EDUCATION IN TUNISIA:

FUTURE-PROOFING THROUGH TECHNOLOGY

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BIG INNOVATION CENTRE

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WRITTEN BY **CARL EL-KHOUEIRI**

A REPORT CREATED BY BIG INNOVATION CENTRE IN PARTNERSHIP WITH THE BRITISH COUNCIL

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FOREWORD

THE REAL STRENGTHS OF TUNISIA IS ITS OPENNESS

The demand of future skills is a new challenge for the education system. 65% of children entering primary school today will ultimately end up working in completely new jobs that don't yet exist, so we can't educate children and the youth towards fitting the existing job market.

Emerging technologies, as digital, Artificial Intelligence, Augmented Reality, and IoT, are **not only changing jobs, but they are disrupting the way we learn future skills.**

This report on future-proofing the Tunisian youth through smart education illustrates that the adoption of education-technology (or **Ed-Tech**) can be an effective way to **engage students at various levels and abilities**, and an opportunity to **use a variety of new learning styles**. Nevertheless, success requires that learners, teachers, assessment and teaching material, and the physical environment are futureproof.

Most of all the report illustrates an urgency - the need to transform the education system to build the top skills which are required already from now on. These are **complex problem solving, critical thinking, creativity, people management, coordination with others, emotional intelligence, judgement and decision making, cognitive flexibility** and others.

These "soft skills" are not only about future of work, but the education system must be transformed so the Youth can be prepared with skills to manage their smart home, live in smart cities and socialise digitally.

However, this is not just a **one-off smart** revolution, but with the emergence of new disruptive technologies for the 21st century, citizens must be **adaptable as lifelong learners**. Learning how to **learn in interaction with technology is a key future-proof skill**.

This also builds upon the results emphasised in a joint report (2018) by Big Innovation Centre, the UK All Party Parliamentary on Artificial Intelligence (APPG AI) and KPMG, called 'Learning to Learn' [1].

In the launch of the Digital Economy Strategy for the Arab League in Abu Dhabi in December 2018 (I am expert advisor and attended the meeting) it was also presented how learning environments are impacted: (i) classrooms are expected to become virtual or in a real-time context, (ii) teachers must become designers and mentors, (iii) instruction becomes construction, (iv) subjects become phenomena, (v) teaching moves from reactive to interactive, (vi) standards become frameworks and personalised, (vii) experts become about crowdsourced and the peers, (viii) textbooks becomes 'the environment' as living lab, (ix) learning become life-long and (x) fluid, adaptive and agile so forth.

Much of the inspiration behind how to prepare a new generation of youth for the future has also to come from looking at international responses and their knowledge and experience of best practice transformations. North Africa is open to foreign direct investment, open to foreign trade, open to foreign ideas, and I think that the **real strengths of Tunisia is it's openness. This is the foundation for transformation and progress.**

Through evidence-based interviews, we have crowd-source information from Tunisian and international experts, as well as users and co-producers of the education system in Tunisia.

Our evidence givers and influencers are either directly involved in shaping the vision, strategy, economic policy and planning, to future-proof the youth through smart education, or they hold significant knowledge on this matter.

Furthermore, attending the Hammamet Conference in Tunisia (November 2018), and later the follow-up meeting in Belfast, it is emerged there is an **international community ready for dialogue and purposeful relationships between the UK and North Africa**. There is a new generation of leaders from the worlds of business, civil society, media and government ready to build new relationships to future-proof how our youth and citizens will live, work and socialise now and in the future, to live more sustainable and happier lives.

Overall, the report proposes some solid answers for a future-proof Tunisia in this respect. By building a new foundation which puts **interdisciplinary and problem-solving at the heart of learning,** Tunisia will be able to **revolutionise the education infrastructure** - from **physical high-tech environments** to how **student assessment and feedback** is provided **automated and digitally, through precision learning**. Taught education curriculums must also be revitalised accordingly to **develop a generation of future leaders**.

For Tunisian youth to become empowered and future-tech ready, it begins at the school gates.

PROFESSOR BIRGITTE ANDERSEN

CEO BIG INNOVATION CENTRE

[1] Big Innovation Centre, KPMG & APPG AI, (2018), "Learning to Learn - the Future-Proof Skills", https://www.biginnovationcentre.com/publications/

FOREWORD

TOMORROW'S LEADERSHIP IMAGINED IN NEW AREAS AND NEW WAYS.

ROBERT NESS

DIRECTOR, BRITISH COUNCIL - TUNISIA

Building local talent pools is vital for economic growth, trade, investment, and quality of life.

That means future-proofing education is more relevant than ever for Tunisia in its ambition to build growth-hubs and promote stronger trade, investment and interaction between the countries of North Africa, the UK, and beyond. With that in mind, it's a good time to imagine tomorrow's leadership in new areas and new ways.

That's why the British Council invited Big Innovation Centre to assess some of the opportunities and challenges in Tunisia by developing this engaging and thought-provoking report. To this end, we invited a range of experts to share ideas and embrace a spirit of collaboration by providing stimulating input.

The report addresses the challenge of the digital era and the emerging innovative technologies which affect us all. It offers insight into key cross-cutting elements affecting all economies; how technology has the potential to stimulate growth, change, disruption, and challenge education systems.

Big Innovation Centre identifies this as an opportune moment to reassess education at the primary and secondary levels in Tunisia, and elsewhere, in light of the 4th Industrial Revolution and the increasing adoption of emerging technologies. The report suggests that this necessitates a long-term strategy which will involve multiple players and shared responsibilities.

The British Council was pleased to be able to enable this research in support of its broader aim to connect people with learning opportunities and creative ideas that will lead to stronger ties between Tunisia and the UK.

The views expressed in this document are, of course, those of the Big Innovation Centre and the expert contributors where applicable.

ABOUT BRITISH COUNCIL

The British Council is the UK's international organisation for cultural relations and educational opportunities. We build links between UK people and institutions and those around the world, helping to create trust and lay foundations for prosperity and security globally. We work with over 100 countries in the fields of arts and culture, English language, education and civil society. Each year we reach over 50 million people direct (face-to-face, at events and digital social media), plus more than 500 million people online, via broadcasts and publications.

EXECUTIVE SUMMARY

The purpose of the report is to present evidence-based findings from experts in the education sectors and those in the new tech economies, with a view to starting a national conversation about updating the education system.

Tunisia has an advantage when it comes to education and skills, which continues to be celebrated when the country is promoting itself as a regional hub for foreign investors. Education reform, however, goes far beyond investor and employer appetite, to address not only the changes within Tunisia and abroad, but also student learning aspirations, and their own sense of fulfilment.

Tunisia and the United Kingdom currently have partnerships in education, research, and innovation. Interest has been shown in both countries to enhance these partnerships and strengthen cooperation.

A mismatch between labor market needs and the qualifications and skills of Tunisian graduates must be looked at through revisiting education at the school level, long before higher education.

The report brings input from emerging technology experts to put the tech-revolution at the heart of education, prompting policy and reform that future-proof it. Innovative trends in education are also looked at, with several contributions from key players in Tunisia, in addition to those in the UK and other countries.

A GLOBAL SHIFT

Section One looks at how automation and new technologies like Artificial Intelligence (AI) are disrupting the global labour market.

1. Tunisia is affected by technology as part of a global economic trend: The safest strategy is to prepare for change in real-time.

2. Not only manual jobs are being disrupted but also knowledge-intensive jobs: Despite economic and welfare opportunities, technology imposes an imminent change with major disruption within many sectors and job levels. It is not only low-skills and manual labourers affected (e.g. by automation), but also knowledge-intensive business services.

3. Education and job-reskilling need continuous adaptation in a fast-changing world: There is a dire need for continued education adaptation and job reskilling to cope with the changes before it becomes too late.

4. Emerging technology as AI and augmented reality can be the solution at the heart of education reform: Despite often being perceived as a threat, Artificial Intelligence and similar emerging technologies could help counter the adverse effect of the disruption, that its own applications in multiple sectors impose. The technologies provide the opportunity for new types of personalised learning, at the heart of education reform.

NATIONAL CONTEXT IN TUNISIA

Section Two looks at the changes brought upon by technology and Tunisia's multi-sector innovation ecosystem.

1. Education providers and civil society initiatives play crucial roles in economic growth: This is seen in Tunisia recently, where serious efforts are fostering an environment of forward-thinking, and ensuring graduates are helped to fit in where they contribute to further economic growth in Tunisia.

2. Public-private partnership programmes build skills and leverage expertise: Effective attempts to bridge the gap between public and private efforts through joint programmes (e.g. through start-up incubators) can effectively help talented young people build on their skillsets and leverage their expertise to attain sustainable business models fit for the future.

3. It's no longer 'whether' but 'how' technology is implemented: In education, the situation is no longer about whether technology should be part of education or not, but rather how it is implemented and where. There is a need to change various aspects of the education system, including the curriculum, methodology, and education technology.

4. Personalised learning through education technology (ed-tech) is not a quick-win reform: It requires a deep understanding of how to collect and process data, which in turn requires new institutional structures, information systems and regulation.

EDUCATION SYSTEMS IN THE WORLD OF TODAY

Section Three, looks closer at the mismatch between global education systems and expectations of employers. It also looks at how schools and technology designers can work together to ensure the implementation of education technology delivers.

1. The ministry of education is aligned with global skill trends; while observing and acting upon national needs.

2. Two of Tunisia's multi-stakeholder reform initiatives are examples par excellence: *Connecting Classrooms*, a hands-on multi-stakeholder programme, addresses 21st Century skills while aligning them with the demands of the local and regional labour market. *Teaching for Success*, a British Council joint initiative with the Ministry of Education aims at elevating English language skills in the country; a major indication of a national shift to recognising them as a basic requirement for better employability.

3. Personalised learning through Ed-tech is about building education results and future-proof learing skills: Personalised learning by implementation of Ed-Tech is not about monitoring or measuring student performance, but must be designed to meet satisfactory education results and develop students' skills for 'learning to learn'.

4. Implementation challenges of technology for education include overcoming regional and socioeconomic variances: When EdTech goes mainstream in Tunisia, policy for EdTech implementation must observe and overcome regional and socioeconomic variances in their capacity to facilitate change and experience the effects.

THE TUNISIAN VISION

Section Four looks at the Tunisian vision starting by re-examining the purpose of education from a local and global perspective.

1. Change is imposed by new Tunisia businesses: Recent changes imposed by new technological and business opportunities affect how the industry is configured, and business is done in Tunisia. This brings a demand for new skillsets.

2. Ministry of education recognises the need for reform: An official recognition of a need for updating the education system in Tunisia is voiced at the highest levels.

3. Education technology needs 'partners' of change: Methodology, interdisciplinarity, curriculum, and so forth, must be elements of change, alongside the integration of technology, in order for the education system to thrive.

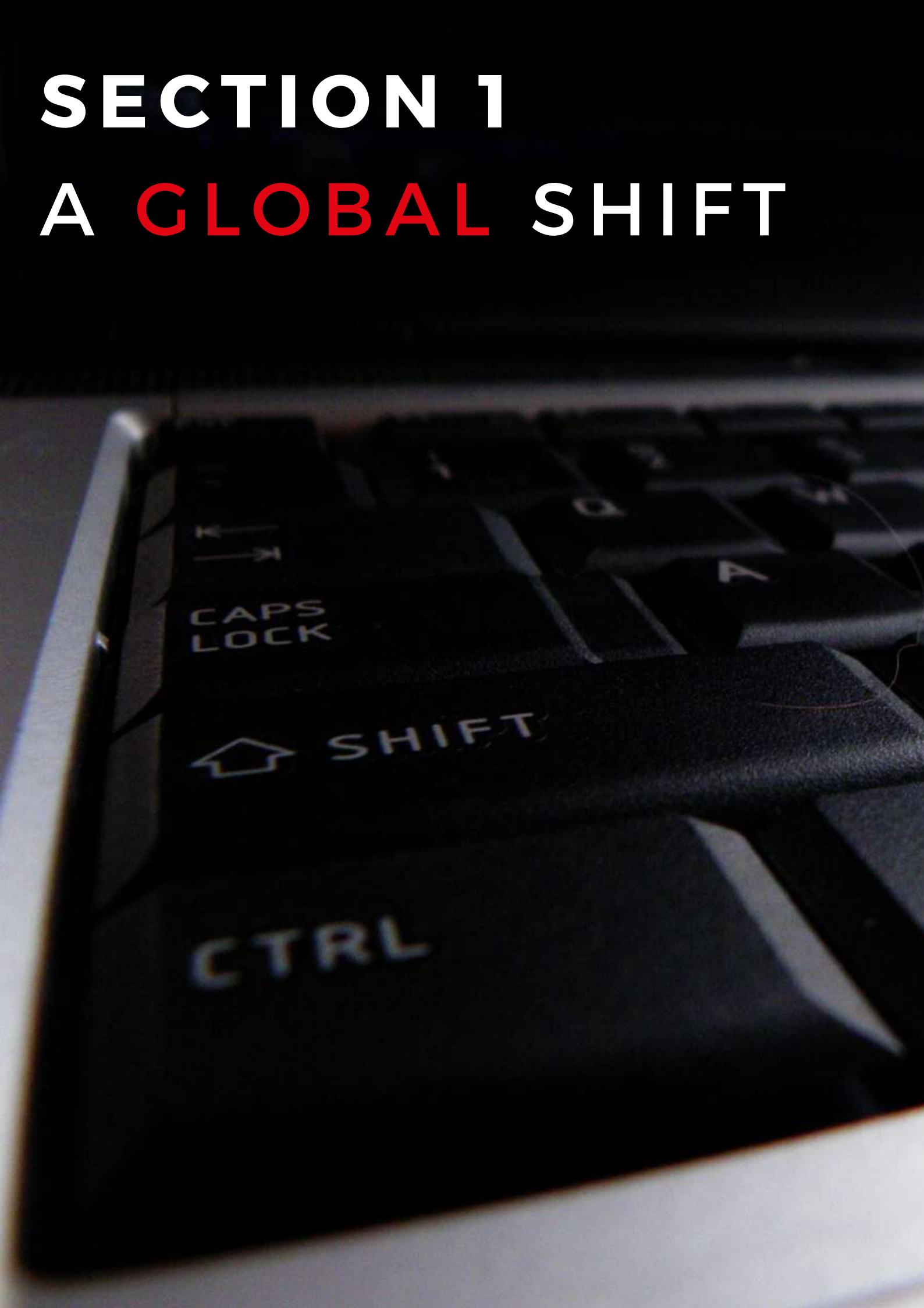
4. Working together is essential: Education and skills development requires an innovation ecosystem. Stakeholders agree that shared responsibility in enhancing skills proves successful and impactful.

TOWARDS FUTURE-PROOF EDUCATION

The report's conclusion is a pre-roadmap to build on what is going well for education in Tunisia from legislation to innovation.

