 2 in 2022, as part of a company-wide phase-out of the Oculus brand after the rebranding of Facebook, Inc. as Meta.

6. **Meta Quest 3 (expected in late 2023):** The Meta Quest 3 is expected for late 2023. It will have a higher display resolution with a 120Hz refresh rate and two extra cameras and a depth sensor, together with a faster processor and more RAM (128GB). It is also expected to be thinner and lighter.

Throughout its history, this development has played a crucial role in democratizing VR technology, making it more accessible and appealing to a wider audience. The standalone design and ease of use have contributed to the growth and popularity of VR in the consumer market.

The challenger: Microsoft Hololens

Microsoft HoloLens has been a key contributor in defining the trajectory of the AR/VR headset landscape. The pioneering technology showcased by the HoloLens has significantly influenced the development and adoption of AR/VR devices, emphasizing its integral role within the industry.

The Microsoft HoloLens is an augmented reality (AR) headset developed by Microsoft, representing a major milestone in the evolution of AR technology. The history of the HoloLens can be traced through several key stages:

1. **Development and Announcement (2010-2015):** Microsoft began working on the HoloLens project, codenamed "Project Baraboo," in 2010. The project was led by Alex Kipman, the inventor of Microsoft's Kinect motion-sensing device. After years of development, Microsoft officially announced the HoloLens during a Windows 10 event in January 2015, showcasing its capabilities and potential applications.

2. **HoloLens Development Edition (2016):** Microsoft released the HoloLens Development Edition in March 2016. Priced at $3,000, this version was targeted towards developers, researchers, and enterprise users. The Development Edition aimed to encourage the creation of new applications and experiences, fostering an ecosystem around the HoloLens technology.

3. **HoloLens Commercial Suite (2016):** In October 2016, Microsoft introduced the HoloLens Commercial Suite, which included additional enterprise-focused features such as device management, enhanced security, and a warranty. This release marked the beginning of the HoloLens's adoption in various industries, such as manufacturing, healthcare, and education.

4. **HoloLens 2 (2019):** Microsoft unveiled the HoloLens 2 during the Mobile World Congress in February 2019, with general availability commencing later that year. The HoloLens 2 featured significant improvements over its predecessor, including a larger field of view, enhanced comfort, and better hand-tracking capabilities. The device continued to be primarily focused on enterprise and industrial applications, with a price point of $3,500.

Throughout its history, the Microsoft HoloLens has played a significant role in shaping the AR landscape. Its focus on enterprise and industrial use cases has demonstrated the practical applications of AR technology, driving innovation and adoption across various sectors.

The newcomer: Apple Vision Pro

During its 2023 WWDC held in early June Apple unveiled its own AR/VR headset, often referred to as "Apple Glasses" or "Apple Glass" and its possible launch in June 2023.

While the specific details of the Apple Glasses project remain speculative, various sources have provided some insights into the potential features and direction of the product:

1. **Integrated AR/VR Capabilities and a focus on digital-physical integration:** Apple portrays Vision Pro as a tool for seamless experiences in both augmented and virtual reality with the integration within the physical world as its distinctive feature, making it a versatile and innovative product in the growing AR/VR market.

2. **Comparatively lightweight Design:** Apple is known for its focus on design and aesthetics. The Vision Pro will come with a comparatively sleek and lightweight form factor. The explicit goal of the company is to make it comfortable and user-friendly for extended periods of wear, although its short battery life (2h) and ambitious digital-physical integration may prove additional challenges on this front.

3. **Connectivity with Apple Ecosystem:** the Vision Pro seems to be designed to work seamlessly with other Apple devices, such as the iPhone, iPad, and Mac, leveraging the capabilities of these devices to enhance the overall user experience.

4. **Advanced Display and Tracking Technologies:** Apple's AR/VR headset may utilize cutting-edge display and tracking technologies to offer high-quality visuals and accurate, responsive motion tracking for a more immersive experience.

5. **Spatial Operating System and Apple Store Integration:** Similar to other Apple products, the Vision Pro aims at featuring a usability-oriented OS that will now operate in 3D, and a rich app ecosystem, allowing developers to create and distribute AR/VR applications specifically designed for the headset.

The Vision Pro will be released in early 2024 in the US, carrying a price tag that multiplies that of its rivals, and its actual placing within the market remains to be seen.

The launching of a metaverse vision has thus played a pivotal role in propelling AR and VR technologies into mainstream consciousness. Its vision of a shared digital space has inspired technological advancements and captured the imagination of individuals and businesses alike, demonstrating the potential for a fully immersive, interconnected world.

WHAT'S NEXT AND WHAT COULD BE RELEVANT FOR EDUCATION

The current uses of AR/VR headsets are limited and mostly exploratory. However, they signal the potential future usage of this technology. However, Virtual Reality (VR) headsets have gained significant traction in recent years, finding applications across various industries and fields. The following deserve to be highlighted:

- **Gaming and entertainment:** AR headsets provide gamers and users with immersive experiences by overlaying digital content onto the real world. Popular games like Pokémon Go have paved the way for more AR experiences in gaming.

- **Education and training:** AR headsets are used to create interactive learning environments and training simulations. They allow students to visualize complex concepts and provide hands-on training for professionals in fields like medicine, engineering, and aviation.

- **Retail and marketing:** AR headsets enable customers to virtually try on products, such as clothing, glasses, or makeup, before making a purchase. They also offer businesses the opportunity to create engaging marketing campaigns with AR-enhanced advertisements.

- **Manufacturing and maintenance:** AR headsets can help workers visualize assembly instructions, access real-time information, and receive remote assistance while working on complex machinery. They can also assist with maintenance tasks by overlaying digital information onto physical equipment.

- **Architecture and construction:** AR headsets enable architects and construction professionals to visualize building designs and make modifications in real-time. They also assist in detecting potential issues and streamlining construction processes.

- **Healthcare:** AR headsets are used for medical training, surgical planning, and patient education. They can help visualize complex anatomical structures, simulate surgeries, and provide real-time data during medical procedures.

- **Tourism and navigation:** AR headsets can offer tourists enhanced experiences by overlaying historical information, interactive maps, and points of interest onto real-world environments. They also provide real-time navigation assistance for users in unfamiliar locations.

- → **Military and defense:** AR headsets are employed for training, battlefield situational awareness, and equipment maintenance. They can help soldiers access critical information, simulate combat scenarios, and provide real-time tactical data.

- → **Art and design:** AR headsets can be used to create immersive art installations or design spaces by overlaying digital content onto physical environments. They can also assist designers with prototyping and visualization of their creations.

- → **Social and communication:** AR headsets can facilitate communication and collaboration by allowing users to share their augmented experiences and interact with digital content in real-time.

As AR technology continues to advance, the applications and use cases for AR headsets will likely expand, opening up new possibilities for both professional and personal use.

As an illustration, Hewlett-Packard employs AR headsets within their large-scale 3D-printing division to deliver remote services to clients without needing the deployment of an on-site service team. The economic rationale behind this approach is clear: the expense and time associated with dispatching a service team are replaced by supplying commonly required components or sending service materials and parts via express courier services. If the necessary materials are already available on-site, the issue can be resolved instantaneously; otherwise, downtime is minimized. Indeed, AR technology not only redefines the service paradigm and its underlying economics but also enhances the efficiency of the entire industry.

One of the most prominent examples in education stems from Case Western University, specifically in their Anatomy I course. Through a collaboration with Microsoft, this class benefits from a virtual representation of the human body that students can explore and discuss collectively. This particular application of AR in education demonstrates scalability due to its utilization in a popular subject area with minimal changes over time. The implementation of AR in the Anatomy I course at Case Western University has been met with resounding success.

Multiple studies have indeed shown that greater immersion in educational content leads to higher knowledge acquisition and retention, as well as happier and more motivated learners. For example, Fisk University in the US opened a virtual reality cadaver lab for its medical school, drastically reducing the expense of acquiring actual human bodies. In addition, the students can practice on cases and diseases not possible or feasible with only the remains of a few generous body donors. The bar for "immersion" will keep rising as new technologies enter the market, and while it may seem silly to ask, "what could be more immersive than VR?". These technologies are still in their infancy. In the next few years, they will become:

— more **lightweight and unobtrusive,** eventually becoming as natural to carry and use as glasses, caps, phones and the headsets that are ubiquitous today.

— **higher performance and multisensorial,** becoming increasingly indistinguishable from physical content. Better optics and audio will be matched with haptic, tactile, temperature, and other sensory input. The physical and digital worlds will blend with new materials and interfaces that don't just faithfully copy real-life places and things, but go beyond them.

— **Social spaces.** VR spaces today are usually limited to a few participants, seated so they can be next to a computer serving the content and powering the headset. Emerging platforms enable participants to wander around a room-sized space, and interacting with hundreds of people.

Nonetheless, opening the scope quickly reveals that the integration of Augmented Reality (AR) and Virtual Reality (VR) technologies into society necessitates a redefinition of social meanings and habits, which, in turn, requires an extensive process of social co-creation. While initial uses can indicate potential directions, it is crucial to remain open to the emergence and development of unforeseen applications as the technology gains momentum and undergoes validation through widespread adoption.

To facilitate this process, several factors must be considered. First, the wide adoption of the underlying hardware is essential, as it creates a foundation for users to access and experience AR and VR technologies. Second, the establishment of economic incentives and business models will drive innovation and investment in the industry. This, in turn, will lead to advancements in technology and the creation of more sophisticated applications.

Additionally, generating hype that captures the imagination of talented individuals and the industry at large is vital for attracting skilled professionals to the field. This influx of talent will ultimately result in the production of innovative applications and devices that further develop these technologies. Similar to the evolution of smartphone applications, this process is expected to span several years, with new breakthroughs and developments emerging over time.

Furthermore, the convergence of technologies such as AR/VR suggests an even more intricate process, with the potential to be highly transformative, albeit at a greater cost and over an extended duration. As these technologies mature and become more integrated, entirely new categories of applications may emerge, paving the way for unanticipated opportunities and challenges. These new applications could potentially revolutionize industries such as healthcare, education, and entertainment, among others.

The broader implications of this technological convergence also highlight the importance of addressing ethical, legal, and privacy concerns associated with AR/VR technologies. As these technologies become more intertwined with our daily lives, ensuring the responsible and ethical use of these advancements will be paramount.

In conclusion, the integration of AR and VR technologies into society is an ongoing process that requires the redefinition of social meanings, habits, and extensive social co-creation. A combination of hardware adoption, economic incentives, hype generation, and the convergence of emerging technologies will drive innovation and development in the field. As we progress, it is vital to remain adaptable and responsive to the evolving landscape, ensuring that these transformative technologies benefit society as a whole.

Generative AI

On November 30, 2022, a chatbot, known as ChatGPT, was introduced to the public. Within a mere two-month span, it amassed a global user base exceeding 100 million, with approximately 15 million daily users. This rapid adoption not only sparked widespread fascination but also incited concerns regarding the potential impact on democratic institutions.

In response to these concerns, the Future of Life Institute published an open letter on March 22, requesting a six-month moratorium on large-scale artificial intelligence experiments. This letter, endorsed by numerous prominent individuals, ignited fervent discussions not only within the artificial intelligence community but also among the general public. This debate underscores the need for careful consideration of the ethical implications and societal impact of advanced AI technologies.

The unprecedented success of ChatGPT was unanticipated. A mere two weeks prior to its release, OpenAI's CEO Sam Altman convened an all-hands meeting within his company to discuss the possibility of developing a chatbot based on the previously released GPT-3.5 prototype. This proposal was met with resistance from various stakeholders, as plans were already underway to develop a chatbot using the forthcoming GPT-4, which had been undergoing red team testing since the summer.

Competing chatbots based on similar models, released by other organizations, had generated little traction and were mired in controversy due to accusations of inaccuracy. Consequently, apprehensions surfaced that ChatGPT would encounter similar challenges. Nevertheless, the team proceeded with the project, ultimately achieving unparalleled success that surpassed any other software product in history.

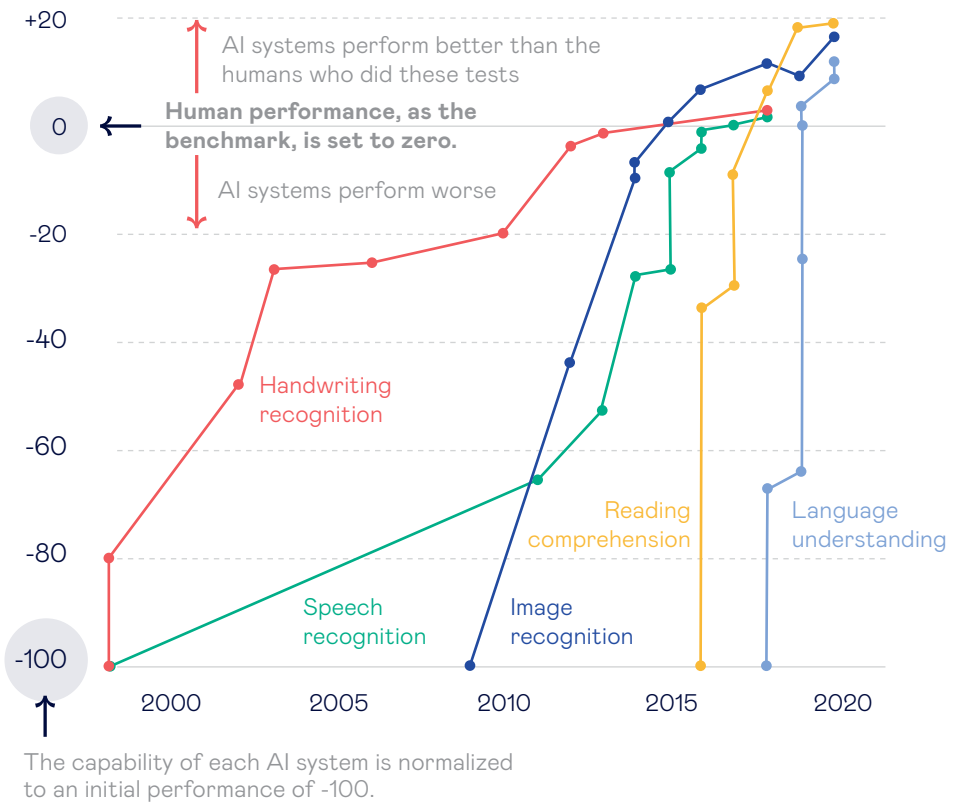
> “
> The insight underpinning Transformers was the recognition that within a sentence, the semantically relevant components may not be situated in close proximity; thus, identifying and connecting these key elements is essential.

HOW WE GOT HERE

While the foundational concepts of neural networks date back to the 1950s, the research driving generative AI and Deep Learning as a whole remains relatively recent. A significant milestone was reached in 2012 with the introduction of AlexNet, a convolutional neural network designed for image recognition. AlexNet achieved a remarkable improvement in existing performance metrics by nearly 30%, a feat seldom observed in the AI domain. Subsequently, by mid-2014, deep learning-based image recognition systems surpassed human-level performance, signifying a major advancement in the field.

The next pivotal development occurred in 2017 when a team from Google published a paper titled "Attention is All You Need," which introduced a novel architecture known as Transformers. The insight underpinning Transformers was the recognition that within a sentence, the semantically relevant components may not be situated in close proximity; thus, identifying and connecting these key elements is essential. The adoption of Transformers proved highly successful across both natural language processing and image generation tasks, and their capabilities continued to evolve gradually. Around 2020, Transformers reached a critical juncture, demonstrating abilities that were on par with, or even exceeded, human capabilities, marking a significant leap in AI development.

Figure 1.
Language and image recognition capabilities of AI systems have improved rapidly
Test scores of the AI relative to human performance



Source: Kiela et al. (2021) Dynaberch: Rethinking Benchmarking in NLP
OurWorldInData.org/artificial-intelligence · CCBY

The advancement of Transformers is not attributable to a single breakthrough, but rather the culmination of numerous enhancements in areas such as data selection, model training, and the generation of embeddings (the conversion of text into numerical representations for processing within deep learning networks). One particularly noteworthy innovation is Reinforcement Learning from Human Feedback (RLHF). The base model, following initial training, offers limited utility; however, its value is significantly augmented through the validation of responses by human evaluators, who select the most appropriate outputs.