Ed-Tech For Good	Continuous Progress	Education In-Sync
Emerging technology in education (such as AI and digitalisation used in personalised learning) must be guided by clear purpose and operational excellence for all stakeholders, i.e. the student, the teacher, and the school. It will be transformative for the economy and society when good practices are guided by sound policymaking.	It is not enough to just grow education technology as an Ed-Tech sector; the quality and effectiveness of applications must be regularly improved and updated to meet changing demands. Ed-tech can monitor personalised learning, but its' application (e.g. via learning systems) must facilitate continuous development of skills through 'learning to learn'.	The Fourth Industrial Revolution has arrived, requiring new skills for work and life. Ambition and new opportunity are essential assets - education providers must prepare the youth and future generations to ***thrive***, not merely ***cope*** with the change.

SECTION 1
A GLOBAL SHIFT



1A. A WORLD OF NEW TECHNOLOGIES

New technologies impose new ways of doing things, including how products are manufactured, how business is conducted, how we communicate in a society, how speech and acts are perceived after mass dissemination through tech and how we react accordingly.

It's still difficult to bring precise quantifiable data on where and how technologies have changed us, as it all happens so quickly. Today's global situation is reflected in our study on Tunisia. Examining the implications new technologies bring in Tunisia, or any country, has to start by taking a look at the world we live in today.

Progress in the sector of Artificial Intelligence, enabled us to enjoy things like expedited health services in rural parts of the world, where young children will have had to wait so long before they have their conditions diagnosed and their medication delivered, in many cases they would not survive the wait.

Blockchain technologies, have given us more options to transact, invest, and grow our financial potential outside the traditional monetary system, in which many remain un-banked. These opportunities will continue to be experienced by larger swathes of people across the globe. Some of these technologies have become far more ubiquitous than others, perhaps not because they're the most useful, but simply because they're more accessible. Things, not just people, now have their identity, helping their owners track their location and movement, check their storage status and share them with the public or a select few.

The Internet of Things (or IoT) has enabled just that, and the opportunities are immense for things like mobile phones, machines, cars etc. We could soon start wondering where the limit is, when robots don't only do very practical things to other machines and things, but also very critical acts that affect us humans, like surgical operations.

Fig.1 Sample of recent research reports on job automation

So How is Technology Disrupting our Lives and Who is at Risk?

Today, employees in managerial roles where leadership is required, or those working in healthcare and social care are less at risk. The common factor between them is high skills, but mostly soft skills, a developing area for Artificial Intelligence.But this is today, we cannot predict what the near future holds.

But what is AI? Blockchain? IoT? why should we care? Why now? Artificial Intelligence(AI), for one, has been getting enormous attention, bringing in global societal, educational, industrial, and ethical implications.

Blockchain, most simply defined as a shared ledger, has the potential to be the technology that disrupts everyday processes, from our medical records to insurance and legal contracts. Although such inventions were devised for specific uses, the global tech community has shifted rapidly from using Blockchain in various industries, it's no longer just about the famous cryptocurrency, Bitcoin.

But how do we overcome the challenges such breakthroughs impose on us? How do we educate ourselves and our younger population to embrace this revolution? How do we make the best out of technology to succeed, not at the personal and career level per se, but also to enhance wellbeing as a society?

Sir Anthony Seldon, Vice-Chancellor of The University of Buckingham is a leading contemporary historian, educationalist, commentator and political author. He was Master of Wellington College, one of Britain's leading independent schools, until 2015. He is author or editor of over 40 books on contemporary history, politics and education. Honorary adviser to 10 Downing Street.

"In my recent book 'The Fourth Education Revolution - will AI liberate or infantilise humanity', I argue AI has the power to transform today's 'factory' education model. There are five key challenges our education system faces: the inability to defeat entrenched social immobility, students forced to progress at the same speed, teachers overwhelmed in mountains of bureaucracy, lack of personalise learning, and a focus on a narrow set of knowledge and skills. AI will impact on all five levels of teaching and learning at schools, colleges and universities.

AI can be the solution. AI can help ensure our education system liberates humankind providing them with a truly transformative learning experience. However, there are potential dangers we must address. These include data misuse, manipulation, technological unemployment, and a passive learning mindset. Ultimately, the benefits of AI in education will far outweigh the downsides."

Evidence input to UK All-Party Parliamentary Group on Artificial Intelligence on Education, February 2019

Dr. Rabie Saidi - Lead Data Scientist in the UniProt team at EMBL-EBI (Cambridge, UK)

Dr. Saidi conducts research and development in the intersection of data mining, big data, machine learning and bioinformatics. He is responsible for adapting and creating new technologies for descriptive and predictive purposes in Bioinformatics.

Leveraging Data Science for personalised and Data-Driven Learning in Tunisia

Whilst Tunisia succeeded in its democratic transition, it still has difficulties moving forward in terms of economic and social progress. In order to promote inclusive growth and a successful economic shift to a higher level of development, the country's growth pattern and structural policy should be reconsidered in light of new technologies and methodologies. One of the most strategic fields to reimagine is education, and one possible way to reform it, is to make it personalised.

The concept of Personalised Learning was first coined in 1960 in "The First Book of Teaching Machines" of Sam Epstein. Nowadays, it is seen and defined as a contemporary reform to make the scalable mass public education become more tailored to the needs of learners and societies.

Personalised Learning is being adopted in a few countries' national education plans e.g., in the UK, where personalising education has been official government policy since 2004.

There is an endlessly increasing number of narratives about Personalised Learning. It can be summarised within three dimensions, namely;
1) personalisation for the learners,
2) personalisation by the learners and
3) personalisation by/for the States/societies.

The first dimension is when educational systems or teachers tailor the learning based on pupils' skills and needs. The goal here is to improve skilling and address the maladroitness of learners regardless of other factors. For example, creating specific education pathways for skilled pupils who demonstrate high performance but also passion for certain fields; or adopting different ways of teaching such as gaming and experimenting. The second dimension means that learners tailor their own learning, provided they have already acquired and developed enough skills to undertake this task. In the third dimension, the State/society imposes strategic decisions, to keep or omit some choices, in order to address needs of national interest such as requirements in certain critical jobs, national defense, or to address major threats like potential extremism.

Personalised Learning is about finding a satisfactory trade-off between the three dimensions, where none of the three would be completely excluded or overtaken by the others. It is a decision to make rationally and should be neither arbitrary nor based on voting or speculations. It simply must be a data-driven process i.e, a continuous analysis of facts and factors, prediction of their impacts, prescription of actions to take, evaluation of results and reiteration of these phases. The different phases of this data-driven process should be strongly linked by a flow of data transformed and processed by means of Data Science techniques.

Data Science is the umbrella of different emerging fields including Artificial Intelligence and Big Data. It is a discipline that provides efficient methods and systems to extract knowledge and information from data, which are then translated into meaningful actions. Theoretical foundations of Data Science are often in the intersection of statistics, mathematics and Computer Science. As Data Science becomes increasingly influential, inevitably there are/will be significant levels of national and global debate over how best it can be used for the understanding and development of economies, governments and societies.

The diagnostic and predictive power of Data Science could be leveraged to foster Personalised Learning. **Modernising education is not about switching from books to tablets or from wooden boards to electronic ones;** Tunisia might not have the sufficient budget for such an investment. **It is more about making the personalisation process of education become based on data and generative of data.**

Data Science can be a game-changer in each of the three conflicting dimensions of Personalised Learning. ***In the first dimension*** i.e., personalisation for the learners, analysing learners' data can provide 360-degree view of their learning lifecycle, to discover non-obvious insights about where pupils would excel and where they need more assistance. ***In the second dimension*** namely, personalisation by the learners, pupils can express their wishes in terms of career, and they get provided with personalised recommendations for suitable learning resources to acquire the necessary skills. ***In the third dimension*** i.e., personalisation by/for the States, some courses could be added in the curriculum for pupils who are predicted to be vulnerable to extremism; to build models for staffing requirements; or even to orient learners to specific skills that are essential for the country to thrive.

Finding, the right compromise between the three dimensions is a typical problem resolving in Data Science. It can be resolved with constrained optimisation to reach a satisfactory load balancing where the conflicting needs of individuals and societies are fairly addressed.

Personalised Learning is not a quick-win reform. It requires deep understanding on how to collect and process data, and engaging pupils' and educators' feedback. Its main goal is not to change education into a desired form but to make it nimble and agile enough to evolve and change depending on the national/international contexts, and to build up a smarter nation.

1B. OPPORTUNITY, DISRUPTION, AND THREATS

The disruption technology is bringing is mostly positive, but coping with it is not an easy task, due to the multitude of sectors it affects.

Economies do benefit from growth, and so would us consumers, employees, teachers and students. In the way technology is introduced to us, innovation can only bring about good change, mostly. Accenture found that AI could greatly benefit the US economy "increasing its annual growth rate from 2.6 percent to 4.6 percent by 2035, translating to an additional USD $8.3 trillion in gross value-added.

In the United Kingdom, an estimate by Price Waterhouse Coopers (PwC) estimates households will have an extra spending power per household of up to £1,800-£2,300 a year by 2030.

According to their report titled: *The Economic Impact of Artificial Intelligence on the UK Economy*, there will be significant gains across all UK regions. England, Scotland, Wales and Northern Ireland will all see an impact from AI in 2030, at least as large as 5% of GDP from the Artificial Intelligence sector.

But how exactly is this growth going to impact a labour market, where only a few qualify for high-skilled jobs?

In the very near future, and due to automation and robotics, more than 13 million employees (in the UK alone) are at medium to high risk of losing these very jobs to automation, and it's not just heavy industries or agriculture we're talking about. When the UK Office for National Statistics releases these facts, people reassure themselves with a 'that won't happen to me' tone but many would question 'what would happen to me?' 'will my education help?' 'How can I compete with robots that don't get sick, work weekends and cost my employer much less'?

Tech experts keep telling us automation never completely took over human input, even in factories. Nevertheless, with Artificial intelligence and other technologies, this industrial revolution is different, and machines are learning too – this is where the perceived threat lies.

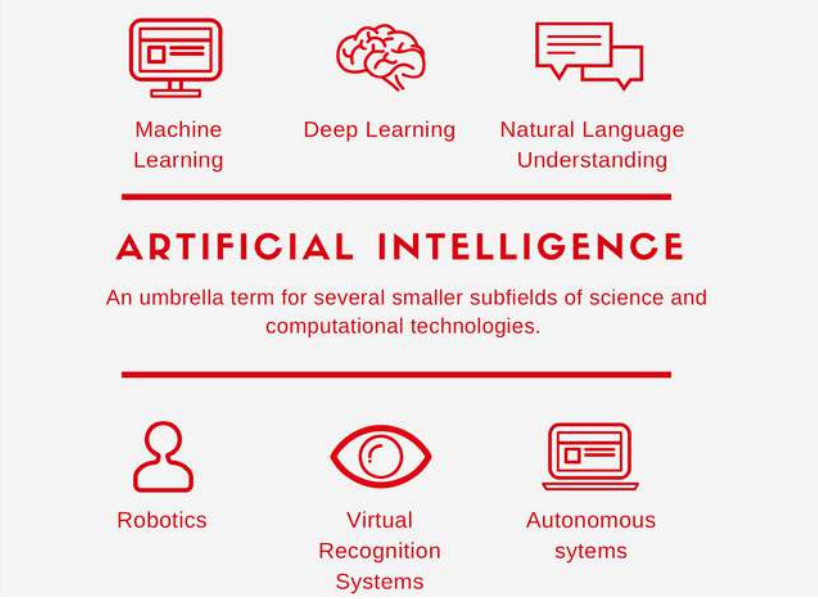


Fig.2 AI Sub Fields.

1C. A TRANSFORMING 21ST CENTURY LABOUR MARKET AND THE NEW IN-DEMAND SKILLSET

As a result of increasingly available big data, computing power breakthroughs, and growing amounts of public and private investment, AI technologies have now the ability to do things previously unimaginable.

The mass benefits that AI brings to our economies and our societies, including improvements in what and how people learn across all ages, are starting to be appreciated worldwide.

However, along with these great opportunities comes a big challenge that policymakers must urgently address, disruption in the labour market.

It is clear and generally accepted that labour disruption is happening. AI is disrupting both the demand side of labour (changing the quantity and quality of jobs available in the market) and the supply side of labour (challenging the existing skillsets of a growing population of potential employees).

The process in which the introduction of cost-saving machines will reduce demand for human labour, has been a concern for society throughout history.

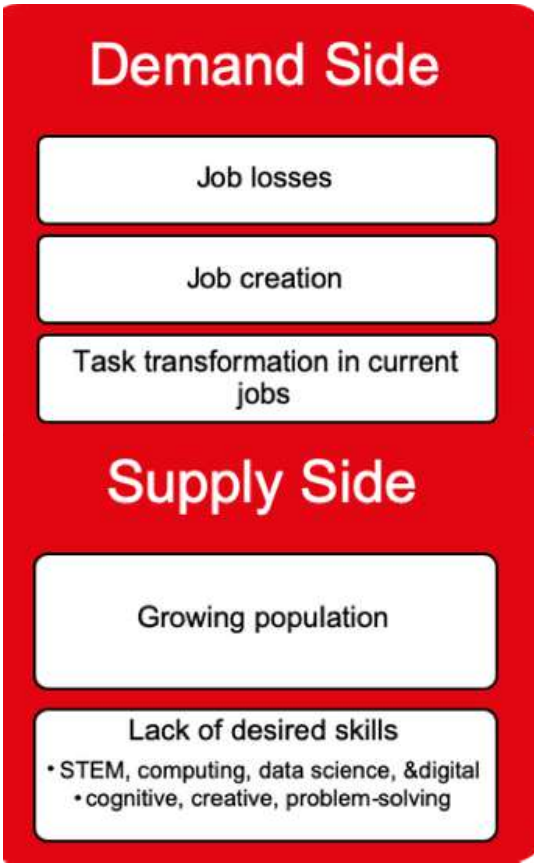


Fig.3 AI Transforming Supply and Demand in the Labour Market

Note: STEM = science, technology, engineering and mathematics

However, although AI technologies themselves are relatively new, the shift in the demand and supply sides of labour is not. The relationship between technology and jobs has been debated for centuries now.
What economist Keynes referred to as 'technological unemployment,' or **the process in which the introduction of cost-saving machines will reduce demand for human labour, has been a concern for society throughout history.**[2]

[2] Keynes, J.M. (1931), "The Economic Possibilities for our Grandchildren" in J.M. Keynes, Essays in Persuasion, Macmillan, London.

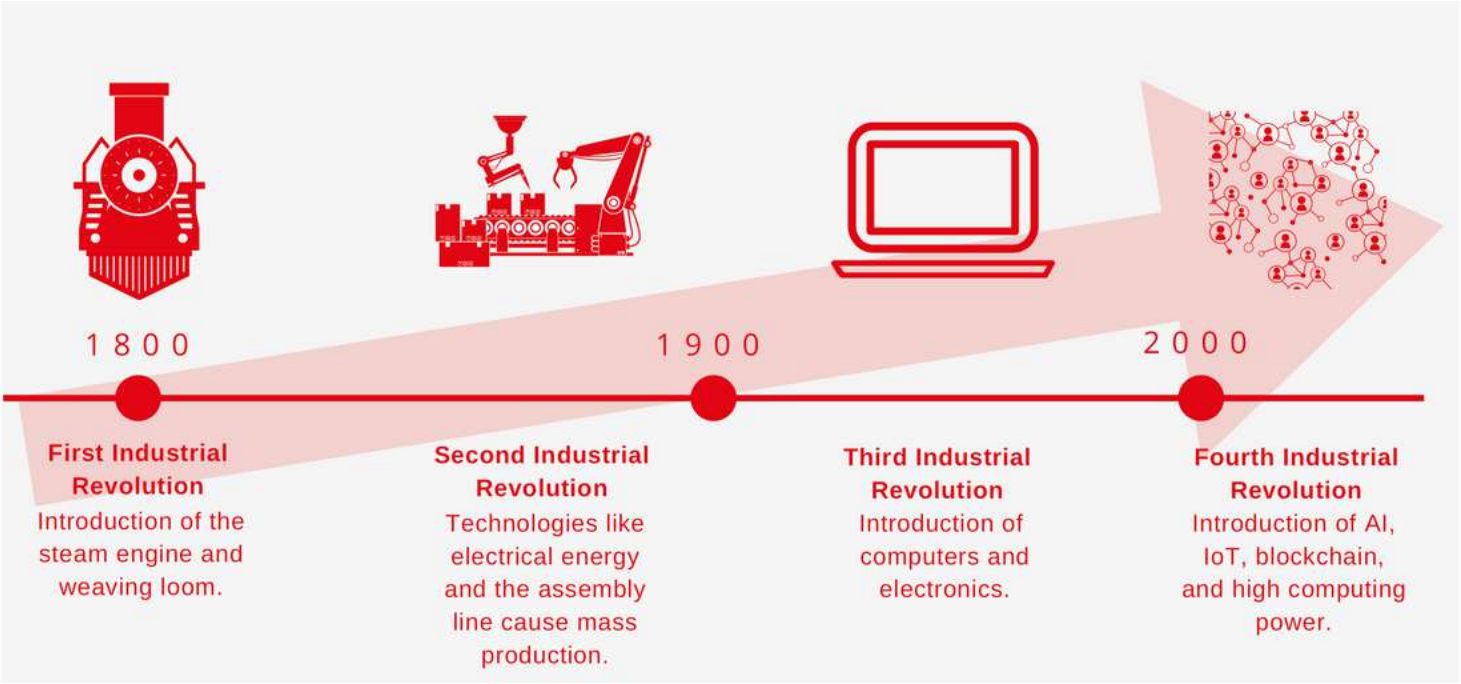


Fig.4 The Four Technological Revolutions

Technological advancement has had an overall positive economic impact in the past. From year 1750 to the late-1900s, for example, labour productivity in the UK has continuously increased (on average by 1.1percent per year), employment rates have fluctuated around a stationary average (ranging between 40percent to 50percent as a proportion of the total population), and real wages have risen (on average by 0.9 percent by year).[3]

Furthermore, past history shows that labour replaced by machines ultimately brought down prices of products and, hence, increased real incomes. Over time, demand for new goods and industries to supply them increased and, consequently, new jobs were created.[4]

Today, with the turn of the millennium and the introduction of technologies such as AI, we are now once again at a point wondering how the introduction of new technologies will impact our jobs and livelihoods. The demand side of labour is transforming in three ways:

- some jobs are disappearing,
- others are being created,
- and all are transforming.

However, there is reason to believe that the disruption in the labour market will be genuinely different compared to the technological revolutions of the past. Above all, the AI technologies of today have the capacity of doing much more than the technology of the past. While in the **past inventions such as the automobile or the telephone had the power to replace the human hand, the innovations of today have the potential to replace the human brain**. AI can replace cognitive skills and is likely to impact jobs at much higher scale than previous technologies.

Past inventions such as the automobile or the telephone had the power to replace the human hand, the innovations of today have the potential to replace the human brain.

[3] Hills, S, Thomas, R and Dimsdale, N (2015), 'Three Centuries of Data - Version 2.2', available here: http://www.bankofengland.co.uk/research/Pages/onebank/datasets.aspx

[4] Autor, D H (2015), "Why Are There Still So Many Jobs? The History and Future of Workplace Automation." Journal of Economic Perspectives, Vol29(3).

In 2013, Frey and Osborne estimated that 35% of current UK jobs to be at risk over the next decade or two.[5] According to their findings, although technologies have created vast employment opportunities for workers throughout history, today's technology is distinct in that as it does not provide the same opportunities, particularly for the less-skilled or less-educated workers. The demand for many jobs (as we know them today) will decrease significantly as a result of labour-saving technologies that are cheaper and, often seen as more efficient than a human being.

A wealth of research has been conducted worldwide, illustrating the potential of jobs across industries and sectors in being diminished. However, these reports rely on technological feasibility, not other factors such as economic implications or regulatory concerns. These latter factors are likely to slow down the automation process as there will be a backlash from society calling for a political response.
At the same time, many reports across the world highlight new jobs are also being created as a result of AI. Precisely, there is a quickly growing demand for a specific profession in the global labour market:

Fig.5 AI And Skills Dimensions

one that requires skills to not only make these new AI technologies but to also manage and commercialise them.

Most of these individuals come from a STEM background (Science, Technology, Engineering, and Maths). The private sector continues to report a lack of qualified employees that match this criterion, having cited a shortage of STEM graduates as a key reason for not being able to recruit "appropriate" staff. Furthermore, leaders across industries are also shedding light on the need for employees with problem-solving, creativity, and interpersonal skills to make business cases from AI applications, to manage their deployment, and to help ensure their implementation is socio-economically beneficial. Global research and advisory firm Gartner, recently named the growing skills gap as the biggest factor in why almost 60% of organisations are yet to take advantage of the benefits of AI and a little more than 10% have deployed any AI solution at all.[6]

Across the world, companies are increasingly demanding the skills needed to create, use, and manage AI. Hence, just as AI is shifting the demand side of labour, it is also having a significant impact on the supply side of. As stakeholders – policymakers, educators, students, parents, etc. – realise the global skills gap in the supply and demand sides of labour there is a push to rethink the skills being prioritised in global education systems. Simultaneously, labour markets must become more flexible, so stakeholders can match the workforce to the ever-changing demands placed upon it by employers and by the introduction of new technologies.

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[5] Deloitte (2015), "From brawn to brains: The impact of technology on jobs in the UK", available at http://www2.deloitte.com/uk/en/pages/growth/articles/from-brawn-to-brains--the-impact-of-technology-on-jobs-in-the-u.html

[6] Harė, J., (November 2017), "The Biggest Roadblock to AI Adoption is a Lack of Skilled Workers." VentureBeat.

There is a growing concern that global education institutions are not fit for the transformations unravelling and hence are failing to prepare people for a new future.

Two categories of skills have been identified as those that will empower individuals with the competencies to compete in today's job market and, even more so in the job markets of the future. These categories are:

1. STEM (science, tech, engineering, and mathematics), computing, data science, and digital

2. Problem-solving, creativity, interpersonal, and adaptability skills

The first category builds on the demand for individuals who can design and deploy AI technologies.

These skills represent the individuals who can create, use, train, manage, and monitor these emerging technologies. Specifically, this category seeks to improve education and training in maths, computing, data science, and a full range of digital skills.

The second category, problem-solving, creativity, interpersonal, and adaptability skills - are arguably the group of skills that humans have a comparative advantage in over machines. Many jobs require uniquely human characteristics like empathy, creativity, judgment, and critical thinking.

Stakeholders worldwide must work together for the skills of the labour force to match the growing demand for both categories of skills. Otherwise, the education systems are at risk of shaping people who will lack the skills needed for the modern world.

Education is key to addressing the jobs and skills challenges of the 21st century.

The education system must be transformed so individuals can be prepared with the skills to:

- Build AI
- Work with AI
- And live with AI

It won't be necessary for every citizen to be a good coder, much as not every car driver needs to be a mechanic. But everyone will need a sense of what sorts of things AI systems can do —even more important— what things they cannot do. If they have some idea of how the systems work, and therefore of what kind of things might go wrong, even better.

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According to the work of the UK All-Party Parliamentary Group on AI, to benefit from the opportunities AI poses and to protect individuals from the hazards, society must prepare and empower people with the skills to survive and thrive.
Using technology is not only for work, but a skill to manage our lives (our health, finance, transport, energy, home).

The number one skill that individuals will need in this period of socio-technological transformation is that of learning to learn, in interaction with technology constantly upgrading our abilities and skills.

Learning to learn is the skill characterising those with the ability to constantly pursue knowledge and understanding. It is about always asking questions, experimenting with new topics and subjects, and staying curious.

Knowing how to learn (or unlearn) will be fundamental to meet the demands of a transforming and agile world.

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SECTION 2

NATIONAL CONTEXT IN TUNISIA

2A. SAILING THROUGH THE TRANSITION: CHALLENGES AND OPPORTUNITIES

Emerging technologies are affecting Tunisia just like they affect the rest of the world, although in varying degrees.

Business leaders in most industries seem to agree that the only way to move forward is dictated by technological advancement that we shall adapt to. But what are the trends specific to Tunisia? And how can they help identify what global strategies apply and work best for the country's economy and therefore its educational system?

In the UK, some elements in the education revolution have reshaped the way we learn, and how we cope with quick changes around us. Nevertheless, even the change process itself has been revisited. In many cases, the debate has gone beyond integrating tech in education to identify applications that make a difference. Whether it's about skills, local job market demand or global readiness, we need to answer questions on how we will be sharing the responsibility of ensuring education results in learning the things that matter. This section will look not at employability per se, but at ways where education policy is perceived as a determinant of graduate performance and therefore economic prosperity in general

According to foreign professors, amongst the skillsets that Tunisian school graduates have is English language. Dr Alex Martin taught at Tunis Business School, where he looked at a noticeable shift from French where young graduates will have embraced English even before their university years.

Such a shift is indicative of the general attitude in the country towards a language viewed as more global, but this shift does not come without its challenges. It is no secret that institutional processes in the country are still largely based on French. But while there's high interest in English language, many students complain that some teachers at school didn't have a grasp of English, and that on many occasions, students would know the language better than their teacher. In the country's internal regions, there is a difficulty in finding qualified teachers for English, there has been a serious effort to tackle this issue by re-training and certifying teachers, which we will look at later in this report, and look at how it is impacting the level of English language skills in the country.

Dr Alex Martin

Lecturer of International Relations, University of Lincoln

2B. A PROMISING INNOVATION ECOSYSTEM, AND ITS GROWING SOCIOECONOMIC IMPACT

Tunisia has recently made serious attempts to be on the Foreign Investment Map.

Many established investors are however knowledgeable of what the education system in the country is like, and have a deep understanding about its economy and business culture, due to historically close ties However, investors ask: why Tunisia? Why now? So, what does the innovation system look like in Tunisia right now, and what is the link between foreign direct investment FDI and education/tech-readiness in the country. Expectation State, a UK based company with the objective to increase private sector investment in emerging states, also operates in Tunisia. Some comments the company faces are those like: We didn't know that there was a good STEM industry in Tunisia? Is Tunisia safe?

These questions are normal from a British investor's perspective, but what about Technology (ICT). Automotive, Aerospace, Textiles, Agriculture, and Renewable energies. There's a demand for re-qualified engineers in these sectors, due to the new skills required, not a shortage in engineers. Engineers, whether in agriculture or Automotive, are normally considered less at risk of losing their jobs, in comparison with factory workers like welders, for instance, but they are not immune to re-training in certain aspects of their jobs.

When we look at the link between the current growth in science and tech based sectors in the Tunisian economy, it would make sense to look at the implications of such growth on education. As of primary school years, exam grades are the main indicators of how students are performing in STEM-related subjects, like maths. Such data, if analysed and assessed with input from schools that are representative of the whole country could tell much about the standing of the country's human capital vis a vis the requirements in the job market as predicted by the current growth.
Addressing any mismatch cannot happen before detecting where it lies. To align the supply with the demand will then be easier to tackle, thanks to a wealth of technologies that have proven to make a difference. We will be looking at these in following sections of this report.

Sanchia Kirkpatrick
Consultant: Economic Development, FDI - Expectation State

Sanchia Kirkpatrick of Expectation State emphasises "**Where there is a link between industry and education, there is a lot more success"** Whether it's FinTech, science, or medical research, observing that link is essential.

Giving the example of the state of Louisiana in the United States where she worked, Sanchia speaks about the role of the state government where Louisiana was chosen against other states for investing in a programme where professionals who have been made redundant can benefit from re-skilling through re-training.

"Where there is a link between industry and education, there is a lot more success"

The growing innovation sector in Tunisia is already impacting the nation's economy. The free mobile phone applications are used by vendors to sell products from shoes to refrigerators without having to be physically visiting the store.

These applications (apps) are developed by Tunisian tech entrepreneurs and has benefits on the consumers who now have more access to competitor items. Sellers, especially smaller entities, now benefit from a more egalitarian environment where the
product and services shape consumer appetite.

Apps like these, when tweaked and updated to match the needs of both vendors and buyers, are not only making a difference to people's purchasing power,

they are supporting a culture that is now establishing new Tech. This new tech culture as a means for trading and economic growth rather than for entertainment and social networking per se. Of course, app development is not the only booming sub-sector in the Tunisian, but they're a great example of an all Tunisian model devised by Tunisians, for their own use, and to suit their own country needs.

The unavailability of global providers like ebay and Amazon in Tunisia has in itself helped tech entrepreneurs in the country to adopt their own models, outside the limitations of Tech giants and the rules and regulations that will have to negotiate with policymakers before entering the Tunisian market.

With numerous tech hubs and a large number of funding and mentoring programs, Tunisia is an active player when it comes to start-ups in the Middle East and North Africa region. In November 2017, Tunis was selected as the location for the African Union's planned Digital African Excellence Center, which will be in charge of training African government officials and private-sector managers in the digital sector. Badreddine Ouali, chairman of Vermeg, a specialised software house covering areas like wealth management. Insurance, and banking, spoke about the strategic advantages that Tunisia benefits from when it comes to Africa. Ouali who is also chairman of Smart Tunisia, an organisation promoting and supporting the economic and social development of Tunisia within a framework of international cooperation, talks about graduate skills being one of the biggest advantages when it comes to Tunisia as a key player in Africa.

This entails language skills (English and French) but also regional knowledge and cultural adaptability.

Other advantages that may have helped put Tunisia on the map of leading digital economies in Africa are geographic location, closeness to Europe and a long-established connection with France and an enabling infrastructure. The Tunisian Government has been remarkable at legislation specific to the country's new digital economy, through the Start-Up Act.

Tunisia's wider digital strategy comprises more than 60 projects, most of which are to be implemented as public-private partnerships (PPP). They include e-government projects, expanding households' and schools' digital infrastructure strengthening the e-business sector through such mechanisms as promoting online payment system, by connecting banks and apps or web vending.

Organisations like Smart Tunisia and Expectation State are actively encouraging foreign businesses to outsource digital services to Tunisia. Their aim is to strengthen the digital sector as a key sector in the country to complement its tourism and agriculture sectors.