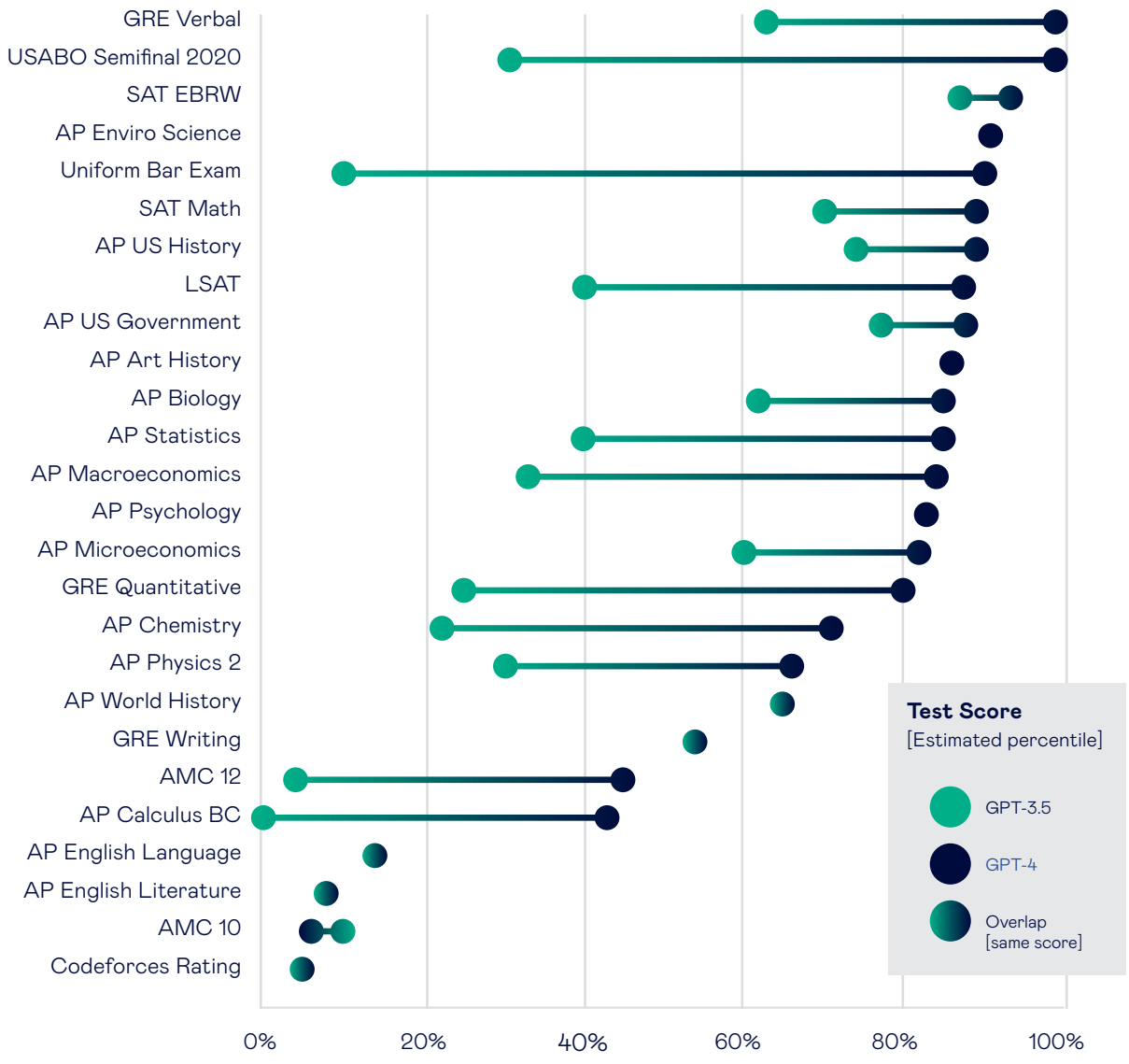
There is considerable ongoing research in these domains, and substantial improvements relative to earlier models are anticipated. Progress will likely stem from both scaling efforts—employing larger models—and engineering advancements. Moreover, the influx of research, talent, and capital invested in the field holds the potential to yield transformative discoveries that could substantially propel the discipline forward.

Nonetheless, there are several noteworthy and thought-provoking facets of these novel models that warrant attention, as they hint at unanticipated yet plausible advancements. First is the emergence of unique properties in these models. It is now

understood that, beyond a certain scale, they acquire abilities such as arithmetic and summarization, with the progression in scale being remarkably steep. Second is their demonstrated capacity to utilize other tools, which becomes apparent once the models reach a specific size. Lastly, the integration of capabilities such as calculus or access to private knowledge bases not only yields improvements in these particular domains but also enhances general inference. Collectively, these areas introduce an element of uncertainty to any predictions, underscoring the potential for unforeseen outcomes.

Regarding the accomplishments to date, a prevalent method for evaluating the capabilities of large language models (LLMs) involves subjecting them to standardized human assessments such as the GRE, LSAT, SAT, AP, or even the rigorous BAR examination. Substantial progress has been observed from GPT-3.5 to GPT-4 across these benchmarks. Current trends suggest that this advancement is likely to continue in future iterations of GPT or analogous LLMs.

Figure 2. OpenAI's latest model is a whole lot smarter than its younger sibling



Source: OpenAI

WHAT'S NEXT

Predicting the long-term trajectory of these models is inherently uncertain, as future advancements in science and technology remain difficult to anticipate. Nevertheless, it is possible to make informed conjectures regarding forthcoming developments and their potential success.

Three aspects warrant consideration. First, the evolution of the core model in the forthcoming GPT-5 and its competitors. Second, the emergence of an ecosystem comprising applications and add-ons that could augment and bolster the core model's capabilities. Lastly, the innovations that may be catalyzed by these discoveries and the implications they may hold.

With respect to the core model, advancements have already been disclosed, including partial developments in multimodal capabilities encompassing text and image processing. Concurrently, there are nascent yet remarkable efforts to generate video content based solely on text input. Another research direction for the core model, as publicly announced by OpenAI, involves personalization, or the ability to tailor a model to specific values and styles. The refinement of the model's objective function to more accurately emulate designated tasks has not only been broadly declared, but initial prototypes have also been produced in this vein (e.g., see the playground space in OpenAI). Lastly, scaling remains a proven avenue for enhancing these models, and it is likely that either GPT or one of its competitors will pursue this strategy.

The development of an ecosystem of plug-ins surrounding these models is arguably one of the most dynamic areas of exploration. These models support the integration of plug-ins, akin to apps, and their relatively straightforward development process has spurred a proliferation of such tools. ChatGPT-hosted plug-ins address existing limitations, as exemplified by the Browsing Plugin, which enables ChatGPT to access the most recent and accurate information from the Internet. Another notable instance is the Code Interpreter Plugin, which facilitates the execution of Python code within a secure sandbox environment. The Retrieval Plugin permits developers to deploy their customized version, linking a private database to ChatGPT for document searches.

Third-party plug-ins from external companies enhance ChatGPT's functionalities, as illustrated by the Wolfram plug-in, which grants GPT-4 access to the computational capabilities of Mathematica. Other examples include integrations with Kayak, Expedia, OpenTable, Slack, Shopify, and Instacart, as well as many others whose numbers are growing.

Plug-ins serve to bolster GPT models in two key aspects. Firstly, they augment the models' capabilities while addressing their limitations. Secondly, they enable the integration of existing applications into ChatGPT, thereby creating a universal interface grounded in natural language interaction. It is foreseeable that, in the near future, voice input will be incorporated as an interface option, beyond the constraints of traditional text-based input.

Lastly, the implementation of these advancements within businesses has led to tangible innovations. Legal and consulting firms are at the forefront of incorporating generative AI into their workflows, as they possess extensive knowledge databases that can be leveraged by LLMs to transform many of their consultants' functions. PwC and Bain's legal divisions have already entered agreements and are actively working on internal implementations. Another sector embracing this technology comprises service companies that rely on contact centers to address customer issues. In this context, the well-publicized partnership with Stripe, aimed at automating their customer service, serves as a prime example. Governments, such as Iceland's, have also entered agreements with the goal of automating inquiries and services. Furthermore, a multitude of startups are either proposing revamped versions of existing applications or introducing new ones. For instance, Character.ai, that recently reached a valuation of $1B, enables users to engage in conversations with fictional or historical figures.

FOCUS ON EDUCATION: WHAT IS THE REAL POTENTIAL?

Of particular relevance to this white paper is the application of generative AI in the education sector. This area has experienced considerable controversy, given that tasks such as essays or summaries can be completed by ChatGPT with a high degree of success and are, as yet, virtually undetectable. Consequently, there is a pressing need to reevaluate educational methodologies and assessment approaches. The majority of the discourse has focused on these aspects, as well as on the future of education as a labor-intensive profession, similar to the legal and consulting fields.

> “There is a pressing need to reevaluate educational methodologies and assessment approaches.

The most notable advancements in this domain have been made by Khan Academy and Duolingo, both of which have developed tutor-like bots that exhibit capabilities equal to or surpassing those of human tutors.

The most mature development is Khanmigo, a tutor that emulates human-like interactions and is based on GPT-4 technology. Its primary function is to provide comprehensive tutoring services for a variety of subjects offered by Khan Academy, including calculus, Python, economics, history, and law. Not only does it provide human-like tutoring, but it also offers coaching and guidance throughout the subject. By observing Khanmigo in action, one can clearly imagine its potential to evolve into a fully-fledged teacher, complementing the existing online lessons of the Khan Academy.

In fact, Khanmigo surpasses the capabilities of traditional academic tutors or coaches, offering a glimpse into the future potential of this technology. The platform facilitates a wide range of learning opportunities, including subject-specific practice, test preparation, vocabulary enhancement through guided exercises, and knowledge exploration via engaging dialogues.

Moreover, Khanmigo boasts remarkable features such as its ability to engage users in intellectual debates, assuming any position desired, and to simulate interactions with historical or fictional characters. These features allow users to delve into the worlds and environments experienced by these characters, thus broadening the learning scope.

Khanmigo's capabilities surpass the confines of a conventional classroom, suggesting the potential to democratize education on an unprecedented scale. By leveraging this innovative technology, it is possible to envisage a future where educational resources are accessible and engaging to a wider audience.

Duolingo's proposition aligns with the objective of revolutionizing language learning by offering comprehensive solutions that not only facilitate vocabulary acquisition and language proficiency but also enable users to engage in realistic, limited-vocabulary scenarios. By simulating real-life contexts, Duolingo fosters the development of practical language skills and bolsters user confidence in their ability to communicate effectively in various situations. This comprehensive approach to language learning prepares users for real-world applications, thereby enhancing the overall effectiveness of the platform.

These initial implementations of generative AI in educational contexts demonstrate the potential to revolutionize learning across all levels. The transformative impact of this technology can be observed not only in the automation of existing educational scenarios but also in the creation of previously unimagined opportunities. This promising trajectory suggests three key implications:

01 **Democratization of Education:**
Generative AI has the potential to provide millions of individuals with access to high-quality education, regardless of their location or socioeconomic background.

02 **Unprecedented Standards and Sophistication:**
The advanced capabilities of AI-driven educational platforms can elevate learning experiences to new heights, surpassing previously established benchmarks.

03 **Redefinition of the Role of Human Educators:**
The widespread adoption of AI in education necessitates a reevaluation and reinvention of the role of human educators, as they adapt to new paradigms and integrate these technologies into their teaching methodologies.

As generative AI continues to evolve, it is poised to reshape the educational landscape, fostering innovation and accessibility on a global scale.

Web 3.0 – Blockchain, NFTs and new forms to certify

HOW WE GOT HERE: THE RISE OF ALTERNATIVE CREDENTIALS

As education and professional training fragment and accelerate, alternative credentials are on the rise. A 2018 study by Pearson found the number of US short-term credential seekers grew from 600,000 in 2002 to over 1 million in 2014; the global market was expected to grow over 30% in higher education from 2018 to 2022, even before the pandemic accelerated demand[7]. A more recent 2023 Coursera survey of 5,000 students and employers across 11 countries found that 90% of students and recent graduates said including industry micro-credentials or entry-level Professional Certificates in an academic program would make them more likely to enroll in that program[8]. This path is leading to concepts such as Stanford Design School's Open Loop University, where learners can loop in and out of education as their careers demand[9]. This demonstrates how traditional universities, even ones with great credibility, could remake the current degree program paradigm.

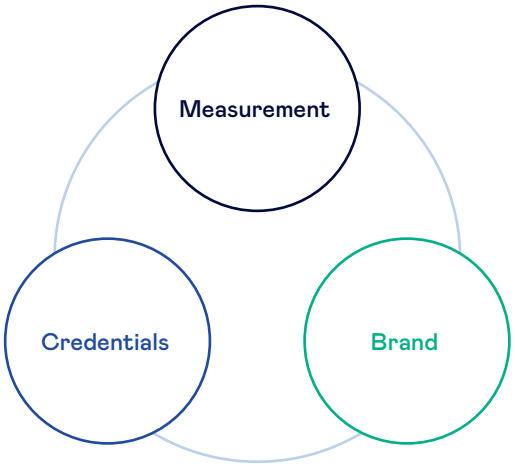
> "There's a difference between offering a certificate and the University of Washington stamping its brand on a certificate offered by Amazon.

Credibility, in fact, is key: A large barrier to entry for new solutions in the education sector is their lack of credibility. A startup or even a big tech player like Amazon can't match the credibility of a Stanford, ESADE, Harvard, or Oxford MBA.

"There's a difference between offering a certificate and the University of Washington stamping its brand on a certificate offered by Amazon. The academic certificate is more fully valued because this is sort of the stamp of approval that a student has mastered this learning content and skills." Chelsea Toczauer: Is Partnership Between Elite Universities and Big Tech Inevitable?

This problem affects not just edtech startups, but also second-tier universities, public school districts, and other next-to-best systems of learning. In other words, the vast majority of education providers. That has knock-on effects ranging from lack of access to higher learning, job market misalignment, to reinforcing inequities across gender, ethnicity, age, and other lines.

Figure 3.
The current credential cycle



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9. *Open Loop University.* Stanford 2025. (n.d.). Retrieved April 24, 2023, from http://www.stanford2025.com/open-loop-university

Web3.0 could break this cycle, by developing a universal credentialing system. For example, using blockchain to provide a more granular level of datapoints than the current, teacher-assessed grading system or high-pressure national tests would make higher education accessible to a broader range of aspirants. And once inside, more diverse offerings of courses and skills would make them more attractive when it comes time to seek a job. After that, new credentials could easily follow them, whether the learning comes from an employer class, an online course, or a master's program at an accredited institution.

WHAT'S HOLDING ALTERNATIVE CREDENTIALS BACK AND HOW TO REMOVE THOSE BARRIERS

Despite their appeal, alternative credentials still face a number of barriers to widespread adoption. Still only a small proportion of employers are aware of the many credential options that exist in their industries, and many of those who are aware of credentials remain skeptical that they predict job readiness in the real world. Colleges face structural and regulatory barriers to implementing short-term credential programs, in addition to a general lack of resources to market such programs optimally.

Pioneers of next-generation, tech-based education credentials

- → General Assembly created an open-source outcome reporting framework in partnership with major accounting firms
- → Labor market data provider Emsi and credit monitoring firm Equifax offer services to collect data on graduates' employment and earnings
- → Lumina Foundation's Connecting Credentials Action Plan measures credentials in emerging industries
- → Interoperability initiatives like Project Unicorn[10], EdFi Alliance[11] and IMS Global[12] hope to standardize microcredentialing across today's multiple platforms.
- → Sony Education[13], SAP/TrueRec[14] and Salesforce/UTx[15] are all proprietary corporate blockchain-based systems for tracking microcredentials, while MIT Blockcerts[16] is an open standard for creating, issuing, viewing, and verifying blockchain-based certificates.

> "Our ecosystem will pay students for learning and remunerate teachers according to their impact in the success of their students. It's simple: the more you learn, the more money you get, the more relevant you are in the Community and the more visible you become to companies that may be interested in you"
>
> **Miguel Caballero, CEO of Tutellus**
>
> Tutellus first launched its platform in May 2013, and has since built a base of 1 million loyal students, 130 000 video courses, and 3000 teachers.