The Start-Up Act calls for reforms to boost entrepreneurship, provide access to funding and other aspects like those pertaining to opening a company or striking it off. The act exempts start-ups for up to eight years from paying taxes, giving public and private sector employees one year to set up a new business after which they have the right to return to their old jobs, and a state-funded salary for up to three founders per company during the first year of operations.
These measures are akin to a welfare state for techies, giving them a safety net to explore their potential. The legislative process for passing the Startup Act is innovative for its unusually participatory nature.

In February 2016, a group of 70 entrepreneurs, investors, and representatives of banks and accelerators held an initial brainstorming session. Together with then Minister of Information and Communication Technology Noomane Fehri, a taskforce made up of members of the startup ecosystem formulated a draft law and ensured that the ratification process moved forward even after a ministerial reshuffle in August 2016.

To inform parliament and gain its support for the bill, the task force used social media as well as the new “Parliamentary Academy” a training module for members of the Tunisian Parliament established in 2016, therefore triggering interest and rallying support behind the Act.

The education system will require an overhaul. Tunisian schools offer many information technology (IT) and engineering courses, but not adequatetraining for the digital sector.

In-line with the growing tech ecosystem, almost all stakeholders from incubators, to lenders, evangelists to investors, agree: the education system will require an overhaul. Tunisian schools offer many information technology (IT) and engineering courses, but not adequate training for the digital sector. Despite the remarkable growth, many young graduates with exceptional IT skills are seeking jobs abroad due to a competitive domestic job market and the employment needs of the Start-ups who tend to employ only a few.

Unlike those who made it big abroad and are now returning to give-back to their country, the youth aren’t always patient enough, and cannot afford to take risks and skill-drain remains a problem. From this standpoint, one can argue businesses should keep up with skilled graduates and not the other way around. While reform in education is needed, in-general, steering it to cater to a certain sector could be a huge risk, especially at the school level.

When it comes to start-ups, many have spoken of the career mindset in Tunisia where established societal expectations are still risk-averse and this does affect the morale of young entrepreneurs, education can change that.

The Hammamet Conference is another example of how civil society can contribute. As illustrated by the conference, it is an "international platform for dialogue and progress in relations between the UK and North Africa', the Hammamet Conference Series 'bring together new and established leaders from the worlds of business, civil society, media and government to engage in dialogue, build new relationships and identify solutions to critical issues".

The Series comprises two key elements: an annual conference and ongoing dialogue. From a conference participant's perspective, Big Innovation Centre saw first-hand how such a multi-stakeholder approach can successfully encourage interaction, cooperation, and a better understanding within the region and internationally.

Through exchanges with and further exposure to foreign economic cultures, Hammamet gives a balanced understanding of what-works for Tunisia and participating countries, and an outward-looking mindset for the UK, Tunisia, and participating countries.

Photo: Hammamet Conference, 2018

The high density and low coordination of funding programmes distorts the market by keeping some companies afloat and making them more dependent on outside funding than on maintaining a competitive edge.[7]

Such critique calls for a rethink of foreign or national aid in the country. **While there has to be money pumped into the economy to create growth and opportunities, more can be done to invest in the Education sector from which leaders are launched to lead all other sectors.**

Expectation State emphasise that vocational training or re-training can prompt academic education providers to align with industry and review the impact of change within various industries, including emerging ones. According to FIPA, the Foreign Investment Promotion Agency, Tunisia has a competitive edge in the region. The Agency names talent competitiveness, an entrepreneurship ecosystem, innovation, competitive industrial performance, ICT Development, and a transition to e-commerce. All of which are related to overall education and skills, and sector-specific training and development.

The high density and low coordination of funding programmes distorts the market by keeping some companies afloat and making them more dependent on outside funding than on maintaining a competitive edge.

Another factor impacting the industrial ecosystem in Tunisia is the European Union and Tunisia Association agreement. The European Neighbourhood Policy provides the framework for political and financial assistance from the EU to Tunisia.

From 2014, financial assistance is provided by the European Neighbourhood Instrument (ENI), which provides funds for neighbouring countries based on mutually agreed policy objectives and priorities.
Since the 2011 Revolution, the EU's total assistance to Tunisia amounted to €3,5 billion, of which €1.2 billion in grants, €800 million in macro-financial assistance.[8]

According to EU sources, nearly 70 schools have been rehabilitated in Tunisia with EU grants. Some 90 schools already participate in eTwinning Plus, the network which connects classrooms in the EU and six neighbouring countries and is use by the Tunisian government to promote digitisation in education. Over 61,000 young Tunisians have received EU-funded microcredits to start or grow a small business. Many young people have benefited from other EU-funded actions to support employment and private sector development and a number of Grassroots organisations received grants to develop social and green entrepreneurship project. [9] These and other aid from countries like the U.S has helped Tunisia, not to mention regular programmes funded by the European Bank for Reconstruction and Development (EBRD) . Nevertheless, those in the education sector in Tunisia and abroad, argue that more could be done in the education sector specifically, even when impact is not as directly measurable as in other sectors like infrastructure or finance.

[7] Sold, Katrin (2018) "The Tunisian Startup Act" Carnegie Endowment for International Peace

[8] European Commission (2019) Countries and Regions/Tunisia http://ec.europa.eu/trade/policy/countries-and-regions/countries/tunisia/ 07 July 2019

[9] European Commission (2018) "The Eu-Tunisia Partnership Also helps Boost Tunisia's Economy" https://ec.europa.eu/neighbourhoodenlargement/news_corner/news/eu-tunisia-partnership-also-helps-boost tunisia%E2%80%99s-economy_en 07 July 2019

A Global Outlook

Tunisia is better-off with the availability of telecom and broadband infrastructure compared to other nations of the continent because penetration rates for mobile and internet is among the highest in the region. Owing to positive response, Digital Tunisia 2020 programme aims to enhance its efforts to improve infrastructure access as well as regulations in the use of internet.

Telecom companies in Tunisia are already in process of transition internet traffic to its new Broadband Network Gateway (BNG) platform.

Proximity to Europe has not limited Tunisia's outreach to international companies, nor its appeal to them. Amongst well-established foreign companies in Tunisia is Huawei Technologies.

The Chinese giant has trained more than 1,000 ICT professionals in the country and it employs more than 90% Tunisian nationals. Huawei has established a regional French speaking talent centre and regional service resource centre in Tunisia. Through "Seeds for the Future", "Huawei ICT Academy", summer internships and ICT skills competition etc. programs, the company is promoting Tunisia as a regional ICT talent hub. At the same time, Huawei adheres to the concept of "openness, cooperation and win-win" and follows the "platform + ecosystem" cooperation model.

In April 2019, Huawei and Tunisia have agreed to strengthen cooperation on digital literacy and the digital economy. Tunisian President, the late Béji Caid Essebsi exchanged views with company representatives on how to better promote digital transformation of Tunisian industry.

2C. POSITIVE OPPORTUNITIES AND EDUCATION-RELATED TRENDS

Implementing inter-disciplinarity in schools is important because the sooner students get used to an interdisciplinary culture, the more chances there are they would apply it as adults.

For this to happen, a project-based approach would work best, where one problem-solving practice would involve more than one subject like maths and physics and others in one go. This is important because they get to believe in the use of these subjects, like when university students see the use of learning accounting in a group exercise with students from all disciplines. The youth are more incentivised and like the group challenge. At the university level, students read up suggested material online before coming into the classroom, without having to buy books or carry them.

The classroom becomes a place to discuss and interact. The teacher becomes a facilitator, who takes part in the exercise rather than someone who lectures. While at the university level students have more access to technology, school students are not as likely to have individual computers at home to prepare material on their own. The other difference is 'initiative', which is completely different at the school level where there is still a need for a more hands-on teaching approach.

Primary school is the age where students are most curious, so it is the time and place to gain knowledge which can easily be absorbed, but emphasis is on the methods of learning to learn. Many teachers also believe in collaborative learning at a very young age. Numerous schools in the UK are now implementing the 'learning by doing' strategy.

Multi-ethnic cultures is an issue too. At Manor Primary School in London a practical approach to learning has been taken, with 53 different languages spoken by pupils some new entrants don't speak English at all.

According to headteacher Kate McGee, attending a school where you don't understand the common language can be a very daunting prospect for a child of any age, especially those between the ages of four and 11 years old. [10]. McGee adds, "having the flexibility to deliver core learning in ways that engage our children is very important – and a curriculum focused around a variety of practical activities with tangible outcomes boosts engagement and helps to improve achievement". Children are attracted to school more if they are participating in activities such as planting tomatoes, cooking or creating a film.

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[10] McGee, Kate (2013) "Learning by doing: why we've embraced a practical primary curriculum" The Guardian

Engaging activities build excitement and at the same time develop the literacy and numeracy skills together with other essential knowledge.

In this case, we've seen that not all learning has to come through technology. Sometimes limited resources and space in schools, one can't always cook or grow plants, and it's not always feasible or safe. This is when technology can provide simulative scenarios through bespoke products that can engage pupils in almost real-life experience where they can still take part in a hand-on exercise.

Pupils are excited to learn how to use a computer by creating and editing a film of your friends? Or develop an understanding of the complexities of the English language through cooking something delicious?

Back in Tunisia, Dr Triki illustrates an example where technology is used as students would watch video recordings provided by teachers with a quiz at the end of each viewing. Before reconvening in the classroom, data is collected and used to detect learning or understanding areas of difficulty so more classroom time can be spent on these areas. This resulted in a better evaluation for teachers who then have a clearer understanding of where students are struggling and why.

Results were generally better and interest in the subject increased through prompting a culture of learning at one's own initiative. This, however, happened at the level of a university, a private one. Throughout our conversations with school teachers and students in Tunisia, it is still difficult to have similar use of technology.

Dr Leila Triki
Dean at the Mediterranean School of Business in Tunis. Member of the Bilateral Tunisia-UK Higher Education Commission

Opportunities for change:
Dr Triki is also member of the Bilateral Tunisia-UK Higher Education Commission, that structure, supervise and ultimately strengthen the countries' bilateral co-operation on higher education. Her experience of being in contact with fresh school graduates gave us great understanding of how students feel about their education and how they embrace innovative methods.

Training faculty members, the whole teaching body, they are the ones who are shaping the mindset of their students, whether through methods of enhanced technology or simply creative but more effective student engagement.

"Change and opportunities that technology and innovation could bring forward, should start at the teacher level"

- Dr Leila Triki

As reform is a shared responsibility, teachers can play a huge role in pushing towards reform by challenging the status quo and creating a bottom-up and organic agent of change depending on the special circumstances in their respective schools and regions.

2D. EDUCATION AND BRAIN DRAIN: SKILL SUPPLY AND DEMAND IN THE LOCAL LABOUR MARKET

One of the main issues facing Tunisia is brain-drain, it is difficult to obtain indicative figures on graduate migration as it is often counted amongst national emigration, which includes non-graduates.

Emigration is a trend that links to both the labour market and graduate expectations, both of which are linked to education. Looking at it briefly is one part of the supply and demand conversation in the Tunisia.

Organisations like Smart Tunisia are looking at how to influence the culture of talent migration, by attracting foreign investment in Tunisia's emerging sectors. Many students who graduate from elite schools in Tunisia, find themselves inclined to pursue higher education abroad, despite the availability of universities that provide world-class education within Tunisia.

Most students and local stakeholders interviewed as part of this report, agreed that education is one element in a graduate's inclination to seek a change in his or her life. Education is part of the experience students have in their childhood and teenage years, during which they can be largely influenced by parental and societal discourse and their school experience.

All over the world, school is the only place in our lifetime where we spend most of our out-of-home time. Socio-political and economic situations around us are often discussed at school, students talk about them with fellow classmates, and sometimes with teachers. The school experience cannot be looked at in isolation of the outer world.

Most of those who were asked about their school years in Tunisia responded with a generally positive tone, some are still in-touch with their former teachers and think highly of them. Part of how school years influence our general attitudes, lies in the learning experience itself. A student overwhelmed with an influx of taught information, important as it may be, would probably want a change by the time they graduated from school. This phenomenon is not specific to Tunisia; those who pursue university education in the United Kingdom often choose universities outside their own cities. This is not necessarily because they do not (or did not) like it where they are, it is more about experiencing different perspectives and find out how they fit in. Part of the fitting in phenomenon is about readiness for the unknown and a will to prove to themselves that they are ready. In Tunisia, Dr Alex Martin who taught at Tunis Business School observes a local culture amongst Tunisian graduates where ambitious school graduates consider leaving the country as a first step in achieving higher and unleashing their potential.

Martin, who now teaches at the University of Lincoln, added **"A lot of the ambitious graduates still think Tunisia isn't the answer for my success"** There is still a lot of ambition to travel abroad to obtain higher education, sometimes encouraged by the parents, not necessarily the school graduate's attitude against the status quo.

The global mindset amongst the youth has created a situation where the conversation can no longer be merely about the gaps between the labour market in Tunisia and the skillset of graduates. The perceived gap between the international market that a Tunisian graduate aspires to be part of versus what is on offer locally is what impacts talent emigration. Tunisian employers in the tech sector are actively involved in events that inform the youth about what's new and their skill expectations, but they're also there to learn about the aspirations of the youth and their expectations from their employers.

"A lot of the ambitious graduates still think Tunisia isn't the answer for my success"

In the tech sector, foreign companies are also encouraged to invest in Tunisia through campaigns highlighting the skillset of Tunisian graduates. While this gives hope to graduates, the selection pool remains huge, which makes employer selection criteria much more tough. This is better news for employers, than it is for job applicants, especially those who do not possess language fluency that foreign companies may require.

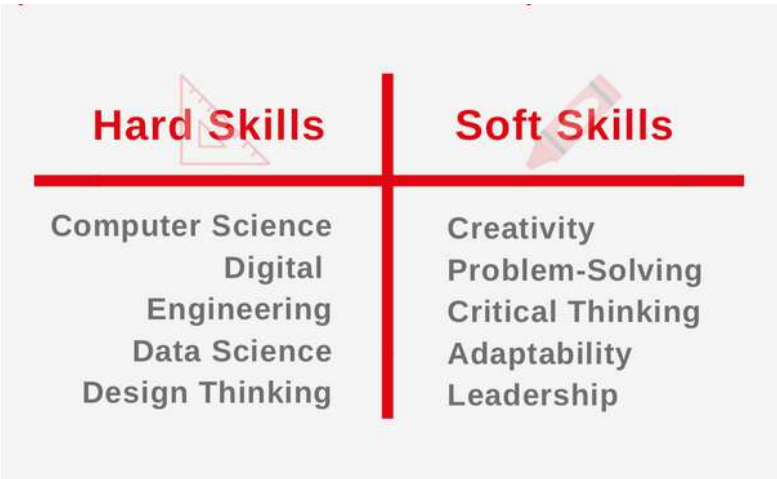
The Tech Industry & Lost Skills

While Tunisia's new tech economy is growing significantly, large-scale tech firms continue to struggle finding enough supply locally.

"The current system is about learning from teachers in a way that depends on memorising material without getting the chance to think of the logic behind things."