10 Project Unicorn. (n.d.). Retrieved April 24, 2023, from https://www.projectunicorn.org/

11 Ed-Fi Alliance. (n.d.). Retrieved April 24, 2023, from https://www.ed-fi.org/

12 *EdTech needs to be easier.* EdTech Needs to be Easier | IMS Global Learning Consortium. (n.d.). Retrieved April 24, 2023, from https://www.imsglobal.org/easieredtech.html

13 SGE Education Blockchain. (n.d.). Retrieved April 24, 2023, from https://blockchain.sonyged.com/

14 Appadvice. (2018, December 26). TrueRec by SAP by SAP SE. AppAdvice. Retrieved April 24, 2023, from https://appadvice.com/app/truerec-by-sap/1251196142

15 Richardson, B. (2017, August 28). *The platform chronicles: 10 questions with Phil Komarny, chief digital officer at the institute for...* Medium. Retrieved April 24, 2023, from https://medium.com/inside-the-salesforce-ecosystem/the-platform-chronicles-10-questions-with-phil-komarny-chief-digital-officer-at-the-institute-for-c7972fd73acf

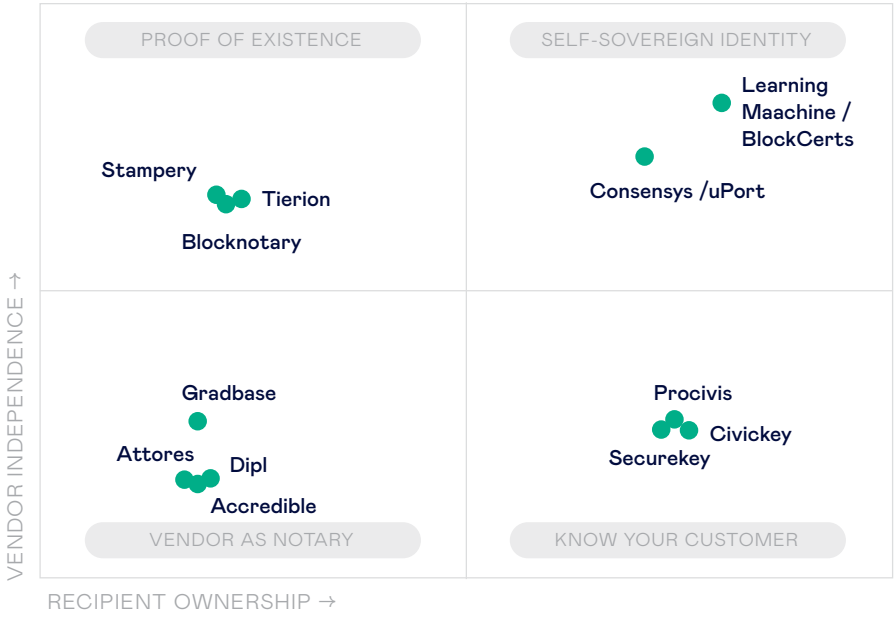
16 Blockcerts. (n.d.). Blockchain credentials. Blockcerts. Retrieved April 24, 2023, from https://www.blockcerts.org/

Blockchain is causing a paradigm shift in the way we think about trust. Traditionally, trust has been placed in centralized platforms or institutions that manage and validate credentials, such as universities and certification organizations. However, blockchain technology enables trust to be placed in individuals (using algorithms) instead. This is because blockchain creates a tamper-proof and decentralized record of transactions, which can be used to verify and validate information, without the need for a centralized authority.

Figure 4. Blockchain has found education with the promise of tamper-proof credentials, facilitating student control of their learning records

Emerging Blockchain Business Models in Education

Source: Learning Machine



Examples of Blockchain StartUps in Education

Tutellus: PsP EdTech platform based on Blockchain. Madrid, Spain

Proofstack: Global & Local Legal Proofs with Blockchain & EU Qualified Timestamp. Singapore

Learning Machine: An enterprise software firm specializing in self-sovereign digital identity through directly owned, verifiable official records. New York, United States

Vivagogy: Vivagogy is changing learning by creating differentiated learning paths and competency assessments with blockchain credentialling. Dublin, Ireland

Appii: Appii is a company that enables you to quickly access your details of education, accreditations, awards and employment history. London, UK

Disciplina: We are developing the first blockchain to create verified personal profiles based on academic and professional achievements. Estonia

Source: HolonIQ https://www.holoniq.com/2030

As a result, blockchain has the potential to transform the way we think about credentials in higher learning. By using blockchain, learners can create a digital record of their achievements and credentials, which can be verified and validated by other individuals and institutions within the network. This shift towards a more decentralized and individualized system of trust has the potential to make the credentialing process more transparent, efficient, and accessible, ultimately leading to a more diverse and qualified workforce.

Initiatives such as MIT Media Lab's bitcoin-based Blockcerts and the Knowledge Institute at Open University UK's solution with Ethereum Smart Contracts for Microcredentials have already created trustless solutions with web3 technology for tokenized credentials. As this trend extends into job experiences and recommendations, digitization of our learning processes and our career records will become even smoother. This has the potential to impact how recruiters hire talent and how individuals present themselves to potential employers, making the job search process more efficient and productive for all involved.

However, impact of new credentialing systems, combined with other technological disruptions, will extend beyond certification. Among the noteworthy changes, the shift from mass education to hyper-personalized learning is likely to emerge as the most significant trend. Technology has and will continue to revolutionize the way we learn, and not just how we learn, but what, when and where we learn. Hyper-personalized learning is usurping mass education as technology increasingly allows us to tailor our experiences according to individual needs and preferences with the goal to maximize engagement. With technology at our disposal, this personalized approach to education is becoming increasingly commonplace. Today's educational platforms can monitor each student's progress and tailor content and teaching strategies to fit their preferred learning styles. Instead of being limited by a strict curriculum, this personalised approach allows students to progress at their own rate and focus on topics that interest them. Beyond the traditional classroom, technology has expanded education's horizons by providing students with access to diverse resources and engaging experiences from around the globe. Technology will continue to shape education in the future by offering students increasingly hyper-personalized and personalized learning experiences.

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Society is transitioning away from traditional educational models, such as earning a 4-year degree, in favor of more adaptive and adaptable approaches to learning.

One of the key dimensions for personalization and tailoring is time investment. Society is transitioning away from traditional educational models, such as earning a 4-year degree, in favor of more adaptive and adaptable approaches to learning. With the rapid pace of technological development and industry transformation, it is becoming increasingly evident that degrees that take years to obtain may soon become outdated. In response, there has been an explosion of nano degrees: short and focused programs designed to equip learners with the specific skills and knowledge necessary for success in rapidly transforming industries. These flexible learning formats enable students to customize their education according to their career aspirations and personal interests. The emphasis is on practical skills and experiences that can be immediately applied in the workforce. Furthermore, the time and financial commitment required for nanodegrees is significantly less than traditional degrees, making education more accessible and affordable to a wider range of individuals. Modular tokenized nano-degrees will provide an agile format for learning and proof-of-learning as people strive to keep up with technological advancements and shifting industry needs.

Beyond these developments, there are more ways that Web3 can transform education and its institutions, and many of today's experiments will become tomorrow's traditions. Two of these experimental ways are especially exemplary of such potential.

01 **Universities becoming DAOs, for more democratic education.**
What if universities could become DAOs or vice-versa?
For example, Tsinghua x-lab (the innovation incubator at Tsinghua University) and several other Chinese universities created the Youth Education Chain League (YEC League), meant to be the opposite of the elitist U.S. Ivy League by bringing top-quality learning to students with little means. Education experts have speculated that in Web3-based education ("ed3"), DAOs could act as decentralized, personalized hubs of learning where in addition to traditional skills measurement (e.g., tests) would be complemented by intangible behaviors (like mentoring a fellow student) and being awarded with tangible value (like cryptocurrency or NFTs). Others see a role where DAOs' flat structure gives members (students, teachers, and others) democratic voting rights that don't exist in traditional, bureaucratic institutions.

02 **Learn-to-Earn model.**
The world of decentralized technologies and cryptocurrency can be very confusing, so many crypto pioneers created "learn to earn" programs that rewarded students with crypto assets for completing educational modules about the space. As the Web3 "learn to earn" model helps individuals earn money by contributing to the development of the ecosystem, universities could partner with blockchain projects and companies to offer internships, co-op placements, or research opportunities that allow students to gain hands-on experience in the Web3 space. This would provide students with valuable real-world experience while also creating the Web3 infrastructure and assets that the universities need.
One example is the Global Centre for Advanced Studies[17], a Dublin-based debt-free accredited college that is co-owned by faculty and staff, and represented on-chain by a token. Others say that for a generation of students raised on video games, the gamification aspect tokenization will lead to more motivated, curious, and successful students - Edverse being a prime example, with partnerships like Oxford University, Pearson, and Google to show for it[18].

17 GCAS College Dublin. (n.d.). Retrieved April 24, 2023, from https://gcas.ie/

18 Edverse. (n.d.). Retrieved April 24, 2023, from https://www.edverse.com/

Evolution and disruption

After surveying the landscape-shaping technological waves we are facing, let's go back a moment and try to learn from history. To put it very simply, the four industrial revolutions we have experienced to date have all had the same behavior. A technology is created and developed that is so powerful and disruptive that it not only changes the way goods and services are produced and/or delivered, but also transforms social models. When this industrial revolution has passed—it happened, for example, in the first with steam and in the second with electricity—only two types of organizations remain, those that have adapted to these new technologies or those that have been created ex novo with them. The third type, i.e. those that have done nothing have simply ceased to exist because they are not, at the very least, competitive in the sector.

Now we are once again facing this situation where exponential technologies such as the ones considered can potentially generate a disruption, a paradigm shift that forces organizations to adapt or re-found themselves, leaving "doing nothing" as a non-option.

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And as was the case with previous industrial revolutions, although this time certainly at a faster pace, there is no time to wait, observe, temporize and then decide. It is time to make decisions even when the present and future scenario are uncertain and without knowing for sure which technologies, such as the metaverse and virtual reality, will really bring about a paradigm shift.

At this time of decision-making, we can turn to Peter Diamandis, co-founder of Singularity University and an expert on the exponential growth of organizations caused by technology, who has tried to identify patterns based on past behavior of technology that can serve as a script to infer what may happen in the future with the technologies we have today. According to Diamandis, it is not a matter of predicting whether an exponential technology will work or not, but of identifying its disruptive capacity for a sector and its potential degree of adoption, which will allow us to make decisions earlier. These patterns are expressed through the 6 D's:

01 **Digitization** a technology becomes potentially exponential and disruptive when it transforms something from analog to digital. It is represented in ones and zeros. Once this happens, it becomes an information-based technology and jumps on an exponential growth curve. The pandemic digitized executive education: we saw how we could complement or even replace a face-to-face (analog) format with a digital format, and we started to widely use applications such as zoom or teams to replace face-to-face classes with online programs.

02 **Disappointment:** these technologies are introduced, some of them achieve great notoriety, but most of them fall into a period of disappointment in which, despite this notoriety, their disruptive impact is very low. It happened with artificial intelligence, it happened with 3D printing and it is happening with the metaverse. We have all heard about this technology, but few things are having a really significant effect. Consider for instance that most business schools that are beginning to use the metaverse are not moving away from creating environments based on Virtual Reality to conduct pilot tests, but rather to teach the value of this type of environment as a real transformer of the educational experience.

03 **Disruption:** in this third evolutionary phase, technologies finally find the space or the way to generate a disruption, a change in the rules of the game of pre-existing businesses; digital photography did so the photography sector or shared mobility platforms in the passenger transport sector. Moreover, we can already sense some cases in which universities, such as medical schools, are beginning to use new types of digital environments and technologies to provide experience and practicality to their learning environments.

04 **Dematerialization:** think of how many technologies have been dematerialized and have gone from their previous form to be integrated, for example, in a cell phone. Surely the most paradigmatic example is the digital camera; we take photos every day and it has probably been years since we acquired a camera. And this has an effect because now the leader in this sector, the photography sector, is no longer Nikon, Kodak or Minolta, but Apple or Samsung.

05 **Demonetization:** Keeping with the example of photography, how much did you pay to take and save the last photo you took? The answer is most likely zero. This a sector that has been demonetized. Users are no longer willing to pay to take a photo or to save it (or even to upload it to Instagram). Imagine what would happen if you didn't want to pay to access executive education?

06 **Democratization:** Its evolution has caused, among other things, a reduction in cost and therefore an improvement in access to these technologies. The lower the cost and the greater the access, the more democratic the use of these technologies will be.

Business Education is no stranger to this process, and we can already say that following the patterns defined by P. Diamandis, the metaverse has a very high potential impact on the education sector, even leading to a paradigm shift.

Part B

Actionable scenarios and the way forward

03
Bridging the skills gap – The Promise of Democratizing Business Education

Higher education aims to fulfill a seemingly insurmountable mission: to prepare students for the future. This task is particularly daunting as it necessitates a clear understanding of the future - an unattainable endeavor in a society where consensus on historical events is often elusive. Often, we cannot even agree on our past.

This arduous mission is further exacerbated by technological disruptions that induce transformative effects on various sectors of society. When these disruptions stem from General Purpose Technologies (GPTs), which trigger profound societal changes, the complexity of the task is magnified exponentially. The impossible becomes increasingly elusive.

Furthermore, human beings and societies function as adaptive entities that generate meanings and establish the direction of technological developments, thereby altering the landscape of technology. Predicting technological and societal adoption proves even far more challenging than forecasting purely technological advancements. This additional layer of complexity makes it difficult to foresee societal processes, such as those that will shape the future of higher education.

Consequently, it is customary to formulate predictions based on historical data, despite the limitations of this approach, which can be likened to navigating a vehicle by only observing the rearview mirror. In adopting this strategy, it is typical to identify potential risks and emerging competencies. The recognition of these novel threats often leads to the implementation of mitigation policies, frequently involving the integration of new competencies into existing curricula. As a result, curricula becomes inflated and lose focus. To quote the late Steve Jobs, true innovation often involves saying no to a myriad of possibilities.

Addressing this conundrum requires a shift from a purely technological perspective to a more comprehensive approach that views it as a societal evolutionary issue. This necessitates not only an understanding of emerging tools and technologies but also a grasp of how societies will employ them, how their utilization will shape future societies, and how individual agents will adapt to this evolving landscape.

As a result, the complexity of the problem has escalated significantly, rendering it unmanageable through mere thought exercises and necessitating an experimental approach. Moreover, the substantial increase in the level of interactions further complicates the establishment of controlled, sandbox-like environments. Thus, the only potentially viable strategy involves active participation in the exploration process through direct intervention. Organizations must decide between adopting an external perspective of the future—which may prove unsuccessful—or actively participating in shaping it.

Assessing Future Skills

In recent years, there has been a growing interest in determining the essential skills needed for individuals to thrive in the rapidly evolving job market. This section aims to synthesize the findings from three prominent studies that have explored the necessary competencies for future success. By delving into these studies, we hope to provide valuable insights and actionable recommendations to empower individuals and organizations to prepare for the challenges and opportunities ahead.

McKinsey DELTAs

In 2021, McKinsey & Company conducted an extensive study involving 18,000 participants across 15 countries with the objective of identifying future-proof citizen skills and determining which competencies governments should prioritize in their workforce development efforts.

The study established a comprehensive framework of 56 Distinctive Elements of Talent (DELTAs), grouped into 13 clusters and categorized under four key domains:

1. **Cognitive Abilities**
   - Critical Thinking
   - Planning and Ways of Working
   - Communication
   - Mental Flexibility
2. **Interpersonal Skills**
   - Mobilizing Systems
   - Developing Relationships
   - Teamwork and Effectiveness
   - Self-leadership

3. **Self-awareness and Self-management**
   - Entrepreneurship
   - Goal Achievement

4. **Digital Proficiency**
   - Digital Fluency and Citizenship
   - Software Use and Development
   - Understanding Digital Systems

The study revealed a positive correlation between overall performance and higher levels of education and digital DELTAs. However, this trend was not observed consistently across all DELTAs, with some self-leadership and interpersonal domains demonstrating a negative correlation with higher education levels.

McKinsey further analyzed the relationship between specific DELTAs and three measures of success: employment, high income, and job satisfaction. The results indicated the following key DELTAs associated with each success metric:

1. **Employment**
   - Synthesizing Messages
   - Coping with Uncertainty
   - Adaptability

2. **High Income**
   - Self-confidence
   - Work-plan Development
   - Organizational Awareness

3. **Job Satisfaction**
   - Self-confidence
   - Coping with Uncertainty
   - Self-motivation and Wellness

The study emphasizes the potential value of leveraging the integrated DELTAs framework to develop comprehensive adult education programs that yield tangible outcomes such as improved employability and job satisfaction. McKinsey recommends transitioning from traditional assessment methods to a certification-based skill system and implementing funding schemes that support this approach.

Considering the ongoing disruptions in artificial intelligence (AI) and augmented/virtual reality (AR/VR) technologies, the study highlights the increasing importance of key DELTAs such as self-confidence, coping with uncertainty, and adaptability for success in this rapidly changing landscape.

Additionally, it is crucial to acknowledge the evolving nature of many DELTAs associated with physical environments and interpersonal human relationships. The emergence of virtual worlds powered by generative AI will undoubtedly transform these environments, necessitating a reassessment of the corresponding skills (DELTAs) in terms of their measurement, value, and significance as essential determinants of success.

Financial Times

In 2017, the Financial Times conducted a survey to identify the most and least important skills for hiring MBA graduates, as well as the most and least difficult skills to recruit from this talent pool.

The most and least important skills for recruitment were found to be:

Most Important Skills:
- Ability to work with a wide variety of people
- Time management and ability to prioritize
- Understanding the digital impact on business
- Ability to build, sustain and expand a network of people
- Ability to solve complex problems

Least Important Skills:
- Specialized marketing skills
- Complex statistical skills
- Environmental management and CSR
- Specialized programming skills
- Specialized financial skills

The survey results reveal a clear preference for social and self-management skills over domain-specific skills. When examining the skills that are more or less difficult to recruit, market availability becomes a crucial factor and significantly affects the overall picture. Skills that are less defined, less codified, more recent, and those that already imply prior success become more challenging to recruit.

Most Difficult Skills to Recruit:
- Ability to use social media to benefit business
- Ability to train/coach others
- Financial forecasting
- Big data analysis
- Brand storytelling skills

Least Difficult Skills to Recruit:
- Specialized marketing skills
- Project management
- Ability to build, sustain and expand a network of people
- Ability to solve complex problems
- Ability to work with a wide variety of people

As with the previous case, it is evident that the most important skills will undergo a redefinition process due to emerging technologies. These skills can be broadly categorized into three main vectors.

First, the ability to successfully self-manage and socially manage in various roles, such as a participant, leader, or creator. This dynamic will change as the personal and social environment becomes more fluid, blending real-life interactions with virtual experiences and human-bot interactions.

Secondly, understanding the impact of disruptions, particularly technological disruptions, is critical. Upcoming technologies will undoubtedly create unforeseen opportunities, requiring individuals to adapt and stay informed.

Finally, solving complex, multifactorial problems will take on a different dimension in a world inhabited by AI co-pilots and specialized bots. These new technologies will necessitate a reevaluation of problem-solving approaches and the skills required to tackle the challenges of the future.

World Economic Forum

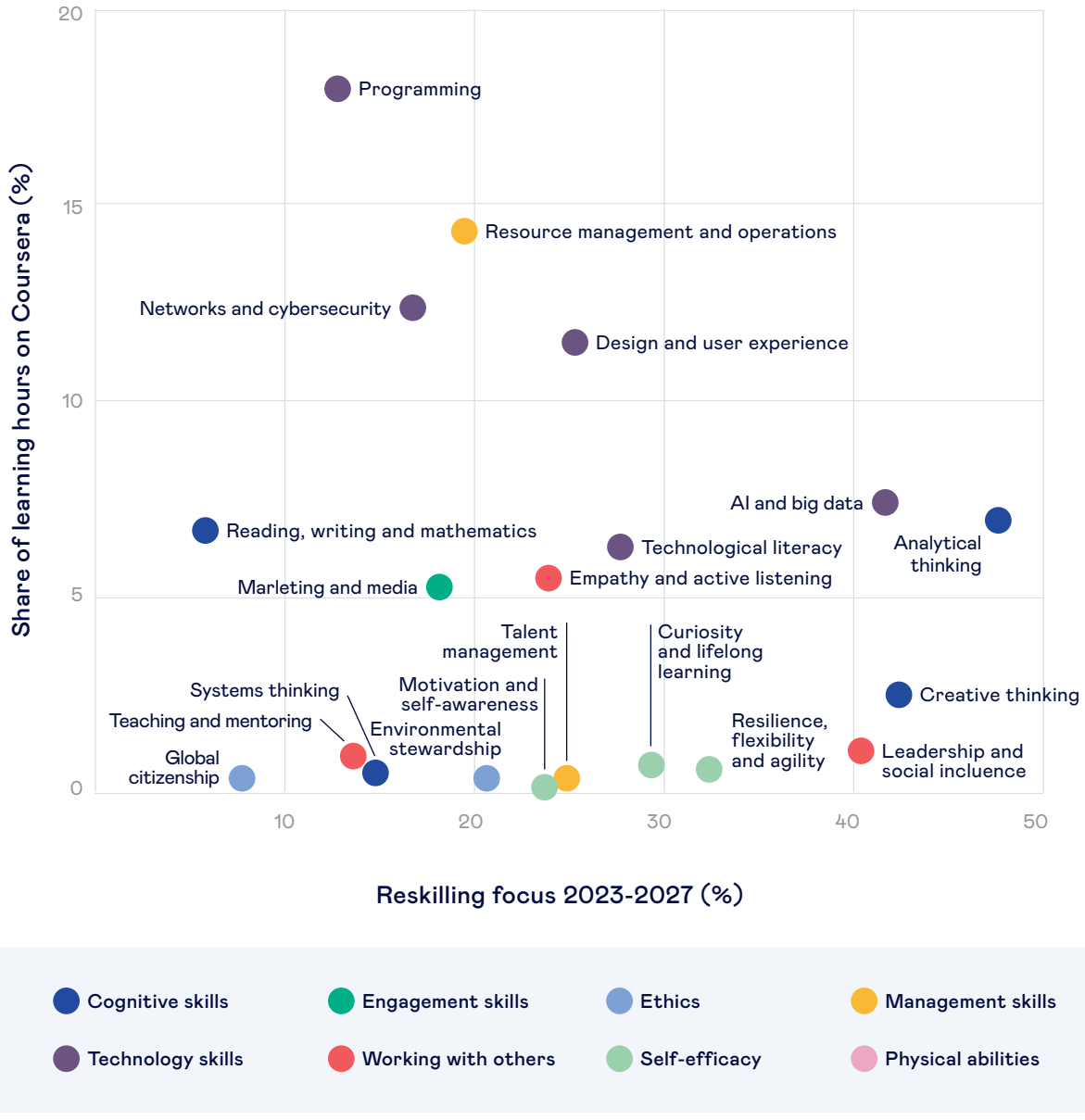
The WEF's Future of Jobs Report, in its fourth edition, covers the perspectives of 803 companies employing over 11.3 million workers across 27 industry clusters and 45 economies, drawing the impact of macrotrends and technology trends on jobs, skills, and workforce transformation strategies between 2023 and 2027.

Employers project that 44% of employees' skills will face disruption within the next five years. Rapid growth in the importance of cognitive skills can be attributed to the rising demand for complex problem-solving in the workplace. Interestingly, creative thinking is reported to be growing at a slightly higher rate than analytical thinking. Technology literacy emerges as the third-fastest growing core skill. Furthermore, self-efficacy skills rank higher than working with others in terms of the rate of increase in importance. The socio-emotional attitudes that businesses consider to be growing most quickly include curiosity and lifelong learning, resilience, flexibility and agility, and motivation and self-awareness. Systems thinking, AI and big data, talent management, and service orientation and customer service round out the top 10 growing skills. Although no skills are considered to be in net decline, a considerable number of companies view reading, writing and mathematics, global citizenship, sensory-processing abilities, and manual dexterity, endurance and precision as diminishing in importance for their workers.

Training is deemed necessary for six out of 10 workers by 2027; however, only half of them currently have access to adequate training opportunities. Analytical thinking is the top priority for skills training between 2023 and 2027, accounting for 10% of training initiatives on average. Creative thinking, the second priority for workforce development, will be the focus of 8% of upskilling initiatives. Utilizing AI and big data ranks third among company skills-training priorities for the next five years, prioritized by 42% of surveyed firms. Employers also plan to concentrate on enhancing workers' skills in leadership and social influence (40% of companies), resilience, flexibility and agility (32%), and curiosity and lifelong learning (30%). Approximately two-thirds of companies expect to see a return on investment from skills training within a year of the investment, whether through improved cross-role mobility, increased worker satisfaction, or enhanced worker productivity.

Figure 5. Supply and demand for skills

The share of learning hours spent by users on a skill on Coursera's learning platform in 2022 versus the probability of it appearing in its skills strategy for 2023-2027.



Note: Coursera data were mapped to the same subset of the World Economic Forum's Global Skills Taxonomy as was used by the Future of Jobs Survey.

Source: Coursera, Inc. ; World Economic Forum. Future of Jobs Survey 2023

In a particularly insightful graph, a comparison is made between what people study (hours spent on Coursera) and what businesses will require (reskilling focus). The graph reveals a gap in the lower-right quadrant, indicating an area where workforce needs are not currently being met by the courses people are taking. This gap highlights the importance of aligning educational offerings with the evolving demands of the job market to ensure effective reskilling efforts.

An Integrative view on Future Skills

When Gary Kasparov was defeated by DeepBlue, many believed that chess was finished. However, the game is now more alive than ever, thanks to innovations like tournaments where chess masters are assisted by chess bots. In these events, the key to success is not having the best chess master or the best chess bot, but finding the perfect combination. A prime example is when a pair of amateurs, using a mediocre chess bot, managed to win one of the most prestigious championships, defeating the chess elite.

All three analyses indicate that soft, non-codified skills are crucial for success. However, the environment and the way these skills are used will change dramatically due to the two technologies driving this disruption.

Table 1. How top skills will be affected by Generative AI and AR/VR disruption:

Skill Category	Generative AI	AR/VR
Personal & Social	Personal co-pilots, social co-pilots, creating and leading mixed groups of humans & assistants	Personal skills in a mixed and virtual world of humans & virtual humans
Understanding VUCA	Understanding and discovering the opportunities of applying generative AI to business	Redefinition of virtual environments adds complexity
Leading through VUCA	Finding novel solutions, leading to develop them and make them real	Leading through a mix of virtual and real environments will need to be reinvented

Co-pilots, assistants, and virtual humans will inevitably change how top skills are exercised due to their relational components and the fundamental shift in both the environment and tools.

Personal and social skills will transform with the help of assistants, much like how these assistants have changed the game of chess. Navigating our social network, whether situated or virtual, will be vastly different from how we do it now. These differences will widen with the advent of virtual humans playing a role in these networks.

Here is a potential framework aimed to categorize various skill types into four quadrants based on two key axes: the extent to which learning outcomes (quality and scale) will improve due to the metaverse's impact (vertical axis), and whether this impact will be highly visible in the short term or more prevalent in the long term (horizontal axis). By combining these dimensions, this framework may offer a comprehensive understanding of the evolving landscape of skill development.

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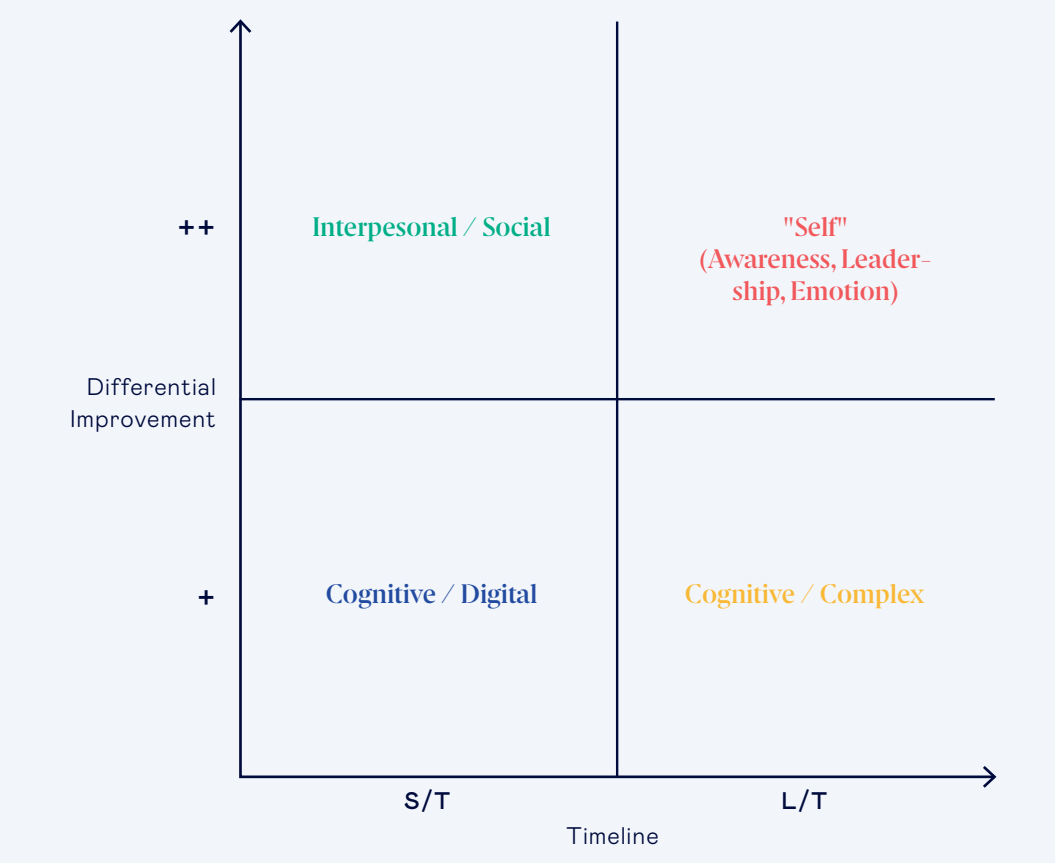
Emotional skills are posited as a "black box" that could greatly benefit from the insights obtained through immersive environments in the coming years, particularly in habit modification. In contrast, the learning of digital skills may not experience as significant of a leap. This framework will hopefully be relevant for organizations and educational institutions to identify which skill sets are likely to be most impacted by the metaverse and to develop appropriate strategies for leveraging these technological advancements to enhance learning and skill development.

Figure 6. Emotional skills



Understanding and discovering opportunities in the midst of these changing environments will require new skills and an "upgrade" of existing ones. However, understanding and discovery alone are not enough; leading through VUCA environments demands the ability to form groups, create novel messages, disseminate them, and capture the will and imagination of people to engage them. Again, these new technologies will dramatically change how all of this is conducted.

Additionally, globalization and the democratization of knowledge will act as a multiplier for these changes, increasing their importance and impact.

In fact we can borrow the concept of dynamic capabilities, a concept introduced by David J. Teece, Gary Pisano, and Amy Shuen, refer to a firm's ability to adapt, integrate, and reconfigure internal and external organizational resources and competencies in response to rapidly changing business environments. These capabilities enable companies to create, extend, or modify their resource base to gain and maintain a competitive advantage in a dynamic marketplace.

According to Teece, dynamic capabilities can be divided into three main components:

01 **Sensing:** The ability to identify, assess, and recognize opportunities and threats in the business environment. Sensing involves gathering information about emerging technologies, customer needs, and competitor activities, and understanding their implications for the firm. It requires an organization to be vigilant and proactive in scanning the environment and recognizing shifts in market trends and customer preferences.

02 **Seizing:** Once opportunities and threats have been identified, the firm must seize them by developing and deploying appropriate strategies, processes, and resources. This may involve the development of new products or services, entry into new markets, or the reallocation of resources to capitalize on the identified opportunities. Seizing also involves making decisions about the organizational structure, culture, and incentive systems to facilitate the execution of these new strategies.

03 **Transforming:** Finally, the firm must continuously adapt, renew, and reconfigure its resources, capabilities, and organizational structures to maintain a competitive advantage in the face of changing market conditions. This process involves the integration and recombination of existing and newly acquired resources, as well as the continuous learning and improvement of the organization's capabilities.

These skills which will be in high demand and sought after by both individuals and higher education institutions will be critical in the coming years.

The Changing landscape of Business Education

Content has long been a cornerstone of business schools and higher education in general. However, the emergence of AI tutors and virtual humans capable of effectively teaching standardized, highly codified content will inevitably disrupt the higher education landscape.

This shift will be accompanied by a transformation of online learning formats, incorporating enhanced interactions and facilitating new forms of social interrelationships and group work.

As a result, business schools must reinvent their core offerings, focusing on experiential learning, innovative content utilization, and exploring areas that have not yet been widely codified.

The manner in which education is delivered will also need to adapt, with the integration of co-pilots, assistants, and virtual humans poised to revolutionize the industry in the same way they transformed chess and go.

This raises the question of whether business schools, and higher education in general, will maintain their current market fragmentation or follow the trajectory of digital technology, leading to increased market concentration and dominance by a few key players.

Presently, the higher education market is highly fragmented, protected by legal constraints and the prevalence of face-to-face interaction. However, as these factors evolve, new market entrants and increased democratization within the sector are likely to emerge. The integration of technology into education is already well underway, and its long-term effects will indelibly alter the face of higher education.

In the interim, managing and navigating this transition, capitalizing on emerging opportunities, and integrating new advancements into existing models is the most viable path forward. Resisting the inevitable is not a viable strategy, especially when it represents the foundation of a new and potentially better world.

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Resisting the inevitable is not a viable strategy, especially when it represents the foundation of a new and potentially better world.

04 Education in the new digital space: the vision

**No one can plan without a vision.
A vision uses our imagination to materialize
and ground our expectations about the future.
Only then planning is possible.**

The next chapter for online education: The Integration of Generative AI, AR/ VR, the metaverse, and Web 3.0

The landscape of education is poised for a transformative shift, driven by the convergence of generative AI, augmented reality (AR), virtual reality (VR), the metaverse, and everything falling within the Web 3.0 umbrella. Individually, these technologies have the potential to revolutionize learning, but their combined impact far exceeds the sum of their individual capabilities.

For instance, generative AI for text could facilitate the development of an intelligent tutoring system, such as Khanmigo, which could provide unparalleled instruction in astrophysics. While this alone would represent a significant advancement in educational technology, the integration of human-like representation, AR/VR, and the metaverse would take it a step further. By enabling students to embark on a guided, immersive journey through the cosmos with their personalized tutor, the educational experience becomes simultaneously personal and social, opening new dimensions of learning.

The convergence of these technologies gives rise to a plethora of possibilities resulting from their combinations and permutations. As these technologies blend with existing and emerging innovations, the potential for groundbreaking discoveries

and novel educational approaches expands exponentially. Additionally, the interplay of technology and social adoption will lead to the emergence of new social behaviors and meanings, further enriching the learning experience.