According to Achref Matar, some skills that are not developed at school are emotional intelligence, creativity, and thinking out of the box. "The current system is about learning from teachers in a way that depends on memorising material without getting the chance to think of the logic behind things." According to Achref, introducing subjects like arts and culture in the curriculum might encourage a creative mindset. School students say they did not study music, aside from at the elementary level but it was also a top-down process of learning songs. When it comes to skills that pertain to the workplace, Achref says he would have liked to have practised other forms of communication. Awareness is another element that can be introduced in various subjects like literature. Whether it's environmental or societal, or good citizenship, awareness can be a useful skill. School graduates like Achref talk about the positive effect of expressing ideas and that it needs to be encouraged as of the primary school.

Fig.6 Top Hard Skills and Soft Skills



2E. WILL THE YOUTH REAP THE BENEFITS OF TECHNOLOGY TO BE PREPARED FOR DISRUPTION?

The challenges of existing education systems and how technology can assist the system in building the new skill sets.

Conversation with Piers Casimir, Head of Computer science at Beechwood Park School North of London

Piers is highly engaged in Tech policy for education, and generally. He tells us how throughout the years, the UK shifted from teaching Information and Communication Technology (ICT) to Computer Science or Computing. According to those who have been in the midst of developing and teaching computing at the school level, it is how the programmes adapt to technological progress, that made all the difference.

In the late 70's and early 80's, the focus was on systems analysis, systems design and coding, known then as programming. Not so long ago, ICT at the school level meant Word, Excel and PowerPoint. This was initially taught to the older and more able pupils and most of the skills taught at that time were not applied by pupils or staff in other curriculum subjects.

The UK has gradually shifted to an interdisciplinary model in computer studies, in-line with the widespread use of computers in most job fields. The teaching still tends to be led by the Computer Science teacher, but the curriculum has now become much broader and the skills taught are actively encouraged to be used and applied, across many subjects in the curriculum. **Computing is now a skill to be used across the board, not just another separate school subject**. As to the shift in hardware, there are still traditional desktop computers, but they're now often complimented by tablets such as iPads and Chromebooks. **Change is no longer about the technology per se, it's mostly about where and when to introduce it, in order to optimise its long-standing impact.** Age groups that are now taught computing at UK schools range from as early as three to four-year-olds, up to 18 and beyond.

Egalitarianism in Education Technology

Computing hardware and software is adjusted to suit children of varying abilities, including those with individual needs. An egalitarian deployment of technology, in both its hardware and software forms, means that all students are developing their tech skills according to their needs and pace. Computer learning in UK schools has evolved further and it is now much more pupil-led.

Students of all abilities have a choice of hardware and software and are encouraged to choose the most useful digital tool to solve the task at hand. Assessors have realised that it's the outcome that matters, although how students get to that outcome is indicative too, Students are encouraged to use any platform(s). When trends in student-computer transactions are monitored and analysed they lead to shape decisions when it comes to buying new software or tweaking what is already there.

Collaboration and project-based work is becoming more popular and more relevant, mimicking the real-world working environment. In a new collaboration with IBM Research, Rensselaer Polytechnic Institute (RPI), a university based in Troy, New York, now offers its students studying Chinese another option: "a 360-degree virtual environment that teleports them to the busy streets of Beijing or a crowded Chinese restaurant. Students get to haggle with street vendors or order food, and the environment is equipped with different AI capabilities to respond to them in real time. While the classroom is largely experimental, it is being used for the first time in a six-week, for-credit course at the university."[11] Cloud computing, such as Office 365 and G-Suite, have empowered pupils to connect with technology both in school and at home far more seamlessly. Topics taught in computing now often include, coding/ programming, algorithm creation, problem-solving, data manipulation, spreadsheet application, database creation and use, presentation creation, mind-mapping, animation, animated presentations, 3D modelling, graphical design, web site creation, hardware and software, networks, robotics, e-Safety and digital responsibility, digital music creation, understanding Artificial Intelligence, cybersecurity, cryptocurrencies and Blockchain. Casimir notes, Touch Typing, whilst seen as a traditional skill ranks highly amongst the skills secondary schools look for.

Modes of engagement

When it comes to assessment, the subject of computer science is a good example of a successful shift from marking to assessment. Practical work of students is assessed, less so 'marked' and student feedback is given in real-time, verbally.

Teacher's Role in leveraging the benefits of technology

Teachers in Tunisia agree that their training is crucial for new subjects. Good teaching comes from good teachers: those who never stop learning. In the UK, teachers complain that despite fantastic resources being available to computer science teachers, there still tends to be a scatter-gun approach in terms of resources available.

Piers Casimir notes that other subject teachers in the UK are much more open to learning these days. However, teachers (in Tunisia and elsewhere) work under time constraints due to the many responsibilities and skill requirements they have to meet, additional training might therefore be difficult to integrate into their schedules. In Tunisia, while most teachers are computer literate, certain online software would have specific features that could require teacher training. Conversations with teachers suggest the best time to do such training would be the summer period when software vendors would send trainers to train teachers.

[11] Karen, Hao (2019) "A new immersive classroom uses AI and VR to teach Mandarin Chinese" MIT Technology Review

If it continues for longer, the mismatch between current education programmes and the skill needs of the economy of today could lead to regrettable outcomes. We could risk a situation where a select few monopolise an entire economy –a tech dictatorship.

Fig.7 How cloud computing phased itself in at schools

If the UK or any other country is to reap the economic benefits that technology brings, there has to be a debate about the social, economic, legal, and financial issues that we will have to confront. Education providers can shape this debate, just like with social or environmental issues, schools can inform students and encourage them to be critical about various implications of automation or other trends and what they mean in certain areas. Case-studies that are easy to digest can help students explore the effective use of technology and assess the long-term impact that it may have, if not handled within the right framework.

With ongoing changes in the economy, how do we cope in the school education department?
Ongoing adjustment in curricula or the methodology? There is a need to motivate, whether it is teachers or others.

Salma Baghdadi
Community and partnership manager at
La Fondation BIAT

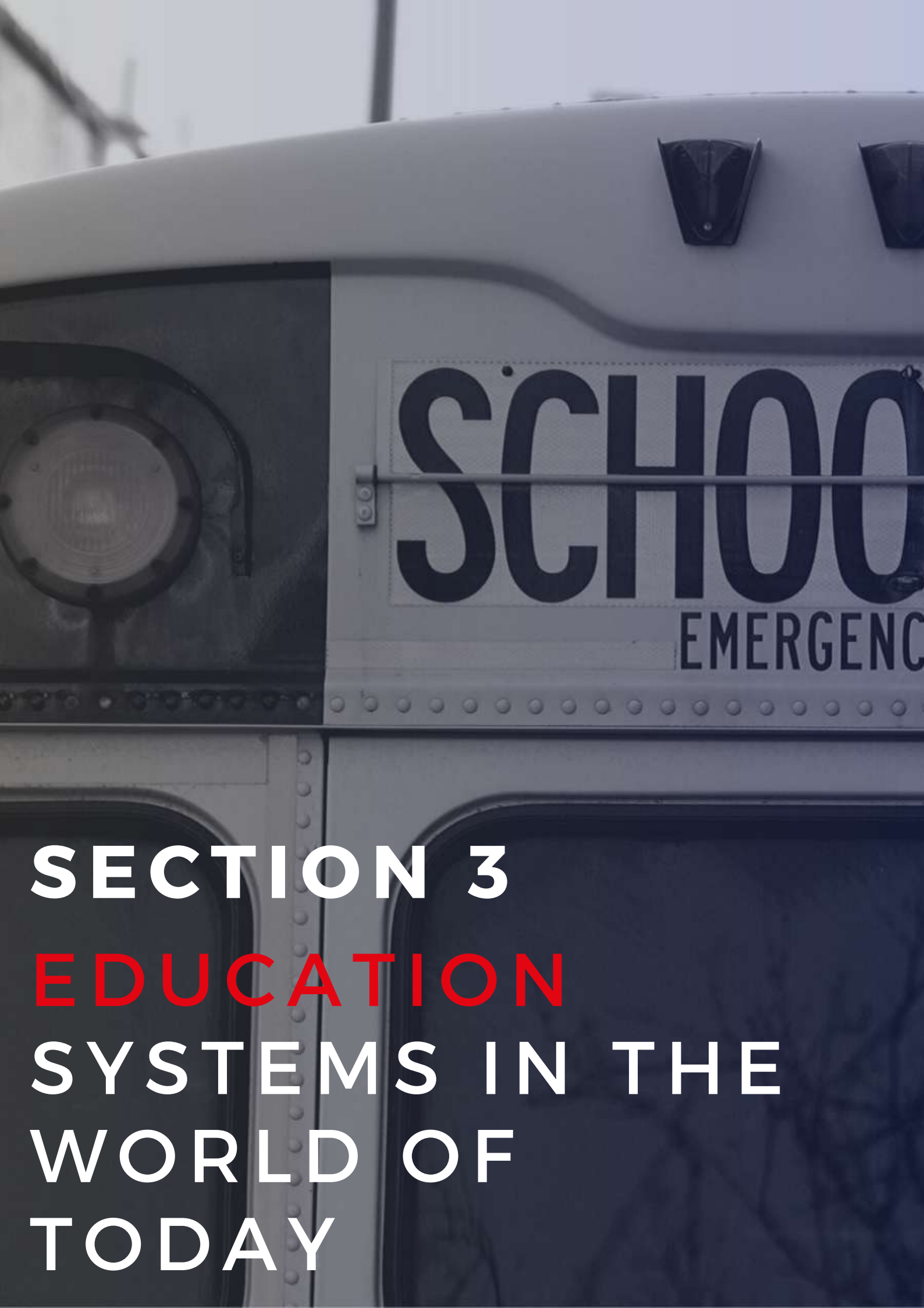
At BIAT foundation, Salma works on youth empowerment through improving the sense of entrepreneurship. While reforming education is not their role, BIAT saw a need to complement the current system by aiming to provide activities and programmes that would not otherwise be offered.

The role of the parents is important to foster an environment of critical thinking skills, creativity and openness. With 25,000 beneficiaries, there is a considerable impact in the country, making the case for the importance of civil society in its various elements, in sharing the responsibility when it comes to education and skills. Tech education start-ups and others are also playing a role in enhancing tech competencies amongst students.

Salma tells us about Engage, a programme by BIAT Foundation to foster student engagement within their local communities. Students are asked to be involved in purposeful and non-commercialised projects that make a difference. How these programmes are enhancing tech ability and skills will depend on their outreach. If the public sector is inspired by organisations like the BIAT foundation, we might be seeing a bottom-up model in terms of education policy that will be able to keep-up with the booming innovation ecosystem in Tunisia. Problem-solving is an essential skill where thought design is implemented.

There is a need to make the youth believe that failing is not the end, it's part of the process

Photo: A Start-up pitch to investors at B@Labs in Tunis



SECTION 3

EDUCATION SYSTEMS IN THE WORLD OF TODAY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3A. 21ST CENTURY ECONOMIES AND CURRENT EDUCATION SYSTEMS: A MISMATCH

In recent years, policy has been reassuring when it comes to supporting innovative technologies and science.

The British Government published the £1Bn AI Sector Deal, a blueprint aims at placing the foundations to make the UK AI-ready. This is due to the estimated £630 bn that could be added to the UK economy by 2035 through AI alone. **The debate has been about enabling the sector to thrive, while preparing the youth to face the drastic changes**. Currently, the gap is huge between what children learn and what they're ought to deal with when they graduate after years in school. Most industry experts agree, there is a dire need to bridge this gap, and this can only happen when key stakeholders are staying abreast with breakthroughs brought by Tech innovation.

But when job markets are well into the 21st century, why isn't our education system?

Today's jobs are vastly different to what they were 10 years ago. Millennials and baby-boomers alike, are facing a rapidly changing working world that we have not seen before.

The days of working for 40 years in one job and retiring with a good pension are gone. According to the US Bureau of Labour Statistics, the average time in a single job in the US is 4.2 years,. Regardless of job sector or industry, 35% of the skills that workers need will change by 2020.

This very rapid pace of change in jobs and skills means there's a growing demand to review skills as well. According to a new report on workforce re-skilling by the World Economic Forum*, "one in four adults reported a mismatch between the skills they have and the skills they need for their current job. The job opportunities that are available today are 21st-century jobs. But the way most people perform these jobs is a 20th century. This is where we have a problem, especially when training and education hasn't been always updated."[12]

The changing and agile work style approach such as freelancing and having remote work teams is a way to adapt to changing conditions. This is the future of work, and **it is only those who are agile enough who will stay in the game for the long-term**, as per the report of World Economic Forum.
As we know, globally, education systems are not matching to the pace at which new skills are required.

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[12] World Economic Forum, 2016, January. The future of jobs: Employment, skills and workforce strategy for the fourth industrial revolution. In Global Challenge Insight Report, World Economic Forum, Geneva

Given this situation, many in the workforce are proactively steering their own ongoing development. There is an awareness that one needs ongoing training in addition to taking responsible ownership of one's own education.

Advisors known as career gurus are inviting graduates and working professionals to ask themselves: Are my skills still in demand? What's the attitude towards these skills? And what skills could I work on today that would increase my income and/or success potential in the coming years?

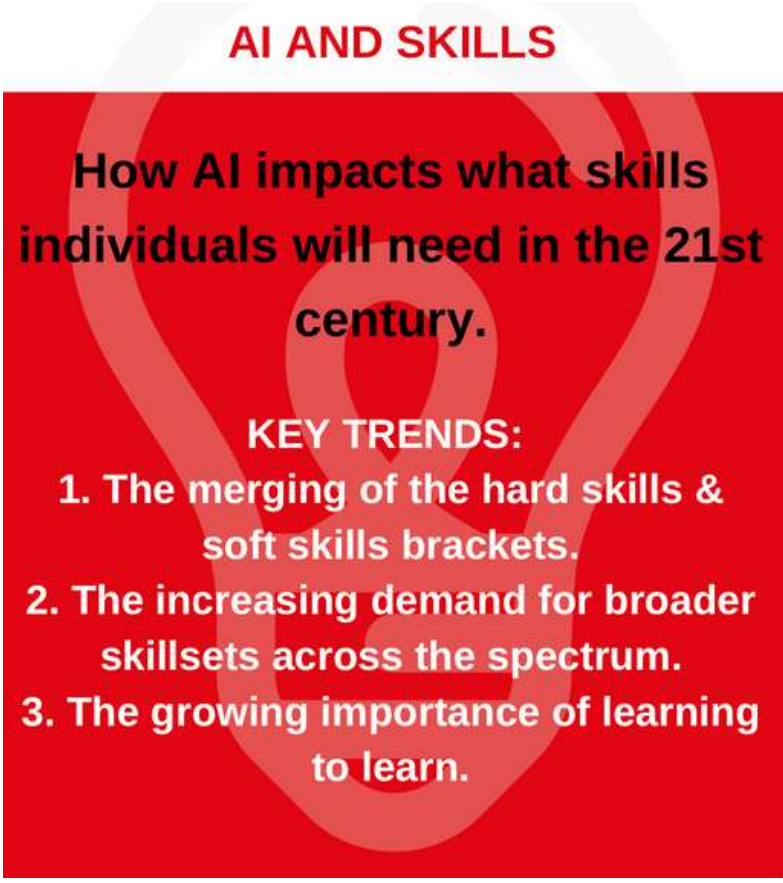
For example, if you are a truck driver, you can perceive autonomous vehicles as a likely threat to your livelihood — maybe not this year or next year, but certainly within five or 10 years. Career experts suggest not to wait until self-driving trucks are a common sight on the highways to start building skills for one's next job, and that one should be ready.