In the following section, we will provide a brief exploration of the potential arising from tech integration in online education. It is crucial to recognize that our current understanding represents only a glimpse into the myriad possibilities that await us, as the future is a vast, unwritten canvas upon which these technologies will undoubtedly leave an indelible mark. But first, as a necessary introduction, we will delve into the pressing issues currently faced within the educational landscape and explore how tech integration can contribute to overcoming these challenges. By examining the hurdles that stand in the way of educational progress, we can develop a clearer understanding of the potential that these converging technologies hold in transforming the future of learning.

The realm of online education presents a distinct set of long-standing challenges, some of which overlap with those encountered in traditional, in-person learning environments, while others are unique to the digital medium.

LONG-STANDING GOAL: INTEGRATING SUBJECTS OF STUDY

A challenge shared by both online and in-person educational settings is the inability to effectively incorporate the subjects of study into the learning environment. This limitation is particularly pronounced in the physical sciences, such as physics, astrophysics, biology, and medicine, where the exploration and experiential understanding of physical elements are crucial. Traditional approaches have relied on sparking students' imaginations to transport them to these realities, with recent advancements in online technologies enabling the use of multimedia resources like movies, clips, or simulations.

“
Future students may be able to immerse themselves in true-to-life simulations rendered in full 3D, witnessing microscopic life up close, or navigating the intricacies of the human body.

However, these approaches pale in comparison to the potential of intelligent VR environments, as it is being shown already by initiatives such as the ones surveyed in Section 2.1. Future students may be able to immerse themselves in true-to-life simulations rendered in full 3D, witnessing microscopic life up close, or navigating the intricacies of the human body. By leveraging the capabilities of emerging technologies, educators can facilitate a more profound exploration and understanding of physical environments, greatly enhancing the learning experience.

LONG-STANDING GOAL: HUMAN INTERACTION

The second major challenge in online education lies in teaching students about human interaction, particularly in fields such as leadership, management, law, economics, and sociology. The need to understand individual and group dynamics and the interaction of various factors within multi-actor environments is paramount to these disciplines.

Traditional methods have relied on students' imagination and narratives in the form of case studies to facilitate learning. However, these approaches are inherently limited. Abstraction and generalization have been employed to distill group interactions into common heuristics or hypotheses, while simulations have been used to study group behavior, albeit at a considerable cost and with limited capabilities. These simulations often fail to provide insight into individual motivations and the emergence of macro-behaviors from micro-motives.

Tech integration has the potential to revolutionize the way human interaction is studied and taught. Current virtual environments, albeit crude, enable students to practice pitches or interviews and receive automated feedback. As the technology for generating movies from text input advances, it is conceivable that educators will be able to create lifelike scenarios in which students can interact with and interview virtual protagonists, propose alternatives, and observe the outcomes of their decisions.

This immersive learning environment can be extended to a variety of fields in the social sciences, including law, economics, and sociology, providing students with unprecedented opportunities to engage with and learn about human interaction in a more realistic and dynamic manner.

LONG-STANDING GOAL: STUDENT ENGAGEMENT

Finally, the most critical and widely recognized challenge in the realm of online education is student engagement. It is well-documented that a significant proportion of students do not complete their online courses, primarily due to a lack of engagement. Factors contributing to this problem include feelings of isolation, lack of contact with fellow students, the absence of pressure from instructors, and the inability to access immediate feedback or support when required.

Nevertheless, the convergence of generative AI, AR/VR, and the metaverse, combined with the integration of real and virtual students, has the potential to transform online education and overcome the engagement deficit. By capitalizing on the synergistic effects of these emerging technologies, educators can create immersive, interactive, and dynamic learning experiences that foster greater student engagement, paving the way for more successful outcomes in online education.

“The integration of these technologies can facilitate the development of virtual classrooms that replicate the social aspects of traditional learning environments, allowing students to interact with their peers and instructors in real-time.

The integration of these technologies can facilitate the development of virtual classrooms that replicate the social aspects of traditional learning environments, allowing students to interact with their peers and instructors in real-time. This can lead to the formation of online study groups, collaborative projects, and social learning networks, fostering a sense of community and belonging among online learners. Moreover, the use of generative AI in the creation of personalized learning experiences can further enhance engagement. By tailoring the educational content to each student's unique needs, interests, and learning styles, educators can ensure that online courses remain relevant and captivating, thereby sustaining student motivation and commitment to learning.

Additionally, the incorporation of AR/VR technologies can provide students with access to experiential learning opportunities that were previously unavailable in online settings. These immersive experiences can not only increase student engagement but also improve knowledge retention and understanding of complex concepts.

Furthermore, the addition of real-time feedback and support mechanisms, powered by AI and other advanced technologies, can help address the need for immediate assistance and guidance. This can help alleviate feelings of frustration and confusion that may arise during the learning process, ultimately resulting in increased engagement and persistence among online learners.

In summary, the fusion of generative AI, AR/VR, and the metaverse holds immense potential for addressing the engagement deficit in online education. By leveraging these cutting-edge technologies, educators can create immersive, interactive, and personalized learning experiences that foster greater student involvement, leading to improved learning outcomes and overall success in the online education landscape.

Major milestones

Although it is still early to pinpoint the exact milestones in the transformative journey of integrating generative AI with AR/VR technologies in education, we can identify three significant stages that we believe will shape the future of learning. It is important to note that the development and adoption of these technologies are inherently social processes, involving the construction of new social meanings and structures, which will unfold over time.

01

Emergence of Virtual Tutors Leveraging Generative AI

The first milestone, which is already taking shape, involves the use of virtual tutors that harness generative AI to guide, assist, and interact with students in a limited capacity. Pioneering examples such as Khanmigo and Duolingo showcase the immense potential of integrating AI with educational platforms. As these virtual tutors evolve, they will become more adept at providing personalized guidance and support, enhancing the learning experience for students across various subjects.

02

Transition to Interactive Virtual Human Tutors

The second milestone entails the transformation of AI-powered virtual tutors into virtual human entities with which students can interact more naturally. This transition will require advancements in various aspects, including refining interaction capabilities, optimizing response times, and enhancing the guidance and goal-setting features of these virtual human tutors. While these challenges are substantial, current progress in AI and AR/VR technologies suggests that they can be addressed within a reasonable time frame, enabling the creation of more engaging and immersive educational experiences.

03

Immersion in Fully Virtual Worlds with Human and Artificial Characters

The third and most ambitious milestone involves the integration of human and artificial human characters within fully realized virtual worlds. This stage will necessitate overcoming numerous technical and logistical hurdles, as well as developing scalable solutions for widespread implementation. As learners interact with both real and virtual characters within these immersive environments, novel social meanings and structures will emerge, enriching the educational experience and fostering a more profound understanding of various subjects.

It is essential to recognize that these milestones, although roughly sequential, will not follow a strictly linear progression; instead, they will intersect and overlap, with advancements in one area influencing and informing progress in others. This dynamic and interconnected evolution will give rise to new social and educational paradigms that are currently beyond our imagination.

All in all, tech integration is poised to revolutionize education in unprecedented ways. As we witness the unfolding of these milestones and the emergence of new social meanings and structures, we can be certain that the landscape of education will be irrevocably transformed, unlocking untold potential for learners around the world.

Tech companies already changing education

As we anticipate the major milestones in the integration of generative AI, AR/VR, and the metaverse in education, it is important to acknowledge the ongoing efforts of technology companies that are already changing the educational landscape. Through various initiatives and partnerships, these tech giants are paving the way for the future of education, while simultaneously shaping user experiences and contributing to societal advancement.

In the early days, Apple began donating thousands of its personal computers to school classrooms in the 1980s. Fast forward to the present, and technology companies like Amazon, Apple, Google, and Microsoft; and their counterparts around the world, have seen the education market as a way of familiarizing new users with their systems (and thus becoming future customers) while also benefiting society. Moreover, universities, and students are just as enthusiastic about the collaborations: In 2022, for instance, top Chinese universities in Shanghai, Fudan, Peking, Renmin, Zhejiang, and Nanjing set up the "Metaverse and Virtual-Real Interaction Joint Research Institute" together with some of the country's Big Tech companies such as Tencent, Huawei, Epic Games, and China Mobile's Migu[19]. The demand for this definitely exists: 2023 survey of college students in Korea found the vast majority (85%) intend to use metaverse-based education services[20].

While tech companies have been honing education offerings for many years, the COVID pandemic accelerated the need. As students were forced to learn from home, tech companies saw an opportunity to become a new channel that supported, augmented, and sometimes replaced in-classroom lectures. Now as universities, jobseekers, and employers shift from traditional full-time, in-person degree programs, technology companies and universities are:

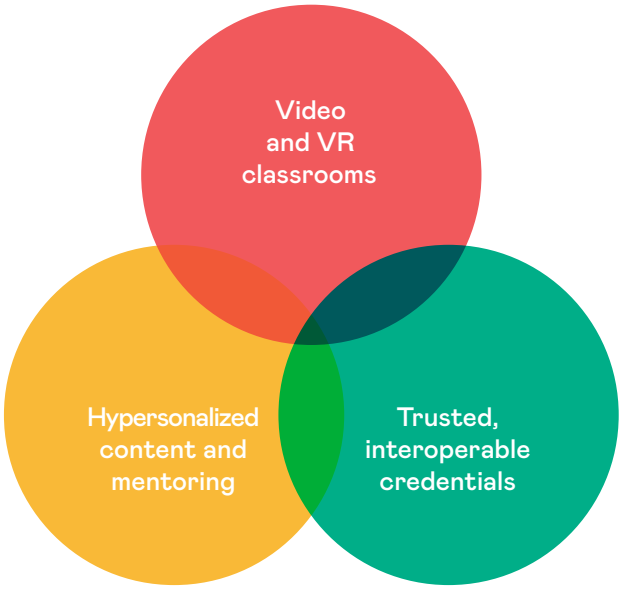
- → **bringing virtual classrooms to VR**
- → **making flexible credential systems as legitimate as traditional ones**
- → **hyperpersonalizing mentorship via realistic avatars and AI-generated learning content**

19 CNStock (2022). ""Joint Research Institute of metaverse and Virtual Reality Interaction" was established in Shanghai". Available at https://news.cnstock.com/news,bwkx-202208-4943042.htm

20 Lee, J. and Jang, S. (2023). "Metaverse-based education service adoption and preference study using conjoint analysis". 2023 International Conference on Computing, Networking and Communications (ICNC). Available at https://www.computer.org/csdl/proceedings-article/icnc/2023/10074583/1LKwIQCvo2Y

One might even say that online learning during COVID is the seed of the metaverse, where the boundary between online and offline disappeared. The blurring of these boundaries involves three deeply interrelated dimensions: the move from video to VR classrooms; hyperpersonalized content and mentoring; and trusted, interoperable credentials.

Figure 7. Dimensions of Boundary Blurring in Online Learning During COVID-19



FROM VIDEO TO VR CLASSROOMS

The pandemic forced billions of people onto video conferencing platforms like Zoom and Teams, and accelerated adoption of VR headsets like the Meta Quest. Seeing the video-to-VR shift as the future, in 2021 VictoryXR (with funding from Qualcomm) created a VR digital campus for Morehouse College. This was a pilot program in which ten US colleges and universities partnered with Meta and Engage, an Irish virtual reality platform, to create 3D digital replicas of their campuses, known as "metaversities"[21]. Using immersive virtual reality headsets, students can participate in learning activities. Among the institutions involved are the University of Maryland Global Campus, which has been sent dozens of free headsets by Meta. Meta has donated hundreds of its Quest 2 headsets to participating colleges. The virtual reality classes at Morehouse College have resulted in a 10% increase in students' GPAs. The metaverse is an affordable alternative to purchasing cadavers, as discussed above and shown by Fisk University's pre-med program. The metaverse can make educational resources accessible to remote students, and South Dakota State University expects its metaversity to reach rural students[22].

21 Koenig, R. (2022). "With Money From Facebook, 10 Colleges Turn Their Campuses into 'Metaversities'". EdSurge. Available at https://www.edsurge.com/news/2022-06-01-with-money-from-facebook-10-colleges-turn-their-campuses-into-metaversities

22 Kshetri, N. (2022). "Six benefits that the metaverse offers to colleges and universities". The Conversation. Available at https://theconversation.com/six-benefits-that-the-metaverse-offers-to-colleges-and-universities-188950

CREDENTIALING

As shown by our survey in Section 2.2, the contemporary credentialing landscape could be easily defined as crowded and noisy, but in both the US and the UK there are examples that illustrate the potential of alternative credentials to offer more flexible pathways to skills and employment.

One example is IBM's partnership with the digital badging platform Acclaim (now part of Pearson and Credly). IBM badges are becoming more recognized, not just at IBM but in postsecondary education as well. Northeastern University in Boston, Massachusetts, recently began issuing college credit toward graduate degree programs and certificates for earners of IBM badges. Adobe, Autodesk, Microsoft and Cisco are also part of the program. Credly by Pearson hosts the largest and most-connected digital credential network, which could help the world speak a common language of verified knowledge, skills, and abilities.

> **Some higher ed disruption watchers have opined that these employer-driven stacks are competing or will compete with some degree offerings, particularly graduate degrees. IBM is offering its courseware for free at Cognitive Class[23], and is starting to figure out how to offer college credit with institutions. They just announced a first partnership with Northeastern University[24] in three graduate programs, where the IBM badges can count for credit towards a graduate degree. According to a recent press release, "Northeastern is the first university to recognize IBM digital badge credentials toward graduate degree programs and certificates, providing a seamless pathway from workplace learning into academic degrees and certificates."[25]**

Another example is Google's Grow with Google initiative[26], which provides adults in the US and Europe access to skill-building opportunities for jobs and entrepreneurship. It claims to have resulted in over 200,000 individuals finding a new job or starting a business since its inception in 2015. Google made the certificates free to all U.S. community colleges and career high schools.

Other small local colleges are partnering with Microsoft, Adobe, and IBM on education. For example, California State University at Fullerton offers certificates and badges tailored to each of the big tech companies[27].

23 Data Science and Cognitive Computing Courses - Cognitive Class | Free. (n.d.). Retrieved April 24, 2023, from https://cognitiveclass.ai/

24 News@Northeastern. (2020, October 21). *Northeastern University and IBM Partnership first to turn digital badges into academic credentials for learners worldwide.* Northeastern Global News. Retrieved April 24, 2023, from https://news.northeastern.edu/2017/09/25/northeastern-university-and-ibm-partnership-first-to-turn-digital-badges-into-academic-credentials-for-learners-worldwide/

25 *Badges about to "change the game" on hiring at IBM.* Education Design Lab. (2020, July 29). Retrieved April 24, 2023, from https://eddesignlab.org/news-events/badges-about-to-change-the-game-on-hiring-at-ibm/

26 Grow with google. Herramientas para crecer laboralmente - Grow with Google. (n.d.). Retrieved April 24, 2023, from https://grow.google/intl/es/

27 *IBM Digital badge.* IBM - CSUF Badges and Certificates | CSUF. (n.d.). Retrieved April 24, 2023, from https://training.fullerton.edu/badging/badges/ibm/IBM.php

HYPERPERSONALIZATION

Almost as soon as large language models like ChatGPT were announced, students started using them as a helper—or a replacement—for all kinds of homework. However, there are clear opportunities to use the technology to enhance and accelerate learning and not avoid it. Section 2.3 already showed some of the most recent, in January 2023, Engage XR announced[28] it had integrated generative AI into its metaverse platform. They used Open AI's Chat GPT-3 and DALL.E to give personality and conversational skills to a mentoring avatar named Athena.

Plato's Phaedrus relates a conversation, where a king warns against the dangers of writing. In his words, writing "will create forgetfulness in the learners' souls, because they will not use their memories; they will trust the external written characters and not remember by themselves." Similar warnings were made about pocket calculators, spell check, and of course now ChatGPT. It is inevitable that the technologies of the metaverse will similarly become core to the future of learning. But how?

With so much already underway and unfinished, it might seem premature to dig deeper about the future, even risky. But we believe it is never too early to envision scenarios and their consequences, so we can guide the means to a better end. In line with the timeline of milestones outlined in the previous section, we are offering a semi-sequential vision of how change could unfold for the broader landscape of online education going forward. Departing from the three-dimensional process detailed above, we believe that providing such a vision is useful to activate the imagination and to produce the future, rather than as a way to predict it.

28 YouTube. (2023, January 21). Athena Alpha Ai Intergration Engage. YouTube. Retrieved April 24, 2023, from https://www.youtube.com/watch?v=pK6Uo5-jDfE

→ OUR CURRENT AI MENTORS WILL BECOME OUR LIFELONG AI CO-PILOTS

Milestone 1:
Emergence of Virtual Tutors Leveraging Generative AI

Right now, ChatGPT and other large language models are mostly trained on public data, ranging from antiquity up until about two years ago. But there are already countless blog posts explaining how anyone with basic programming skills can create their own large language model for their startup, their hobbies, or their personal life. Soon personal ChatGPTs will be straight forward products or even features in the technology ecosystems we already use. The same way that a college student today probably has access to almost every assignment they've ever done in their life stored in a Google Drive or Dropbox, these language models will increasingly allow people to mine their own archives, and learn and imagine in ways that are actually unique to them.

→ OUR CO-PILOTS WILL BECOME DIGITAL DESCENDANTS

Milestone 2:
Transition to Interactive Virtual Human Tutors

These personal large language models will be digital twins closer to our own selves than any others imagined until now. Yet those digital twins will have been fed only on our past. By combining them with the ability to imagine future scenarios, pathways to achieve them, and their consequences and alternatives, our own digital twin will actually mutate and multiply into our infinite digital children. These "digital descendants" will run out ahead of their owners to explore possible futures, modeling and prototyping them and their consequences, coming back with the results so their owners can choose the best one. These models will interact with each other, collaborating and combining each of our potential futures with other people's. Like Tinder profiles based on futures not the past, the Descendants will lead us to new friendships, jobs, classes, and places, causing experiences and adventures that we would not have found without their help.

→ OUR DIGITAL DESCENDANTS WILL PROTOTYPE OUR MANY POSSIBLE FUTURE SELVES

Milestone 3:
Immersion in Fully Virtual Worlds with Human and Artificial Characters

Similar to how Plato imagined the technology of writing would do to memory, metaverse technologies will now do to learning and to imagining as well. But the king in Plato's story obviously got it wrong: reading and writing are critical to helping us learn from others we will never meet, lives lived as we could never experience for ourselves, and share our stories with anyone who wants to join our adventure. These digital descendants (co-pilots, avatars, agents, or whatever we may call them) will seem as intrinsic to our own identities as the ones we already invent when we read or write, plan or hope. They will not just come back to us with something as simple as course recommendations for a successful career: they will inspire our souls with rich pictures of our future selves in the form of full-length movies generated just for us, personal songs composed in our favorite keys, or paintings of who we might become when we live our lives fully. All their art will be our art, and we will share it with the people we want to be a part of it all.

→ DIGITAL DESCENDANTS WILL BECOME LEARNERS, TOO

Milestone 4:
Immersion in Fully Virtual Worlds with Human and Artificial Characters

What role do universities have in this world where algorithms and students are indistinguishable from one another? In this world, metaversities will teach algorithms just as they teach students. There will be "places" that we send our algorithmic future selves, to gain knowledge, reasoning, ethics, street smarts, and all the other things universities have always offered. As De Kai, a Distinguished Research Scholar at Berkeley's International Computer Science Institute has said, we must teach AI as we teach our children, and as we ourselves learn. In fact, this future is already happening:

> **"The hidden danger that we are insufficiently aware of is that machines today are already learning and spreading culture based on how we interact with them. Even though today's AIs are still weak, they have already become integral, active, imitative, influential members of society. More so than most human members of society, if we are honest." Prof. De Kai.** [29]

29 Prof. De Kai Professor of Computer Science and Engineering at HKUST & Distinguished Research Scholar at the International Computer Science Institute. (n.d.). *Teaching ai to learn. dotmagazine.* Retrieved April 24, 2023, from https://www.dotmagazine.online/issues/unleashing-creativity-in-work-life/digital-education-as-foundation-of-digital-ethics/teaching-ai-to-learn

05
Business education – The road ahead

Business education is at a crossroads. First online, boosted by the pandemic, then the AR/VR/XR and generative technologies are poised to change it forever. How can we shape the business education that present and future challenges demand?

In the previous section, we presented a long-term and ambitious vision. In this section, we aim to translate it into concrete actions in three dimensions, which are the sections of this final part: what to do, who (the actors), and how in its deepest dimension (learning methodologies). Interestingly, each of these three dimensions, while intimately interconnected, corresponds slightly more with one of the valued technological disruption channels thus far. "What to do" is more hands-on and can, therefore, be associated more clearly with the physical and spatial dimension, which is more related to the metaverse and new spaces of augmented or extended reality. As discussed in sections 2.3 and 3.3, Web 3.0 has great potential to define alignment among the various actors involved. Finally, regarding "how we learn," generative AI may present the most significant impact. In each of the following three sections, we will discuss all the technologies. However, we find it useful to maintain these differentiated emphases to make the following toolbox as functional as possible for the change in business education.

The problems that we need to solve to make it real

The next 2 years: top executive programs, online & blended

Based on the current state of development of exponential technologies, with a special emphasis on the metaverse given its disruptive potential for online education along with the challenge it poses for its implementation, and on the skill map defined above, we identify four areas with their corresponding goals that will demand actions[30].

30 Cortés, M. (n.d.). Analyses and insights on potential impact of the metaverse on the education sector. Retrieved April 25, 2023, from https://openaccess.uoc.edu/bitstream/10609/141246/7/Metavers%20i%20sector%20educatiu%20v01_EN.pdf

AREA:

Impact on learning models and processes

GOAL: **Making the transition from face-to-face to online to immersive content and environments**

As we surveyed in Section 3.3, education was becoming more digital even before the impact of the COVID-19 pandemic on educational environments. Three trends were defining this progressive digitalization on business education:

→ **Producing digital media and content:** the transition began when traditional educational environments turned to digital tools to manage and monitor their programmes. Environments such as Moodle and other platforms allowed students and teachers to log into a digital environment where they could store documents, access digital content, track programmes, and so on.

→ **Using digital infrastructure:** traditional classrooms later brought in digital media such as computers, tablets, smartboards and mobile phones, which transformed classroom-based educational experiences by creating a hybrid model in terms of infrastructure.

→ **Creating digital educational environments:** experiences such as those offered by the Universitat Oberta de Catalunya have taken the entire educational environment online, from the classroom itself to the content, learning processes and student monitoring.

These initiatives, some of which are more established than others, have coexisted with an educational approach set on face-to-face teaching and learning. The latter, however, radically changed following the COVID-19 outbreak and the widespread move towards hybrid educational processes and environments in which videoconferencing platforms have become a common tool.

The potential advent of new digital spaces would trigger a much more disruptive next step in this transition. Its integration could change the paradigm completely, since it is not merely evolving or transforming content, processes, and environments by adding a digital layer. It would mean leaping from face-to-face, hybrid or online education to a fully immersive educational experience, which would set off a paradigm shift in terms of content, environments and learning processes.

ACTIONS:

1. Identify, even with a high degree of uncertainty, the possibilities that disruptive tech integration can open up for education.
2. Given that these technologies are still developing, create a model for monitoring changes and assessing its potential for use, i.e., instead of reacting to changes. Take a more proactive approach (for example, by setting up a radar system aimed at spotting new developments in this area).
3. Plan possible actions, accepting that some of them will involve core changes (transforming people's way of thinking, enhancing physical infrastructure, such as buildings and classrooms, with technological infrastructure, etc.).
4. Understand that this paradigm shift is not about bringing what is done in the physical world to the digital environment (one of the main criticisms of the videoconferencing model used during the pandemic), but instead about creating an entirely new environment.

Actors to involve: Educational institutions, educators as well as immersive tech companies

GOAL: **Improving the quality of learning: personalization and matching the student's pace**

When it comes to any learning process or pathway, one of the challenges is being able to personalize it for every student, considering factors such as their prior knowledge and skills, how fast they learn, their interests, and even the reasons why they need to engage in the learning process in the first place.

The developments we are beginning to see foreshadow decisive progress in this area from several angles:

- → **Learners will be able to explore the immersive environments on their own or with other users, moving through them at their own learning pace.**
- → **Since the infrastructure and its use are digital, this can be automatically converted into data, which can be used for a range of purposes, including understanding and anticipating the next steps in each student's learning process.**
- → **Included in this equation are not only the metaverse, but also artificial intelligence-based algorithms, which aggregate data on metaverse users (students), making it possible to predict and personalize the next steps in their learning processes.**
- → **This data-driven process will make it easier to quickly and systematically assess students' performance, so as to continuously adjust the process or even change it completely.**

ACTIONS:

1. Possess the necessary technology to convert the process into data that can be analyzed to draw conclusions about how the process should continue.
2. Building on the previous challenge, possess the necessary skills and technologies to continuously produce new content and resources for these personalized educational pathways. Transform the role of student and teacher (to be explored later in this report) and work out how to manage the changes that this will entail.

Actors to involve: Educational institutions + edtech startups.

GOAL: **Leveraging the new, proven possibilities of virtual worlds**

As we have highlighted in Section 2.1, gaming platforms are among the metaverse's most immediate forerunners. As such, it could be very fruitful to explore not only their dynamics but also their codes of conduct, and apply their lessons on the educational environment for business schools.

We anticipate that the qualitative leap will take place when teachers themselves begin to use the platform in their own curricula. That is, once the platform has helped to outline any potential risks for students, for example by limiting the possibility of strangers contacting them through the platform. Emulating the platform's game creation and sharing dynamic, teachers take preset templates and personalize the topics and levels (as if it were a game) and create interactive tutorials for their students about the subjects in their curricula. From there, students play these levels to enhance the learning process.

There are a few knock-on effects, for instance:

→ **Content creators on platforms such as Roblox earn money for their creations based on how well they do among other users on the platform. By learning how to use the platform and produce content, students can become content creators themselves and generate a revenue stream for their future, which would be in and on itself a valuable contribution to any business education.**

→ **Digital skills (e.g., coding) prime students for a successful career in the future.**

ACTIONS:

1 Identify existing platforms and analyze them as research tools to be applied later in the educational environment (benchmarking).

2 Ensure that those designing and carrying out educational programmes and curricula immerse themselves in these platforms; gaining first-hand experience is a crucial first step towards leveraging their capabilities.

Actors to involve: VR developers/platforms + curriculum developers.

GOAL: **Moving from lecture methods to gamification**

This report is not revealing any sort of well-kept secret when it recalls the value of gamification as an educational tool. However, it is worth noting again just how important this type of practice is right now. It embraces games as fun activities to spark learning, making educational environments resemble recreational environments and, as a result, enhancing students' receptiveness to learning. Also, it hones skills such as teamwork, collaboration, strategic thinking, spatial awareness and imagination. Finally, it enables key lessons on issues such as losing and failing in a controlled setting.

By harnessing the features of the metaverse we can take gamified education to the next level. The use of immersive technologies adds a realness factor that affords students more intense experiences and, in addition, allows teachers to take part in the process as facilitators or even as participants themselves (as we will see later on).

ACTIONS:

1. Spot any potential risks that platforms such as those for gaming pose for students' cognitive development, as discussed by Stanford University regarding games such as Fortnite[31].
2. Use these methodologies to work on specific skills that are extremely difficult to develop in lecture-heavy environments.
3. Co-create these environments with learners.

Actors to involve: Educational institutions + game developers/platforms + learning designers.

31 James, J. (2018) "Stanford experts provide guidance for how parents and teachers can navigate the Fortnite craze" Available at https://ed.stanford.edu/news/stanford-experts-provide-guidance-how-parents-and-teachers-can-navigate-fortnite-craze

GOAL: **Reaching a greater number of students**

One of the clear advantages of moving education online is the possibility of reaching more students and removing the distance between students, teachers, and educational institutions. This advantage increases when we think about the potential impact of the metaverse on education.

Using the underlying theories of exponential growth in business environments as a reference, the size of the potential market is one of the first key characteristics. Indeed, the bigger the potential market, the greater the possibility for a business to grow in it. This growth can come in three ways: expanding within the existing market, creating a new market from an existing one or creating adjacent markets.

At the intersection of education and the metaverse, this growth can also take three avenues:

Expanding within the existing market: educational institutions that build the metaverse into their educational models may expand and grow within current markets thanks to the attractiveness of the technology, its features and the updated educational processes.

Creating a new market: a second possible route is that of reaching new population and/or geographic markets.

Creating adjacent markets: the third growth strategy involves creating adjacent markets. Educational institutions can follow in the footsteps of companies such as Apple, where the manufacture of computers led to adjacent businesses around the underlying technologies and with the aim of meeting various needs among the same target market.

ACTIONS:

1. Dissociate the business goals of educational institutions from the technologies they use in their programmes and courses.
2. Leverage user-centered methodologies to imagine possible needs that could be met using metaverse technology, even those outside the normal scope of education.

Actors to involve: Educational institutions.

AREA:

Matching educational supply and demand to create human capital and transfer it to the productive system

GOAL: **The gap between educational supply and the demand for talent**

Some people believe that there is a widening gap between what the education system is offering and what the market actually needs in terms of the skills and knowledge required to carry out productive activities. The consequence of this potential mismatch between supply and demand would be a loss of productivity and competitiveness, which is crucial in any educational field, but of utmost importance when we are discussing business education. If companies cannot bring in the talent they need, they make up for this deficit by hiring less qualified professionals and upskilling them or recruiting people who skip formal education altogether and are trained directly by companies instead, often in their own training centers. Whatever the case, this can lead to a decline in productivity which can weaken competitiveness if other countries do manage to narrow this gap.

We have recently witnessed the first large company respond to a skills shortage among its employees. In 2021, Bank of America set up a programme within its own corporate university, called The Academy, and rolled out a training curriculum featuring virtual reality technology and a metaverse. Through this programme, more than 50,000 employees across 4,000 branches will be able to virtually simulate face-to-face interactions with clients (in a practice environment). There are currently 20 simulations allowing employees to work on skills to improve client relations, manage conflicts and become more empathetic listeners.

This first example highlights the need to move past educational programmes that fail to meet company challenges (e.g., using scripted videos or group dynamics with simulators), as well as the will to explore training environments, like the one described above, that are not yet part of higher education and must therefore be designed specifically by companies to meet a need.

ACTIONS:

1. Identify what is in demand in the business sector.
2. Quickly provide solutions.
3. Create collaborative environments between the worlds of business and education to even out the imbalance between supply and demand.

Actors to involve: Educational institutions + businesses and corporations.

GOAL: **Bridging digital and generational divides**

Bringing these new digital spaces to life will clearly require high investments in technological infrastructure (creation of content, platforms, etc.). Users, too, will have to invest in high-performance computing and graphics hardware, a device for entering the metaverse (for now, an AR headset), and high-speed bandwidth, to name a few examples. This raises at least two concerns in the scope of education, which are after all specific forms taken by the overall access challenge outlined right from our Introduction:

→ **The economic and digital divide:** as pointed out by some authors[32], the fact that some people do not have access to certain technologies or cannot afford them creates an imbalance in educational attainment and learning processes. Any educational institution considering evolving its learning resources and methods towards the metaverse will have to take this into account if it does not want to make access and use more exclusive to some.

→ **The generational divide:** the use and availability of digital technologies are evolving and becoming an increasingly normal part of everyday life. Against this backdrop, the need and motivation to use certain technologies may mean that age is no longer a key factor determining their uptake. This was laid bare throughout 2020 and 2021. During the strongest waves of COVID-19, people who knew little about, or rarely used, technology were forced to rely on it for transactional (access to e-commerce), work (videoconferencing and remote working platforms) or social purposes (access to online healthcare services or contact with family members). However, the development of the metaverse entails a new paradigm shift not only in the type of infrastructure required (more powerful computers, VR headsets and high-speed internet access), but also and most importantly, in our understanding of what an immersive reality and virtual world would imply. This poses a challenge for any institution offering education to learners of a certain age who, until now, have been unconcerned with accessing and using technology.

ACTIONS:

1 Ensure that accessing new tech-powered education is affordable to as many people as possible.

2 Accept that technology can slow down deployment and that its cost will have to go down while system performance goes up.

3 Take action to prevent an age divide by making the metaverse and other spaces more normal and appealing to groups who are currently the furthest removed from technology.

Actors to involve: Tech companies + educational Institutions + government/policymakers.

32 Goldin, C. D., & Katz, L. F. (2010). *The race between education and Technology.* The Belknap Press.
Goldin and Katz provide an evolutionary analysis of the US education system. They show that there is a wage gap between those groups that have access to a certain level of education and those that do not, and that this gap is growing over time.

AREA:

Redesigning environments (infrastructure) and the roles of those involved in education and transfer it to the productive system

GOAL: **Redesigning educational environments**

A crucial step towards introducing new hybrid spaces in education has involved replicating physical infrastructure in a digital environment. Necessity and opportunity are converging for educational institutions to re-envision the structure of traditional classrooms. Thankfully, as explored along this report, other technologies will facilitate hyper-personalization. Consequently, classroom time may increasingly be devoted to workshops, group exercises, and collaborative discussions, wherein students can apply and explore the content they have learned through automated tutoring systems.

Furthermore, the integration of AI-driven tutoring systems and interactive tools will require educational institutions to invest in robust digital infrastructure and provide adequate training for educators, enabling them to effectively leverage these technological advancements in the classroom. This process will also entail a reevaluation of traditional assessment methods, as new tools and techniques are developed to measure student progress in a dynamic, technology-enhanced learning environment. All in all, the emergence of AR/VR spaces, automated tutoring systems and interactive educational tools heralds a significant shift in the realm of education. As institutions adapt to these changes, they will need to reconsider the design and purpose of the traditional classroom, fostering a more personalized, collaborative, and engaging learning experience for students. Ultimately, the successful integration of these technologies will depend on the ability of educational stakeholders to maintain a sense of community and shared learning, while also embracing the transformative potential of these new tools.