But where does this 'readiness' concept leave us in terms of school education?

As our careers progress, we are always encouraged to make decisions about which work to take based on how much we will learn, to prioritise jobs where we are more likely to develop new skills.

Aside from making a living, if we are looking for jobs in which we can learn and grow, why can't we ensure that our children learn as they grow?

if we are looking for jobs in which we can learn and grow, why can't we ensure that our children learn as they grow?



Few firms offer upskilling or retraining, for their employees to benefit from technological change, not merely cope with it. School graduates of tomorrow are not likely to benefit from this in a future expected to be even more fast-changing.

Employers expect tech-readiness to be provided by the educator.

Social Mobility and Education

Inequality in Britain is "now entrenched from birth to work", according to a damning report by the government's social mobility commission that "charts failures in education and employment policies that have caused class privilege to become more entrenched." [13]

[13] Richard Adams. (2019). Social mobility in UK "virtually stagnant" since 2014 | Society | The Guardian. Retrieved December 9, 2019, from https://www.theguardian.com/society/2019/apr/30/social-mobility-in-uk-virtually-stagnant-since-2014

The report says "how entry into professional occupations is largely dependent on parents' careers, with **children from professional backgrounds 80% more likely to go into a professional occupation such as law or medicine than their less privileged peers**, thanks to their connections and their stronger educational qualifications."

In addition, the report mentions "technological change also threatens to further entrench those disparities".

The report highlights the importance of adult education while bringing to light the fact that "almost all forms of adult education have been in decline since 2010".

Different students, different learning pace, what experts say:

In the book *How School Improves* Nancy Safer and Steve Fleischman talk about today's education climate, and stress their argument on assessing students performance and use the data to focus on what the student need, assess teaching effectiveness and adapt accordingly.

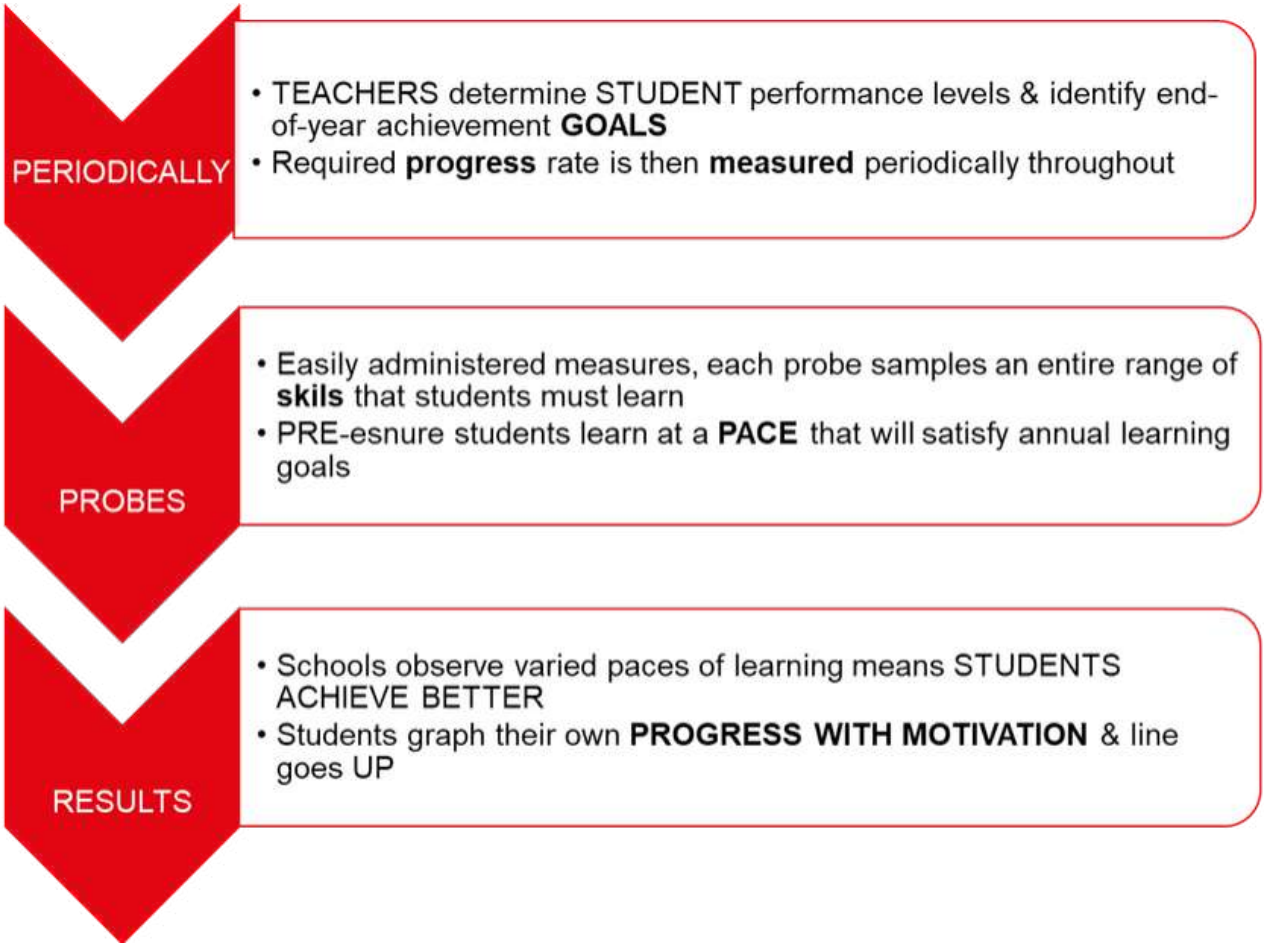


Fig.8 Student Progress Monitoring

As the authors describe, "To implement student progress monitoring, the teacher determines student performance level and identifies achievement goals that they need to reach by the end of the year. The rate of progress the student must make to meet those goals is then measured." The approach ensures the pace, and different capabilities of students to learn and educate themselves.

Results:

The approach helped teachers to identify the needs, and also additional requirements for individual students if any. This helped student performs and achieve better.[14] The research demonstrated that the student monitoring approach made students aware of their own performance, and the process as reliable.

Why is this relevant?

Student progress monitoring fits well into the routine of the classroom. Reviews and data examination can be quick, and the results are immediately understandable and easy to communicate.

In some classrooms, students graph their own progress and find it motivating to "make the line go up."

Personalised learning is an option that student progress monitoring can lead to when and as required. [15]

[14] Fuchs, L. and Fuchs, D. (2002). What is scientifically based research on progress monitoring? (Technical report). Nashville, TN: Vanderbilt University.

[15] Safer, N. and Fleischman, S "Research Matters / How Student Progress Monitoring Improves Instruction" Educational Leadership (Vol 62)

A Citizenship engagement toolkit and implementation challenges

Grade 7-9 then Premiere to Baccalaureate get permission from the minster, involve inspectors in coordinating the curriculum, you cannot get something to be implemented by the teachers (or information passed to them) without approval of the inspectors. Commissariat Regional (local level) they get orders and they disseminate them for implementation.

(Inspectors-Ministry-Commissariat Regional are involved in the toolkit) Inspectors also train teachers.

The objective of the toolkit is to boost better citizenship engagement, voting culture, practising their rights, etc.

Technology will certainly facilitate the dissemination of new material and encourage more of them as it will be easy to edit or update them. This is especially important with areas so far from the capital, where all those involved in this report spoke of disparities in education quality.

Biggest challenge that Tech could fix: Communication between actors involved in devising and implementing education policy because once something is decided or implemented

Accessibility via VR and immersive technologies for hands-on experiments where currently there is a lack of material in the classroom.

3B. THE SCHOOL SYSTEM IN TUNISIA: A SNAPSHOT

In order to look at the Tunisian education system we will illustrate its various elements including school levels, key stakeholders, overhauling efforts, and how things are going and how they are affecting skills in general.

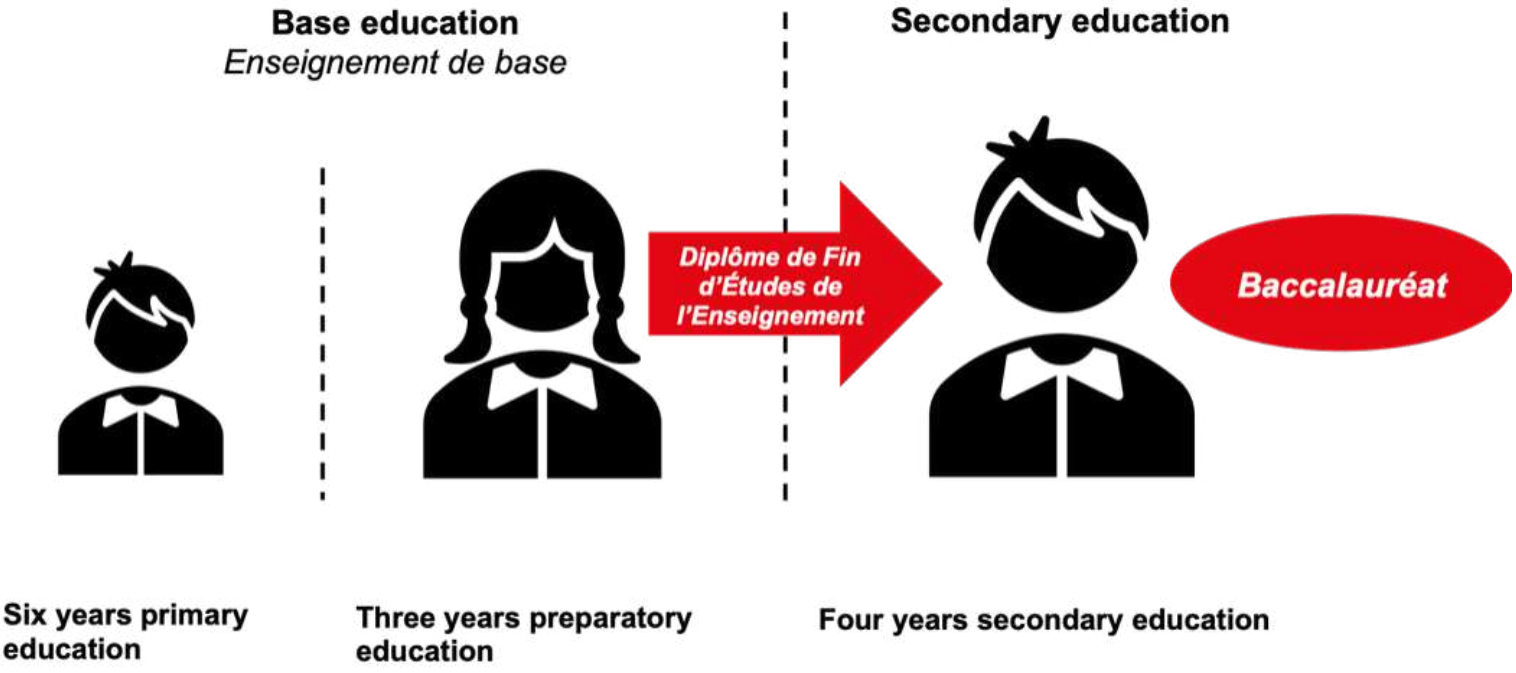
This subsection features input from Ines Zaibi, who is managing the Connecting Classrooms programme in its 4th version. In an in-depth interview, we clarify how this is reshaping the way public partnership cooperation and institutional change happen. We also talk to Hamza Ben Nasr who speaks about schools and skills in the country.

At a glance:

The basic school education which goes for nine years are divided in to two stages: 6 years of primary and 3 years of preparatory education (lower secondary). At the end of year 9, students sit for national exams, Students are required to score above 50 percent at the end of sixthgrade to progress to the lower secondary level.

Secondary education, which goes for four years, it is the equivalent of High School and it is the last stage of school education and is divided into two stages: general academic and specialised. In the academic branch, students follow the classic curriculum for one year after which they choose one of five options: language arts, sciences, and economics and management.

Fig.9 School Phases in Tunisia



Strengths and Drawbacks: Finding the right Balance between Learning and Skills

School graduates, education experts, and employers almost unanimously agreed; school education in Tunisia is superior – there is nothing to prove there. The same people argued there was a gap in the area of engaging soft skills and tech fluency within the curriculum. In relation to skills, it is important to view employer demand in the employers' two subcategories; businesses who cater to the local market and those who export goods or services abroad. Employers who deal with other countries, require similar skillsets to those required internationally and communication is key.

We know what the required skills in today's economy are, but why do many graduates remain uncertain about possessing these skills?

School graduates, education experts, and employers almost unanimously agreed; school education in Tunisia is superior– there is nothing to prove there.

Hamza Ben Nasr, a junior university student in Tunis talks about a lack of confidence he noticed when he was expected to contact external parties, including sending emails. As someone with access to technology and internet connectivity at home, Hamza can search for better ways to write emails, look at templates and eventually find or create a writing or oral communications tone that he is comfortable with. But with many students living in homes with no reliable internet access, can basic online correspondence be introduced as of school years? Or should this be something students would learn later at the university?

When communication skills are addressed with a business leader as a skill, the answer isn't definitive. Provided one has the will to get their message across, some employers suggest that it's mostly about confidence and a 'can-do' attitude.

If we're looking at jobs requiring repetitive tasks, 'just-doing' is good enough. But job categories that were once considered unthreatened by the tech revolution are now at very high risk due to the incorporation of artificial intelligence in job sectors like legal and banking.

Education providers around the whole world are maximising efforts to align with these changes by reforming the way education is delivered. Like many other countries, Tunisia has the advantage to draw lessons by looking at strengths and weaknesses within shifts to automation or other nationwide tech implementations as they happen abroad. In education, this short period allows stakeholders to consult and devise a strategy to overhaul education and prepare graduates for imminent economic changes.

Reform, in most cases, is not necessarily about altering an entire curriculum or imposing drastic changes that affect the integrity and main objective of school education as we know it today, it is more about the how children learn.

With most businesses and heavy industries, the product that the end user receives is still the same, what is making a difference is how things are produced and how services are delivered, and what/who it would take for thing to be done in a more cost-effective and quicker way.

Educating and learning would be no exception, and most agree that opportunity outweighs risk. When teachers have automated ways that lead to assessment, it gives them time to do other tasks. Such smart tech can also offer data and bespoke analytics that would help instructors spot trends in pupil achievement and subject matter understanding. While many instructors are sceptical, and sometimes daunted, technology does not threaten teachers; it gives them time to engage more with pupils and spend more time on boosting interest and setting students up for success. Making the learning experience better is proven to improve learning outcomes.