There are promising examples undergoing already. In 2021, for example, the Chinese University of Hong Kong (CUHKSZ) created its first metaverse prototype. Leveraging Unity technology, it recreated its physical infrastructure in the metaverse. The digital facilities allow students to carry out the same actions they would on campus. The Communication University of China has followed a similar pattern. On 26 December 2021, it inaugurated its metaverse campus during a hybrid graduation ceremony that took place at a real-life venue and in the metaverse. In this case, development was carried out on the Xi Rang platform, owned by tech company Baidu.

Both examples show that for the moment redesigning educational environments means replicating or creating digital graphic representations of physical structures. However, there is clear potential to create new environments for learning that go beyond the traditional classroom or the recreation of educational buildings. In November 2022 Esade launched its metaverse campus. Through a virtual reality solution, Executive Education students can access a lecture hall, 6 group work rooms and a sports area where they can practice archery, basketball and baseball.

ACTIONS:

1. As in many points above, but especially here, possess enough technology to develop graphic environments.
2. Consider moving beyond the digital recreation of present-day physical environments, imagining immersive learning environments that fit the subject matter or training content (such as the solar system or bygone cities and civilizations).

Actors to involve: Space designers + learning designers.

GOAL: **Transforming the role of student and teacher**

Face-to-face educational models, as well as the hybrid models that evolved from them as a result of the COVID-19 pandemic, have clearly set roles for teachers and students in the classroom. Teachers play an active role as knowledge transmitters while students assume a passive role as knowledge receivers.

Some pedagogical movements have attempted to transform these roles by devising models and environments in which students take on a more participatory role and teachers facilitate the learning process rather than purely transmitting knowledge.

This trend is most likely to spill over, leading to foreseeably transformed roles:

→ **Role of the student:** the first tests using virtual worlds, gaming platforms or even the metaverse as educational environments seem to lay out a path that students must actively take as leaders of their learning process. They no longer simply receive content, but rather play a leading role.

- For example, some Spanish universities began using Second Life as an educational tool in 2007. In these cases, students take on an active role not only in creating their avatar and defining other user settings, but also by leading the process themselves by completing specific actions.
- In other examples, such as the educational initiatives hosted on Roblox (as seen earlier), students perform a similar active role.

→ **Role of the teacher:** in a new digital environment such as the metaverse, teachers will definitively take on the role of facilitator. With turnkey educational materials and settings available (and often not created by the teachers using them), teachers will instead support, guide and facilitate students through their learning process, likely playing a more passive role than before. The role of teacher will effectively be transformed. Moreover, as teaching will take place in environments that offer more knowledge than teachers can realistically hope to possess, their added value will be ability to understand and master the process and environment and to facilitate students' learning. This transformation will not occur overnight, requiring planning and learning on the part of teachers.

ACTIONS:

1. Prepare teachers for this new role, setting out a process of change that helps them transition from knowledge transmitters to learning facilitators.
2. Provide support in student-led learning processes.

Actors to involve: Educational institutions.

GOAL: **Understanding the new ways of capturing attention**

In 2003, Stanford University set up the Virtual Human Interaction Lab, a research center focused on understanding the psychological and behavioural effects of augmented reality. In 2021, the centre rolled out the first course developed entirely in a metaverse environment, called Virtual People[33]. Students engage in the course through a VR headset and an avatar.

One of the main lines of research stemming from this experience focuses on how to capture participants' attention in an environment that is so different from what they are used to. It raises questions about what triggers participants' attention in the learning process. Two areas stand out in this case:

→ **Access to otherwise impossible, overly expensive or dangerous content:** an environment such as the metaverse opens the door to content considered dangerous or extremely difficult to access in a classroom. The creator of this course at Stanford University, Professor Jeremy Bailenson, cites experiences that would otherwise be too dangerous, such as an underwater ocean voyage, or expensive, such as travelling to the world's major cities. Because students are able to immerse themselves in this type of content, their attention is guaranteed. This fulfils one of the metaverse's essential features: allowing participants to perceive their virtual surroundings as reality.

→ **Social learning:** one of the course's activities involves groups of students putting on performances using their avatars. Here, students play a central role and engage in group work, with the added bonus of being able to take full advantage of the platform's immersive capabilities.

As highlighted earlier in this report, one of the best knock-on benefits of digital-based experiences is data availability. At Stanford University, these data can be used to improve and personalize the course. So far, the instructors and students taking part in the course have shared over 3,000 hours in VR environments.

ACTIONS:

1 Identify participants' expectations, in order to anticipate anchor points that will keep their attention from drifting away.

2 Continuously examine use patterns, prioritizing empirical measurements to pinpoint areas that capture participants' attention the most.

Actors to involve: Tech companies + research institutions + learning content creators.

33 *Vhil, Virtual Human Interaction Lab.* VHIL. (n.d.). Retrieved April 25, 2023, from https://stanfordvr.com/
This "experiment" leveraged the platform offered by ENGAGE, a company specialized in creating virtual environments for the metaverse.

GOAL: **Tackling assessment and monitoring challenges**

The specific traits of the metaverse will have a direct impact on assessment and monitoring. Factors such as personalization, the unique pathways followed by students and the undeniably individual nature of the process can transform commonly accepted models.

Firstly, this will involve redefining assessment criteria to encompass more than just knowledge acquisition. Factors that have been included in some educational processes in recent years come into play here, including digital skills and competencies, decision-making, the ability to evolve in changing environments and the flexibility to cope with processes that are not entirely set in stone.

Secondly, it will influence how student progress is facilitated and tracked. The availability of near-real-time data, especially comparative statistics, will lead to possible new assessment methods.

Thirdly, it raises questions about privacy. This would require coming up with a way, for example, to safely monitor conversations among students, or limit the nature of these recordings. This privacy may interfere with the assessment and monitoring of social learning, i.e., how sharing among students and the skills they display enhance their learning process.

Finally, it will be necessary to predict how teamwork will evolve in an environment such as the metaverse that (potentially) individualizes the educational process.

ACTIONS:

1. Redefine assessment criteria.
2. Use data to facilitate and track student progress.
3. Find a balance between privacy and social or collaborative learning.
4. Think of ways to develop teamwork in an environment that fosters individualized educational processes.

Actors to involve: Educational institutions.

AREA:

An ecosystem-based model

GOAL: **New partners in education**

The world of education has been working towards an ecosystem-based model for some time now. Institutions are teaming up to offer joint educational programmes and pathways, and partnerships are being established with companies in different sectors to create synergies and added value. The current metaverse blueprint seems to show the ecosystem-based model as one of its key pillars, and this is likely to be the case in the future as well.

First of all, the metaverse will require technological developments that educational institutions will have a tough time achieving on their own. It certainly makes more sense to build them together with the technology sector.

Secondly, ecosystem-based models will improve the educational content and the format it comes in. Along these lines, we have begun to see models such as Roblox's, which currently includes some type of collaboration with over 300 educational institutions of all kinds to create and deliver content.

Finally, picking up on what was said about matching supply and demand in this sector, it is essential to have ecosystems that involve the same companies where students will eventually work (or already work).

Put simply, the education sector may take two routes into the metaverse:

Adaptation: educational models, including content and methodology, may adapt to metaverse technology. Educational institutions would create content themselves, leveraging technology developed by a third party to create their own metaverse and move their programmes into the digital environment.

Transformation: unlike above, the creation of ecosystems made up of universities and other educational institutions, businesses and tech companies could transform the model, the content and the programmes to be developed.

ACTIONS:

1. Make decisions about what model to pursue (educational institutions).
2. Identify current ecosystems and explore how to take part (e.g., Roblox).
3. Identify potential partners with whom to create these ecosystems.

Actors to involve: Educational institutions + tech companies + industry + corporate partners.

GOAL: **Setting standards**

Besides filling a real gap in the market, one of the biggest challenges to widespread adoption facing any newly created technology is to ensure ease of access and use, as well as uniform standards, if it is offered by various companies. Without a set standard, every manufacturer or supplier of the technology will follow its own, which makes uptake very difficult.

This is one of the most pressing issues surrounding the metaverse right now. Several big tech companies (e.g., Meta and Microsoft) have their sights set on this technology, but the outcome of these ventures will depend on whether their development is based on uniform standards or whether each company charts is own path.

For example, the mainstream device for plugging into a metaverse today is the VR headset. If each company designs its own headset and fails to make it compatible with other platforms, users will either have to purchase multiple devices or stick to one single platform. This is a very basic example, but the matter can become quite complicated if, for instance, the programming languages end up being platform specific. The various platforms have spoken out about setting standards and ensuring that this does not limit their growth, but their actual intentions are still unknown.

This whole issue of standards applies to the world of education, where regulation and, above all, certification are fundamental. Metaverse-driven changes, for instance, will not only be in media or hardware, but also in content and, most especially, learning pathways. This could trigger the need to redefine curricular content and certification processes. As of yet, there is virtually no reference to this subject in educational research, but it is certainly something to think about and make decisions on.

Actors to involve:
educational institutions + accreditation bodies + regulatory bodies + standards organizations.

GOAL: **Interoperability, blockchain and non-fungible tokens**

As touched on above, interoperability is one of the major challenges in the new ecosystems. Ensuring that all digital assets created in one metaverse can be used in another will undoubtedly be one of the keys to its uptake. This is not currently the case in two of today's major digital ecosystems: social media and video games.

→ **Social media:** when users open a social media app for the first time, they have to create a profile, write a description, set a username and search for contacts. This works against them in two ways: firstly, they may not want to spend time registering, and secondly, they may not be able to use the same username across apps if it is already in use. The only feature linked to interoperability, and one that is not widespread, is the ability to import a network of contacts to see if anyone is already using the app.

→ **Video games:** in most games, players can own digital assets that are linked to their account (e.g., clothing or skins). These can be acquired for free on some platforms and for a fee on others. However, when they switch to another game or platform, they are not transferable and must be acquired again.

In the metaverse, this would mean having to create a self-resembling avatar and a username on every new platform. The limitations that this would impose in terms of engaging on different platforms are evident. There are two factors that offer a glimmer of hope, however:

→ **Metaverse drivers:** the main tech companies driving the metaverse (e.g., Meta and Microsoft) have already expressed their intention and interest in creating features that enable cross-platform interoperability.

→ **Blockchain and non-fungible tokens (NFT):** these technologies can enable interoperability, allowing assets acquired on one platform to be validated for another (in NFT format) through blockchain.

Interoperability would open up huge possibilities in the field of education, potentially leading to:

→ **Joint programmes:** educational pathways based in the metaverse could be developed.

→ **Validation:** thanks to mechanisms such as blockchain, specific qualifications or pathways on one platform could be validated and added to another institution's curriculum.

→ **Content creation:** the teaching and learning content created by an educational institution could be used in other environments.

ACTIONS:

1 As a starting point, ensure effective interoperability. This challenge may be beyond the control of educational institutions, but they must lobby to achieve it.

2 Create digital assets (i.e., educational resources) within the metaverse that are attractive for other environments.

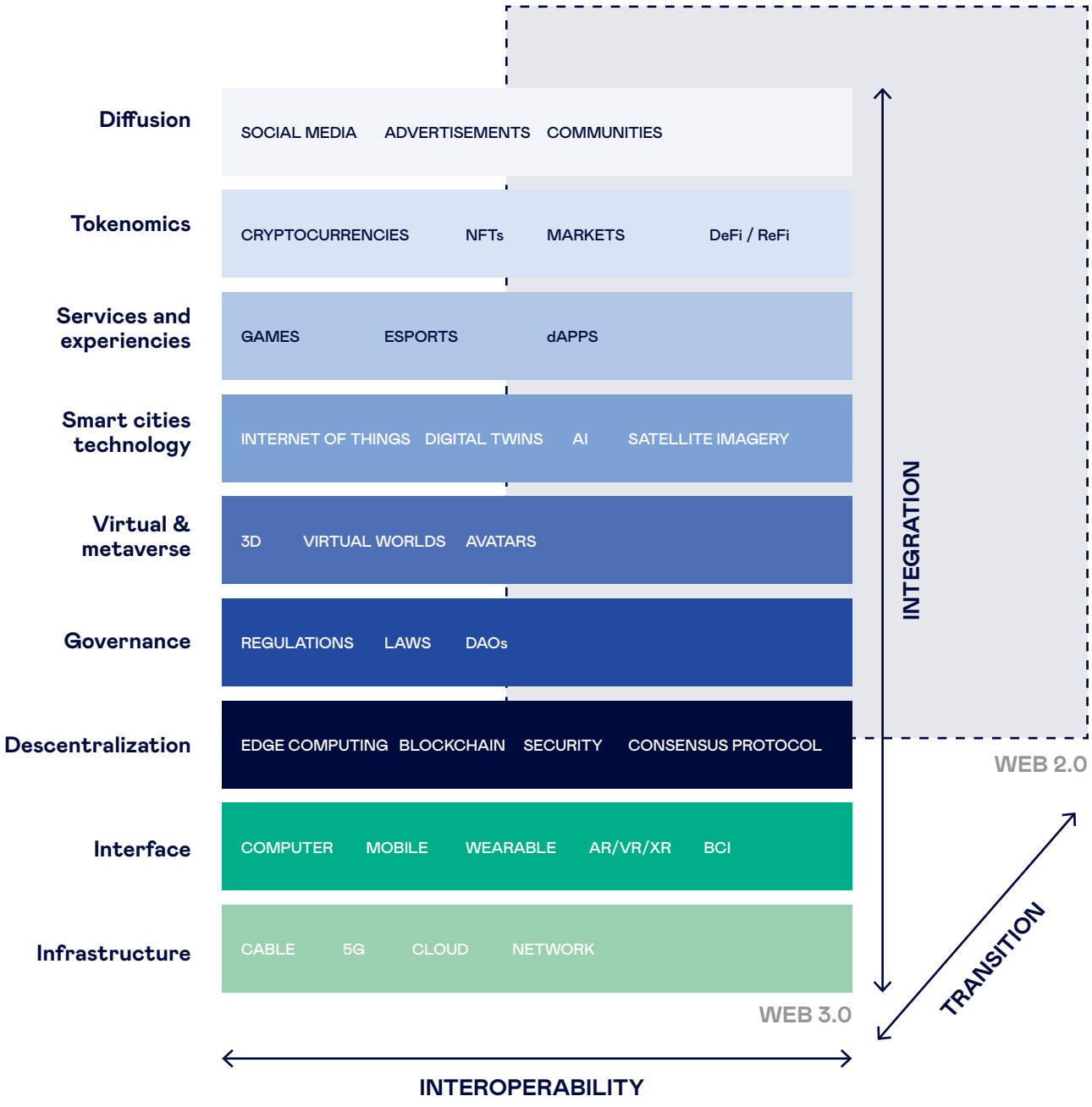
3 Foster collaboration between different environments.

Actors to involve: Blockchain companies + government + regulatory bodies.

The actors that we need to mobilize to make it present

The metaverse, dWeb, and XR technologies are all parts of a new ecosystem that is coming together in many organizations and industries. Education can learn from their experience, to accelerate its own adoption.

Figure 8. Complexity of Web3



Source: Futurity Systems

There are many requirements for deploying any complex system, but three of the most important are:

- **Vertical integration across the stack.** From the utilities and infrastructure like operating systems and networks at the bottom, to the applications and user experiences at the top, each component must work well with the ones above and below it. In the case of the metaverse in education, that means things like students' digital twins having verifiable accreditation, via the blockchain.

- **Interoperability between platforms and chains.** Thriving technology ecosystems are diverse, which means that there are multiple components doing the same things in slightly different ways. While this can be inefficient, the value of the diversity is more than compensated for by innovation and speed. There is not, nor may there ever be, a single blockchain dedicated to education content, credentials, or anything else. Therefore, developers must ensure that what they develop is compatible with Polygon, Etherium, and other chains. Educational content too needs to be compatible with more than one VR platform.

- **A migration plan from the old system to the new.** Despite the enthusiasm for disruption, new systems built on existing ones are preferable, as well as migrating data and users smoothly between systems. Education's migration from web2 to web3 will mean, for example, giving up the storage of all student data in central servers, instead the data will be distributed across many machines to increase accessibility and security. Some universities still making the switch from costly paper textbooks to online content; and now they need to leap to VR and AR materials. The technical and practical advantages might initially seem to be outweighed by the challenges and risks, but that's nothing new. For many years, universities, hospitals, and government agencies required keeping paper copies of even trivial official business, even to the point of printing out emails and storing them in binders. Only after many years of an inefficient, burdensome system do they switch.

Perhaps the biggest challenge of capturing the opportunity presented by the metaverse, dWeb, and decentralized technologies is not even technical. The hardest part is that it will also require coordination of several groups—universities, government, and companies—each of which has a strongly centralized culture that is even sometimes reinforced by policy and law. In other words, centralizing what is currently decentralized (the group of actors) in order to take action. Specifically, this means:

- **The "buyers" of educational services** - individual students and companies that want to hire or train employees need to be willing to transition into this mode of decentralized content, operations, and even financing of education. As mentioned earlier, blockchain-based content, credentialing, and payment can help break the deadlock held by conventional institutions.

- **Governments, universities and academic faculty need to set the benchmarks from web3 learning (chain, protocol and standards) for interoperability.** Virtual worlds must interoperable across platforms, tokens, coins. Digital assets also need to be transferable and useable across different domains. If the incumbent institutions do not lead the change, outsiders will, potentially with the same kinds of disastrous effects as the for-profit university debacle in the US, or the fake degree scandals in Europe.

- **To succeed, big tech companies and startups need to develop products that have been validated and integrated across the entire vertical stack.** However, in the absence of a coordinating body, determining the necessary specifications to build such products can be challenging. If we have a virtual world but students do not have enough bandwidth to stream 3D content, then the network is obsolete and needs government capital to be rebuilt. If immersive content can only be run in one type of VR platform, investment in any platform becomes riskier and adoption slower.

At its core, this is a problem of "centralized decentralization". No centralized entity (university, government) knows how to solve a decentralized problem. No decentralized groups or technologies want to be restricted by centralized one.

The changes in the learning process we need to assume

Disruptive innovations are known for their resistance to effortless integration into prevailing systems, structures, and processes. These disruptive forces exert considerable influence on organizations and society at large, leading to substantial shifts in paradigms and practices. Two cutting-edge technologies (AI-driven tutoring and memory access) that have recently emerged in the global landscape provide excellent examples of this phenomenon.

These technologies defy conventional attempts to incorporate them into existing methodologies as mere supplementary tools or adjunct components. Instead, their transformative potential transcends traditional frameworks and necessitates a profound reevaluation of the status quo. As a result, these innovations demand the conception and implementation of entirely new methodologies that can fully harness their transformative capacities and redefine the boundaries of possibility.

This process of reinvention does not stop at the level of methodologies, it extends its reach to the realm of education as well. In order to fully comprehend and exploit the possibilities offered by these disruptive technologies, educational institutions must reevaluate and reconstruct their pedagogical approaches. This entails cultivating new curricula, fostering innovative learning environments, and nurturing a culture of adaptability and continuous learning among educators and students alike. Their transformative impact necessitates the development of novel approaches and, ultimately, the reimagining of educational paradigms. We highlight here three of these new ways of thinking about interactions in the educational setting: engagement with knowledge, our ways to retain it, and the coordinating actions that take place around this process of knowledge transfer and re-creation.

A NEW DEFINITION OF ENGAGEMENT

One of the most immediate and prominent aspects of the educational landscape that is poised for transformation is the delivery of well-defined and engaging teaching content, such as calculus, algebra, programming languages, and introductory economics courses. Those who have experienced them can attest to the fact that such AI-driven tutoring systems, coupled with interactive tools, often surpass human instructors in effectively conveying this type of content.

As this transformation unfolds, educators and institutions will be challenged to identify and implement effective strategies that ensure students remain engaged in a cohesive learning community, transcending their individualized learning experiences. This may involve fostering a culture of collaboration, developing innovative methods of group interaction, and promoting a sense of belonging and shared purpose among students.

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Educators and institutions will be challenged to identify and implement effective strategies that ensure students remain engaged in a cohesive learning community, transcending their individualized learning experiences.

A NEW WAY OF RETAINING ACQUIRED KNOWLEDGE

Another crucial aspect that has undergone significant transformation is the equilibrium between information retained in memory and information accessible through digital tools. While this shift has been ongoing since the advent of search engines, recent advancements in generative technologies have amplified its impact to an unprecedented degree, far beyond what was once thought possible.

This evolving landscape necessitates the incorporation and utilization of tools that augment our ability to access, summarize, and comprehend vast quantities of information, while simultaneously preserving our capacity to reference and contextualize this data within broader frameworks. As technology continues to progress, both the balance and the tools required to navigate this information-rich environment will need to adapt through an iterative process of continuous refinement and adjustment.

A particularly intriguing aspect of this transformation is the role of memory in the digital age. Memory extends beyond the mere retrieval of information, serving as a fundamental cognitive function that provides essential reference points for situating and making sense of new data. As reliance on digital tools and generative technologies increases, it is imperative that we understand and appreciate the nuanced interplay between human memory and artificial intelligence.

Educational institutions and organizations must, therefore, strike a delicate balance between leveraging digital tools for information access and fostering the development of robust memory skills in students and professionals alike. This also involves promoting a culture of critical thinking and reflection, and encouraging individuals to actively engage with information, rather than passively consume it.

Finally, the dynamic relationship between information stored in memory and information accessible via digital tools has been significantly influenced by advancements in generative technologies. As this transformation unfolds, it is essential for individuals and institutions to adapt by embracing tools that complement and augment our cognitive capacities, while still valuing the vital role that memory plays in information processing and understanding. By striking the right balance and refining our approach iteratively, we can harness the full potential of these technological advancements and navigate the evolving landscape of information access with greater proficiency and insight.

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It is essential for individuals and institutions to adapt by embracing tools that complement and augment our cognitive capacities.

HYBRID COORDINATION DYNAMICS

The nature of interaction within educational settings is poised for significant change, as it transitions from being predominantly human-centric and classroom-based to incorporating advanced technologies and new modalities.

Firstly, the introduction of virtual humans capable of engaging in human-like conversations and interactions will lead to a substantial shift in the dynamics of educational discourse. These AI-powered entities are expected to begin as tutors, eventually evolving into discussion partners, collaborators, and evaluators. This phenomenon has already commenced with virtual tutors utilized by platforms. However, the embodiment of these AI agents within virtual human avatars will introduce an entirely new dimension to the educational experience.

In parallel, the dyadic interactions between human students and virtual humans will expand to encompass entire classrooms, with AI entities assuming responsibility for coordination and management. The initial stage of this process, which involves summarizing and synthesizing arguments presented in class, has already been implemented in tools such as Microsoft Teams, powered by GPT-4. However, the next phase will see AI-driven coordination become more visible and embodied, moving beyond the currently prevalent code-based, behind-the-scenes approach.

This shift toward AI-mediated coordination represents a significant change, as coordination has traditionally been regarded as a distinctly human task, requiring authority, empathy, and respect. As virtual humans take on these responsibilities, it will be crucial for educational institutions and stakeholders to carefully consider the ethical implications and potential challenges associated with delegating these inherently human roles to AI entities.

Ultimately, the successful integration of virtual humans and AI-driven coordination in education will depend on striking the right balance between embracing the potential of these technologies and preserving the essential human elements that underpin the educational experience. By navigating this delicate equilibrium, educators and institutions can harness the transformative power of these advancements to create more engaging, efficient, and collaborative learning environments for students and teachers alike.

A Roadmap to Actionable Outcomes

The perception of technology adoption as a uniform process often leads to the assumption that the speed of adopting one technology can be applied to others. This tendency is particularly noticeable in the case of AI and AR/VR/XR. Building upon the rapid adoption of foundational technologies like tablets and smartphones, we often overlook the need for adaptation and the profound societal impacts that accompany technological transformations.

While certain technologies enjoy rapid adoption rates, such as tablets that share operating systems and apps with smartphones, requiring only a purchase to adopt, other technologies require a learning curve or even an organizational transformation. AI serves as a prime example, as its adoption necessitates not only learning the technology but also integrating it into the fabric of an organization.

Consequently, different technologies exhibit not only varying speeds but also different rates of adoption. While some companies fully invest in a particular technology, reaping its benefits, others may not consider adopting it or, at most, adopt integrations with off-the-shelf systems.

In the context of widespread technological adoption, we commonly envision four levels of adoption: **personal, professional, functional,** and **systemic.**

Personal adoption is primarily limited by the learning process and integration into everyday life. Technologies like ChatGPT or AR/VR are prone to rapid personal adoption due to their inherent appeal. Professional adoption often stems from the translation of personal use to the professional environment, as seen with coders who incorporate ChatGPT as a co-pilot in their work.

The dichotomy of **personal-professional** adoption is well established and often serves as the entry point for new technologies in the workplace. We experienced this with the use of spreadsheets at a personal level, which eventually permeated companies, solving numerous problems that existing IT systems failed to address while creating new challenges.

The third level of adoption is **functional.** Functional adoption is more complex than personal or professional adoption but involves limited interactions, typically focusing on replacing or augmenting specific functionalities or tasks. Examples include the adoption of recommender systems, pricing algorithms, and others.

Lastly, **systemic adoption** is the most intricate level, necessitating the coordination of multiple functions during the adoption process. While many of these functions are automated through code, others involve human participation. An illustrative example is the integrated system at Amazon warehouses, where humans, machines, and systems are coordinated through code. Naturally, this type of adoption presents higher barriers to entry and greater potential for capturing value.

Furthermore, in the realm of education, we anticipate a convergence of AR/VR and Generative AI, leading to an explosion of innovation. Both technologies are considered General Purpose Technologies, enabling widespread adoption across multiple sectors and fostering exponential recombination.

Finally, it should be reiterated that technology adoption occurs within different constituencies, each characterized by its unique pace and level of adoption. Governments, tech companies, elementary education, higher education, and professional education will all exhibit varying rates of adoption in both face-to-face and online formats.

A ROADMAP

"The best way to predict the future is to invent it". This sentence attributed to Alan Kay and a very similar one, referring at its creation instead of its invention, by Peter Drucker ("The best way to predict the future is to create it") highlight the importance of actively shaping the future rather than passively observing it. In both cases, the implication is that the future is not predetermined, but rather requires deliberate production. To facilitate this process and drive technology progress along with its adoption, a roadmap consisting of actionable steps and milestones is crucial.

In line with this approach, we propose a series of steps for each level of technology adoption: Personal & Professional, Functional, and Systemic. These gather the actions envisioned in the three subsections above the present one into a streamline path forward that fits the vision laid out in Section 4, not by predicting it, but by posing a roadmap to help creating this new future. These steps should be taken as a 'flexible and level-based' roadmap, in the sense that it should be adapted to the needs of each environment/organization, and to the level at which the change is fostered: if, for instance, change begins at the university level, systemic levers will structure that specific roadmap, with all other steps playing a role conditioned to these. Under any scenario, by delineating them, we aim to show organizational leaders and 'change implementers' how could they align the toolkit offered in the previous subsections to produce an integrated aimed at pushing the boundaries of what is possible and foster innovation in technology and its utilization.

PERSONAL & PROFESSIONAL

1 **Prepare teachers & professors for the use of AR/VR & Generative AI.** To enable educators to effectively utilize Augmented Reality (AR), Virtual Reality (VR), and Generative Artificial Intelligence (AI), comprehensive training is paramount. Without proper training, the risk of partial adoptions that neglect essential aspects of these technologies becomes prevalent. However, training does not necessarily have to follow a formalized structure; instead, fostering collaborative learning communities that facilitate the exchange of best practices, exemplary cases, and experiences can prove highly beneficial. It is crucial to establish dedicated spaces for such knowledge-sharing initiatives and align incentives, often centered around visibility and recognition, to encourage active participation and foster the successful integration of AR/VR and Generative AI among education professionals.

2 **Design & create tools supporting the new roles.** As we have been evaluating across the present whitepaper, the evolving landscape of education entails a shift from traditional knowledge transmission, that will predominantly be carried out by automated systems capable of sensing individual levels of comprehension and adapting accordingly, to a paradigm centered around human facilitation of learning, potentially in conjunction with virtual entities. However, to effectively fulfill these roles, the development of suitable tools is imperative. These tools should encompass a range of resources, including curriculum examples, scenarios, and exemplary cases, to support educators in their instructional endeavors within this new framework. By providing educators with the necessary tools, we can foster optimal learning facilitation and adaptability in an ever-evolving educational landscape.

3 **Prototype & Test in actual scenarios.** A crucial next phase entails integrating the newly developed tools into authentic classroom environments. This requires identifying effective approaches for seamless integration that align with the existing dynamics of educational settings. By prototyping and testing these tools in real-world scenarios, we can gauge their efficacy and refine them based on practical insights. This iterative process ensures that the integration of these tools optimally supports instructional practices and enhances the overall learning experience for students.

FUNCTION

4 **Prototype & test function-based tools.** The development of modular tools designed to address specific functions presents an opportunity for seamless integration into the learning process. These targeted tools, particularly those addressing the 'pain points' faced by educators, such as student progress tracking or student evaluations, are likely to be well-received. This next step involves prototyping and rigorous testing of these function-based tools to assess their functionality, effectiveness, and alignment with educators' needs. Through iterative refinement based on empirical feedback, we can ensure that these tools successfully fulfill their intended purpose, supporting teachers in overcoming challenges and enhancing the overall educational experience.

5 **Develop function-based tools.** The creation of function-based tools, such as web tutors as widely commented through the present report, represents an initial manifestation of generative AI in the realm of knowledge transmission. These tools hold significant promise due to their potential for widespread deployment, driven by clear economic foundations driven by zero-marginal cost and non-decreasing returns on scale. This transformative deployment has the power to revolutionize the accessibility and economics of education, shifting it from a linear trajectory to an exponential growth model. By leveraging the capabilities of generative AI, these function-based tools have the capacity to enhance educational experiences, broaden educational access, and catalyze unprecedented advancements in the field of education.

6 **Development of prototype courses.** As the future of online education unfolds, the upcoming iteration is poised to be driven by generative AI and augmented/virtual reality (AR/VR), facilitated by social interaction. However, to realize the transformative potential of this paradigm shift, the creation, deployment, and validation of prototype courses are imperative. These exemplary courses, situated at the forefront of the functional stage of transformation, bear the potential to revolutionize the field of education and, consequently, society as a whole. By actively developing and refining these prototype courses, we can pave the way for a new era of education that leverages the capabilities of generative AI and AR/VR technologies, fostering enhanced learning experiences and reshaping the educational landscape.

SYSTEMIC

7 **Design, prototype and evaluate the *new* university.** The formulation, prototyping, and assessment of innovative university models are integral to the development and evolution of higher education. Such innovative designs emerge from comprehensive exploratory processes, enriched by the collaboration of various stakeholders. The integration of diverse values and paths is paramount to attain optimal results. In educational institutions like schools and universities, this necessitates a conscientious and deliberate exploration.

8 **Develop integrative tools.** Construct comprehensive integrative instruments. These holistic tools are supplemented by other instruments designed to execute coordination and integration tasks. In addition to functional ones, it is imperative to foster the development of these systemic tools for broader applicability and effectiveness.

9 **Living-Labs of real-life experimentation.** Education epitomizes a multifaceted undertaking where variables such as social status, culture, aspirational levels, and degrees of entrepreneurship, among others, impact the outcomes. To capitalize on these disruptive changes, the initiation of a series of Living Labs is advocated. These labs will function as platforms to facilitate rigorous experimentation, testing, and validation processes. Such innovative setups pave the way for an evidence-based approach to educational advancements.

A new era with humble beginnings

We enter in a new era where not only we will witness changes in the curricula—where in virtue of hyper-personalization part of it will be personalized to each person's pace and capabilities—but also in terms of the interactions, something that encompasses socialization.

It is challenging to predict the changes ahead, since we can barely assess its potential. It is also very challenging to foresee the speed of this social process, a process that will co-evolve. Yet we can imagine that this will be a scenario at several speeds, also determined by the regulatory context: in most countries, education is heavily regulated. This limits the capacity of change, because most of the educational infrastructure operates in a non-market structure. Therefore, we can expect that innovation comes primarily from the from the least regulated parts of the system, areas such as tutors, teaching and learning aids, etc.). However, education is something so vast that it is impossible to limit innovation even in regulated areas. Business schools, albeit logically subject to regulation, are also a privileged space to not only assume, but also foster, those innovations.

However, the varying speeds of innovation in different areas and countries will determine both its scope—and therefore the next winners in terms of companies and systems—as well the winners in terms of societies. This is a tremendous opportunity to leapfrog for societies whose educational system is not at a high level, because its size or due of the lack of qualified teachers. As in any other disruption, innovation has the potential to be an equalizer.

The potential of innovation as an equalizer, coupled with the conviction that business schools can play a central role, lies at the heart of this whitepaper's motivation.

As mentioned in the introduction, there is tension between maintaining the prestige and quality of elite institutions while simultaneously ensuring widespread accessibility. Additionally, the market is characterized by fragmentation, even as content becomes increasingly globalized.

By embracing the goal of technological innovation as an equalizer, we can minimize these tensions. Business schools, aside from being a privileged space due to their social function, also serve as a laboratory where both tensions are particularly demanding. Consequently, they represent a litmus test for entering this new era. In this whitepaper, we have proposed several ways to overcome these challenges, or at least to start thinking about how to do so.

Great advancements often have humble beginnings, missteps, setbacks, and failures. This disruption in business education is no exception. These are the humble beginnings, and we truly believe that the most significant achievements are yet to come.

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