From an international or local employer's perspective, this would mean a graduate who is more in-touch with his/her education and more likely to have understood the various applications of knowledge in everyday life and in the workplace.

There are two types of secondary schools (high schools) in Tunisia. For a Lycee Pilote (a pilot highschool), students have to pass a certain test to qualify. Teacher level is considered better, and students tend to be dedicated to their studies.

Hamza Ben Nasr

Business major student, Tunis Business School.

Reform Starts Somewhere

Ines Zaibi told us about *Connecting Classrooms*, a programme that develops skills and knowledge in young students, so they're better prepared for the world of work. This happens through teacher training. Policy dialogue is one of the major strengths of this programme where key stakeholders engage with each other to align on national education reform in Tunisia. The discussion takes the form of advisory forums, seminars, national, regional, and international, to identify areas of focus to respond to the needs of the country.

The programme offers continuous professional development for teachers and headteachers, with training on six core skill categories: Communication and collaboration, imagination and creativity, student leadership and personal development, citizenship, digital literacy, critical thinking and problem-solving. We will be taking a closer look at these skills and their significance in section 3D. *Connecting Classrooms* qualifies teachers to transfer these skills to students as part of the discipline that each instructor is responsible for.

In its early versions, the programme entailed delivering training to teachers in some schools in various regions of Tunisia, but now there is cooperation with inspectors who have a key role in accompanying and assessing teachers.

These inspectors are advised on curriculum mapping, where they then decide which core skills link directly to a certain discipline and need to be integrated it within it.

Ines Zaibi

Education Project Manager,
British Council

After obtaining the core skills identified with inspectors, validated trainers deliver the training to teachers so they can integrate these skills in the curriculum of their respective disciplines. The inspectors will have the responsibility to monitor the situation to ensure that the integration of these skills becomes common practice on the teacher's side. Inspectors would be the ones to measure impact.

It is not just about teachers attending the training sessions. There is one whole preparatory day to discuss all the core skills, one and a half days of training and most importantly, one half-day of developing action planning. **Teachers wouldn't leave the room without developing action plans on how they will integrate certain skills in the classroom, and through which sort of activities will they be doing so.** Trainers accompany teachers for 10 to 14 weeks to support them throughout any upcoming challenges, where they could get in touch with the British Council or the Ministry. After this period teachers meet with trainers to share good practices with their peers and any shortfalls they faced. The British Council initially recruited qualified trainers from a pool of trainers validated by Imagine Education UK. These Master Trainers would be called to Tunisia where they will train and validate local trainers who would then go out to schools and train teachers. The Programme is in its 4th version, with each version lasting three years.

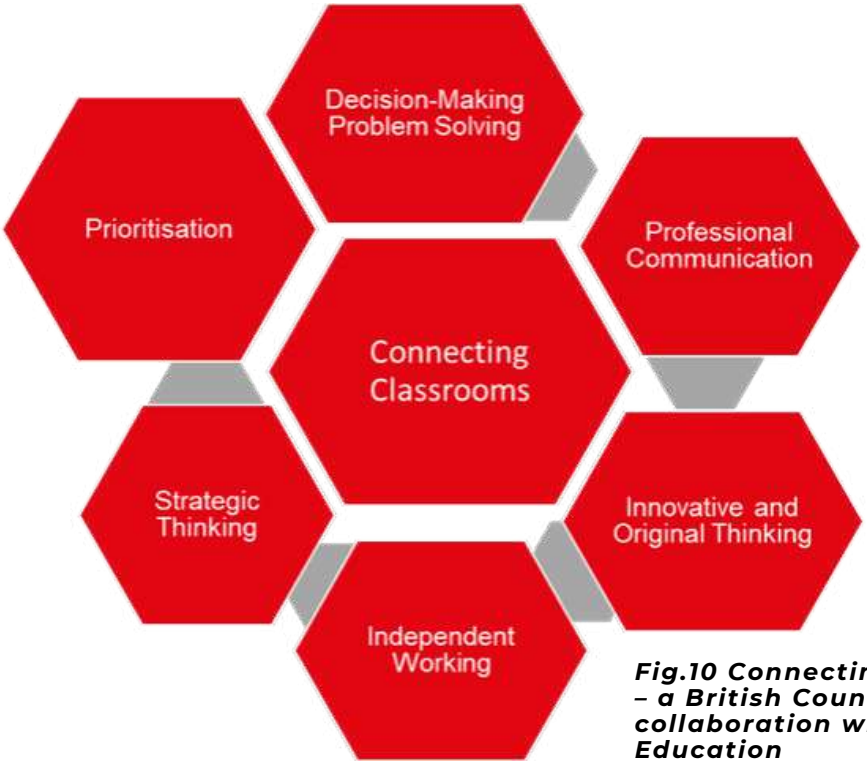


Fig.10 Connecting Classrooms – a British Council Initiative in collaboration with the Ministry of Education

The new skill: Enterprise

A new course piloted in the schools of Tunisia since March 2018. The Ministry of Education showed an immense interest in enhancing education as an enterprise through introducing school clubs as co-curricular activities. These are the enterprise skills.

While these skills may overlap with some of the core skills in the *Connecting Classroom* programme, they are more about fostering an entrepreneurial culture, not merely employability. This is important in countries with higher unemployment rates. Enterprise skills are proving as valuable where the world is witnessing high growth brought by start-up and SMEs.

Discussions with employers, schools, vocational training institutions in Tunisia indicate that there is a mismatch between job applicants' skills and employers' expectations. This even applies to applicants with qualifications like education or previous work experience,

Current assessment models at schools focus on teaching precise exam answers. This leads to less creativity as students are aware of the risks and therefore stick to answers they know will give them better grades, rather than look for better answers that could yield better results in a real-life situation.

Programmes such as *Connecting Classrooms* and the way they are implemented are about institutional reform. Ines Zaibi, Education Project Manager at the British Council in Tunis, suggests that the way in which collaboration and cooperation with the Ministry of education has changed. Partners like the British Council work in parallel towards curriculum reform.

How the British Council adds value is in ensuring that core skills as established by the Ministry are integrated in the curriculum. ***Connecting Classrooms* therefore guarantees that graduates will have learnt and adopted these skills across the board and not just within the context of a discipline at school**. As to Information and Communication Technology, the aim is not to learn it as a discipline but to learn how and when to use it in areas of communication, research, etc.

3C. EDTECH CHALLENGES: OBSERVING THE TUNISIAN CONTEXT

Although technology in the classroom does have many benefits, there are also clear challenges, in some cases drawbacks too.

Lack of proper training, and the extra time required for the implementation of technology are just a few of the reasons why tech tools are often not used extensively in the classroom. To understand education technology, one must also understand human behaviour and how technology affects it.

Technology like in most sectors should be enabler, and must be integrated in classrooms or for education purpose smoothly. We should be able to reap its advantages rather than looking at it as a hindrance in the process of teaching.

The context is as important as the technology itself. For instance, But what language would tech products be based on in Tunisia: English. Arabic, or French? Along with this, the access to technology is vital, like the availability of infrastructure for all.

This is likely to be a problem in regional Tunisian schools where facilities are not on-par with schools in Tunis, the capital.

Technology implementation can also be time consuming and costly, especially during the initial setup and training phases. When things seem to work smoothly, technology failure may occur, sometimes leaving users with no alternative to carry-on.

Along with this are also the technological challenges and a need to be updated as technology itself advances.

Finding quality material to support classroom objectives after such changes is not an easy task. Based on the Ministry of Education's policy, inspectors in Tunisia would still need to be directly involved in the design of these resources to ensure they complement the curriculum and align with its objectives.

Evidence from education providers in the UK, for instance, suggests that these issues may have limited effect, but if placed within a country-specific context, there must be a conversation on how best to adopt nationwide implementation of new technology.

The costs involved in a tech overhaul often prompt policymakers to revisit the current education system and innovate it without necessarily being too dependent on expensive technology.

Innovation could make considerable difference in the way administrative operations around teachers run and how they affect the way they manage their time. Such innovation doesn't always have to involve very new technology. It could be more simple housekeeping and file-sharing processes that make it easier for files to be accessed remotely, like cloud based filing. Mountains of bureaucracy could be replaced by a more agile, more accessible, and more indicative administration.

From there, those responsible for the back office, whether at the school or education departments under the MOE, can monitor the situation and see how the new system is working and proceed with what-works and abandon what doesn't.
If the basic issues are tackled first, they will provide the cornerstone to build on, and kickstart a culture of innovative management within the education sector.

Socioeconomic Inequalities: Problematic aspects of adopting tech in the classroom.
When technology is available in the classroom, students have a prerequisite to know how to use the equipment for learning. Students from households with no computer access might struggle and fall behind peers who have the opportunity to familiarise themselves with new technologies before they use it in class.

It can be expected that students from wealthier households will already be tech savvy and are more likely to use tech in class to its utmost potential. This is an issue in Tunisia as much as it is in other countries with income variances. While income disparity in Tunisia is not the focus of this report,

If the basic issues are tackled first, they will provide the cornerstone to build on, and kickstart a culture of innovative management within the education sector.

Inequalities must be considered when choosing technology at school.
For example, schools might consider mobile friendly tech instead of desktop-based, because students are more likely to have access to a mobile phone or tablet, than a computer.

Another challenge that critics talk about is distraction. Chris McDonough, a teacher in Ealing's St. Gregory's school in West London argues: "As children grow older, technology becomes more of a distraction because of the information access it provides. At the university level, students who use technology in the classroom typically earn lower grades. [16]

Naturally, mobile and other technology must be purposefully used.

"There are numerous ways a computer pulls a student's attention away from the learning lesson, from social media to online gaming. When one student is distracted, the effect tends to permeate to the other students in the classroom as well."

To ensure proper use, a school can control what its students access, even if they are using their own devices. This can be done by limiting school-provided internet access to websites that are pertinent to the lesson or research.

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[16] 21 Technology in the Classroom Pros and Cons – Vittana.org. Retrieved December 9, 2019, from https://vittana.org/21-technology-in-the-classroom-pros-and-cons

Tech and Soft Skills

While it is important to be conversant and professional via emails or live chats, essential interpersonal skills are being developed by interacting on a personal level. High school teacher Ariana Di Matti suggests: "That a couple of students decide to become friends is less important than the skills that develop when exploring the possibility of a friendship. This exploring level is not omitted by online interaction, but the way in which someone interacts with a person online is very different from how they may interact in-person."

Verbal & Public Communication Skills

Despite its numerous advantages, technology cannot replace personal interaction in class. In today's and tomorrow's professional environments, there is still a need to verbally communicate with others in a public setting. Group cooperation often happens face-to-face at the workplace, verbal presentations encourage students to practice their public speaking skills.

The Tech Credibility Dilemma

Technology facilitates the spread of information. Many stories that are circulating online are being discussed as if they are established facts. A student doing research might take some information from an online source and treat it as fact instead of adopting a critical approach toward its credibility. Many online sources are not consistently accurate, students must be prompted to cross-check sources and learn how to identify credible ones. Such habits are important for enhancing their critical thinking as they use technology.

3D. SKILLING FOR STUDENTS

Preparing a child for a work world that is not clearly defined is not an easy task.

If we step back and look at the bigger picture, the question emerges: what skills student needs to succeed in the 21st century?

Learners today want exciting, energetic and flourishing environment that incorporates technology into the classroom or online. Technology is part of day-to-day life for most individuals and it shall be reflected in the education environment as well. Ed-tech shall engaging and even incorporate peer to peer or collaborative learning.

Each country has its own priorities set when it comes to skills from education. In an evidence brief, part of the Tomorrow's Schools taskforce, suggested to the New Zealand government five key competencies for living and lifelong learning:[17]

- Critical Thinking
- Using language, symbols, and text
- Managing self
- Relating to others
- Participating and contributing

We look into these skills, prioritised by the Tunisisia Ministry of Education from various perspectives, which helps understand why and how these skills align graduates with the demand global and national socioeconomic transformations impose.

1. COMMUNICATION & COLLABORATION

Students should have no restriction in the art of communication whether it is using visual art forms, speech or even use of technology for that matter.

"Communication is a broad term that incorporates multi-faceted levels of interaction and sharing information."[18] including text, speech, video, imagery, interactive analytics, VR and more. However, personal interactions still count, and these are not always straightforward, communication as a soft skill is not only about being able to communicate, but abilities.

This skill is put to test when the situation is challenging, for example because of language or physical/mental or disability barriers. Students at school should be encouraged to venture out of their comfort zones and communicate with those who communicate differently, including students with individual needs or adults. A child or teenager's ability to communicate his or her idea cohesively can improve their sense of agency (initiating, executing, and controlling their own actions and opportunities), not merely good marks at school.

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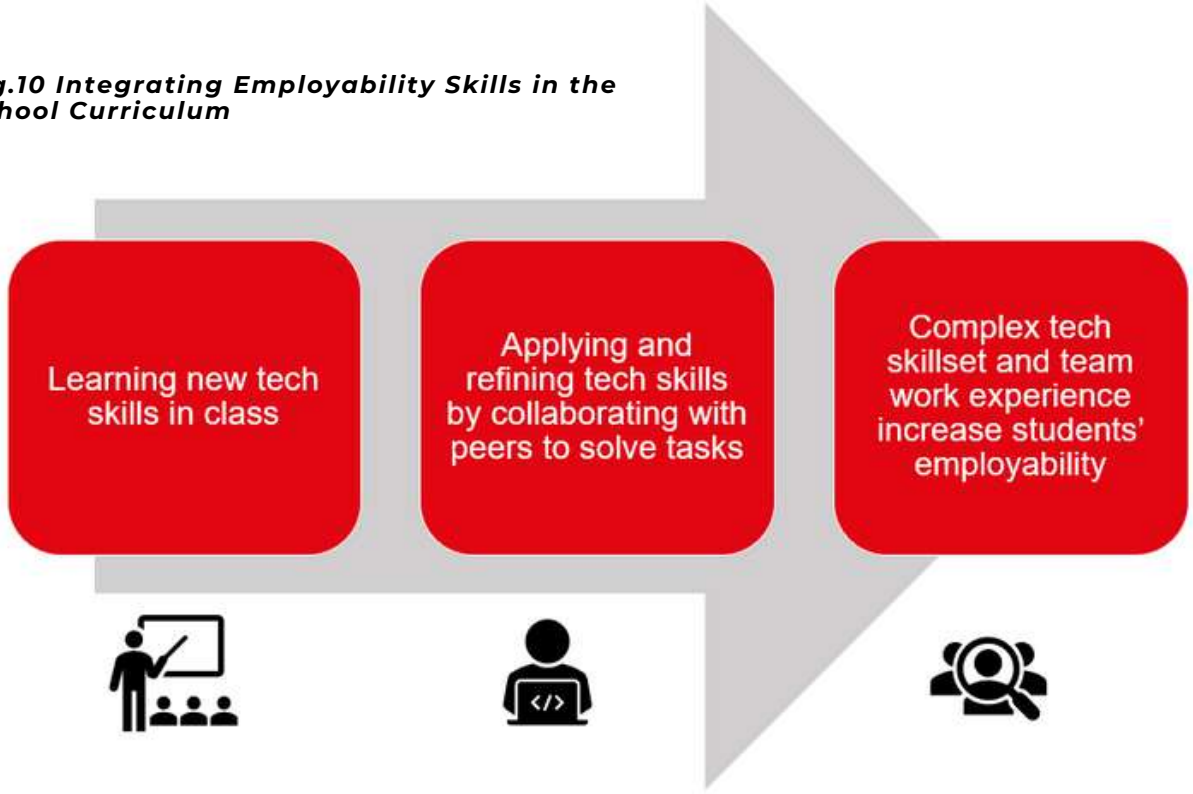
[17] Tomorrow's Schools Independent Taskforce (2018), "Our Schooling Futures: Stronger Together" New Zealand Ministry of Education.

[18] WATANABE-CROCKETT, L. (2016). The Critical 21st Century Skills Every Student Needs and Why. Retrieved December 9, 2019, from https://www.wabisabilearning.com/blog/skills-every-student-needs

Fig.10 Integrating Employability Skills in the School Curriculum



School activities must continue to remind students that responsible communication will put forth best representation of who they are as individuals in every encounter or partnership they make in their lives. Whether talking face-to-face, blogging, texting, or creating a visual product, their values and beliefs are defined by how they communicate with others. Encouraging them to develop and improve every aspect of their communication skills will help them appease, encourage, enthuse, and reject in the best way possible, depending on the intricacies of the scenario.

Students of the digital age are social by nature. They text, post, update, share, chat, and constantly co-create in technological environments with each other. When they are unable to do this in school, they become generally disengaged. Connection and collaboration with others are essential, not only to their learning but their mental and emotional wellbeing. Collaboration is a skill that educators must exercise with them regularly.

Some, nevertheless, argue that schools must not be a model based on social-recognition and approval. **It is yet to be researched whether the like-and-share model might lead to suppressing creativity and the freedom of expressing one's individuality and/or non-conformity in a tech world often designed to boost trending rhetoric rather than genius.**

The workforce of the future (and even our present day) has a global outlook, restricting thinking to a country or even a continent, is no longer a sustainable for them. At the workplace, it is now the norm to communicate and market for global demographics instantaneously and effectively. Often, an organisation's business partners, or clients, could nowadays be halfway across the world. This also applies to interest groups that students could subscribe to while in Tunisia, they meet and work with each other every day. The ability to collaborate and communicate in these situations is essential.

This kind of interaction goes hand-in-hand with the mindset of global awareness that is part of Global Digital Citizenship

In Tunisia, this starts with students being aware of others without compromising on their national identity or one's own culture or subculture. The more students know about other religions, political inclinations, or regional subcultures, the more they understand the difference and build bridges while being able to celebrate their own identity too.

2. CREATIVITY AND IMAGINATION

According to employers, graduates need to be able to think and work creatively in both digital and non-digital environments. Due to ongoing exposure to digital interfaces, students are in a constant state of stimulation as they use technology. Without knowing it, they are producers and consumers of information. While problem-solving is a skill that comes naturally to the digitally savvy, it can be improved significantly in others, with further engagement during the school years. Academics in Tunisia and abroad agree that this could come from doing rewarding projects and meaningful tasks that give students challenges to overcome in imaginative ways, whether independently or as part of a team.

With social media being too politicised, students will be freer if they are being creative within a less pressuring environment and are given constant and instantaneous feedback from their peers and according to objective criteria, instead of praise and/or disapproval that they may get on social media.

When encouraged, creativity can help pupils progress at school, especially if they apply it across a myriad of learning exercises or to help themselves overcome learning or memorising difficulties whether it is maths or history.

3. LEADERSHIP & PERSONAL DEVELOPMENT

Before exploring ways to encourage leadership at school, let's look at some characteristics that make a good leader, brought by Researchers from the University of the Sunshine Coast in Australia, who have been working with staff at a Queensland high school to ensure student voice is an integral part in the development of student leadership programmes.[19]

Throughout the research, students identified qualities of a good leader: being inspirational, courageous, and confident. Other traits included trustworthiness, loyalty, reliability, and **an interest in people and their needs**, and ways to support them.

Looking at the skills that makes a good leader, the author of the article mentions social skills among others skills and treads (optimism, passion, knowledgeable, ethical, intelligent, ability to take critique and learn). Social skills are about encouraging and supporting each other, and the ability to obtain support and build network.

Leadership development opportunitiesand suggestions

According to the joint research, students wanted their schools to provide more practical activities, more practice in public speaking, which they believe provides opportunities to

[19] Pearson, M, Ferdinands, L, Evans, L (2019) "Student voice: Developing student leadership programs" Teacher Magazine

become leaders, developing students' skills in ways other than advertising 'leadership'. In order to increase interest, programmes need to be more considerate of student time, so that program participants do not fall behind in the classroom. To encourage students who normally would not go near a leadership programmes, suggestions were made about offering rewards for attending like out-of-class physical activity, food, or events and/or a certificate of participation.

Teacher Influence

Students shared a belief that leadership development can be negatively or positively influenced by teachers. Students felt that some teachers do the leader's work, which doesn't give the opportunity for leaders to do it. Students said it is important to be around non-judgemental teachers, especially students who have shown signs of learning difficulty.

4. GOOD CITIZENSHIP SKILLS

According to various definitions, good citizenship usually entails adaptability, fiscal responsibility, personal accountability, environmental awareness, empathy, tolerance, global awareness, and respect for other religions and cultures.

Those young graduates who spoke to us about citizenship, seem to agree that the Arab Spring and the revolution in Tunisia created a culture of collective responsibility and sense of purposeful citizenship.

Technology has trivialised distance and national borders, we are yet to keep up and take full advantage of it.

After the revolution, political instability caused a lot of disappointment that caused the youth to feel they no longer belong, or no longer have a cause. Through incorporating citizenship as a competency, The Ministry of Education is fostering a sense of awareness and responsibility amongst students where they can make a difference and create positive change in their schools and their communities.

Citizenship is not only seen within the Tunisian context, it entails global citizenship and the ability to integrate and communicate within the global community.

Cultivating a sense of citizenship is not just about boosting the morale, it's about values. Citizenship is being learnt as of the 7th form in Tunisia, but the Ministry of Education has requested that it started as of the primary school which will start in September 2019.

5. DIGITAL LITERACY

Tunisia's Ministry of Education launched its digital school programme "Solution Numerique Pour Tous" (which means digital solutions for all) in May 2015 as part of its wider program of reform. The primary goals of the program are to work with the approximately two million students and 150,000 primary and secondary teachers to improve the quality of education through promoting the use of digital tools in the learning process, expanding access to digital resources for all students and using digital technology to support academic success and innovation in teaching and learning.

Achieving all of these will be a challenge, but Tunisia has some experience to draw on.

But what is digital literacy, and why is it important?

As mentioned in the article Cornell University offers a definition that works, although narrowed. “Digital literacy is the ability to find, evaluate, utilise, share, and create content using information technologies and the Internet.”[20]

With the increased importance of technology in society, digital literacy is one of the most valuable tool for lifelong learning.

For adults, the ever-evolving tech world can either help them succeed or hold them back. The influence of technology on business means that it has become increasingly important to continue education after entering the workforce. From early learning through adulthood, digital literacy is showing the most promise for success.

The EdTech industry has long focused on the value of digital competency for children. Experts suggest it’s time for digital literacy to become incorporated into a similar ongoing education system for adults too. If we talk about education in Tunisia, adults who are directly involved are parents and teachers, they should be prompted to do their part too, to support their children’s education.

For school students, the access to a home computer with internet significantly increases their future prospects.

[20] Lynch, Matthew (2017) "What is Digtial Literacy" retrieved December 9th 2019 from https://www.thetechedvocate.org/what-is-digital-literacy/

6. CRITICAL THINKING & PROBLEM SOLVING

Students need to learn and be able to solve complex problems in real-time as of their school days. What makes this skill a must-have is the fact that students will face complex problems that they cannot even simulate right now. The more solution-driven students are prompted to be, the more they are likely to be successful in unforeseen situations. As industries and technologies advance rapidly, so will coping problems that accompany them. The more we focus on student ability to develop effective solutions to real-world problems, the more successful those students will become.

When we speak about problems, we always hope there is a solution. Solution-driven people see exactly that-- the solution, not the problem. Initiative, therefore, should be steered towards the solution, rather than reporting a problem and dwelling on it. Such initiative comes with the risk of failure but calculated risk taking is a valued skill in most business fields. Risk-assessment as part of the solution-finding exercise is something that should be considered when education tech applications are being engineered.

Students need to learn to think analytically, which includes proficiency with comparing, contrasting, evaluating, synthesizing, and applying without instruction or supervision.

Tasks that require linear thinking and routine cognitive work are being outsourced more and more. Experts argue that it is essential to guide students towards being able to constantly think analytically and critically. It is a skill that is crucial to their ability to succeed in life after the classroom.

Analytical thinkers see data and information in many different dimensions, and from multiple angles. They are adept at conceptualisation, organisation and classification, and knowledge synthesis. These types of skills are invaluable because they allow students to deal with problems more practically, whether they are of social, mathematical, or scientific nature. It empowers them to make effective and level-headed decisions in their lives and relationships. It's no surprise that critical and analytical thinking skills are important to success beyond school, and even beyond a person's career.

Other soft skills can influence critical thinking, these may be biased sometimes, like when we judge a certain theory as too socialist if we are a student within a pro-capitalist predisposition. Like creativity, critical thinking at school can be measured and assessed, to enable the student to be analytical and critical without being steered too heavily by their own socio-political prejudices. It is therefore important for teachers and fellow students to engage in each other's thinking and interact openly. Such practices will not only encourage critical thinking, they could encourage innovative thinking.

En Anglais: **The Elephant in the Room**

While all the skills prioritised by the Ministry of Education are on-par with those adopted by education providers globally, English as a skill is something that policymakers in Tunisia take seriously. This was clearly emphasised in a meeting with the Minister of Education in Tunisia H.E Hatem Ben Salem.

Enhanced communication skills form part of an improved social life, but also better job opportunities in the future. Although many job interviews in Tunisia are conducted in French, English language skills are very crucial. In Tunisia, there are Arabic, French, German, English, and Mandarin speaking employers, to name but a few. For many of these companies and individuals, English is the Lingua Franca. Tunisia is well on its way to becoming an even more established industry hub in the region, covering west African countries using English language. Tunisia could, therefore, benefit hugely from enhancing English language skills in schools.

Being proficient in English means being able to communicate clearly and effectively. Many employers are steering towards conducting interviews in English, in-line with their global counterparts. **Poor English language skills mean slimmer chances of landing a job or being accepted on a course in a university abroad.** Handling international business deals requires effective skills in English. Using incorrect tenses, prepositions, and the like will make one's statement less accurate. In order to have an increased competence in the professional world, one should have a good grasp of English language. Stakeholders, including students, ministry officials, teachers, and employers, all agreed there is a need to enhance English skills.

Poor English language skills mean slimmer chances of landing a job or being accepted on a course in a university abroad.

Maya Arnaout

Project Manager,
British Council

Cooperation with Tunisian MOE on incorporating English in lower primary levels *Teaching for Success is* a project that aims at improving the English learning experience, through establishing systemic alignment between textbooks, exams, and the curriculum.

Why it's needed:
At the moment, English is introduced as of the 6th grade which is the last level in the primary, the new goal of the Ministry of Education is to introduce it at level 4 and that's where the British Council is supporting through providing face-to-face training to the Tunisian pedagogic assistants in the UK at Norwich Institute. The project is in-line with the interest in digital and interactive learning at the Ministry of Education.

Modes of engagement: Teaching for Success features an online platform where both teachers and students can learn.
The CNTE, National Centre of Education Technologies suggested how the platform would look like. A committee from the 55 inspectors are defining what resources should be on the platform and what resources could be added from the British Council side. The British Council in Tunisia is accompanying the work of the ministry, including organising meetings, etc. When it comes to other national or foreign stakeholders working with the ministry, they will have their own separate programmes. The British Council, for instance, does meet with other stakeholders, to discuss the scope of their work to ensure there is no overlapping.
The Ministry of Education keeps of the consultants working on UK-funded programme like Teaching for Success, specifying foreign and local ones.

There is a lack in speaking and listening skill when it comes to English, which could be due to the absence of video or other audio-visual learning methods.

How it works: Programme officers meet with language coordinators at the ministry, difficult to get approval and appointments at the ministry with key people. Issue can be the change in liaisons in certain departments
Key participants: In order to work together, things need to be approved by the MOE with technology suggestions by the CNTE (National Centre for Education Technology)
Project officers deal with pedagogic assistants who are newly assigned to play the role of English inspectors specifically for primary education. Teachers are engaged through online placement tests and an online course. Subject to passing their tests, these teachers would then be able to start teaching grade 4 next year.

Photo: Tunisia's Minister of Education Hatem Ben Salem, UK Ambassador to Tunisia Louise De Sousa and British Council Director Robert Ness launching Teaching for Success in October 2018

The project is party based on a study that highlighted Tunisia areas of development in English language skills amongst graduates. Apart from the learning platform, there will be summer camps and winter camps where teachers are suggested ways for better teaching. These camps are normally held for the pedagogic assistants or the teachers.

SECTION 4

THE TUNISIAN VISION

4A. REVISITING THE PURPOSE OF EDUCATION

This section looks at the purpose of education as part of devising reform. Based on input from local teachers, we look at the potential of innovation in schools.

Throughout this last part of this report, we continue to emphasise the idea of collective responsibility in bringing about change. Three showcases will illustrate how tech solutions in schools have made a difference

On a field trip to London schools to explore recent reform in UK education, Mr Hatem Ben Salem explored some technologies and education methodologies that are currently implemented in the UK. Ben Salem, who held the same position a decade ago, emphasised the need for change in the system.

As a key stakeholder, the Ministry of Education is addressing any gaps between the curriculum and skill requirements in the national, regional, and international labour markets of today.

In an interview with Oxford Business Group, Mr Ben Salem stated:

"Educational institutions need to be updated. There are more than 5000 schools across the country, but not all of them are in good condition… The aim is not to have merely students filled with knowledge, but students who are both useful and well-rounded. In order to carry out these reforms, we expect a stronger contribution from the private sector in the public sphere. Public-private partnerships will be increasingly present in education in order to grow the sector and implement the necessary reforms"[21]

But before reform, thinking about the aim of education is crucial. The way businesses and human behaviour developed into our current form of socioeconomics, have redirected us to an inevitable discussion about the very purpose of education.

Photo: Tunisia Minister of Education Mr Hatem Ben Salem

[21] Oxford Business Group (2018), "Hatem Ben Salem, Minister of Education: Interview" available here https://oxfordbusinessgroup.com/interview/first-class-hatem-ben-salem-minister-education-priority-reforms-and-challenges-digitising-sector

Dr Wayne Holmes
Institute of Educational Technology (IET)

Having been involved in education, educational technologies and education research for more than 25 years, Wayne is a lecturer in Learning Sciences and Innovation, at the Institute of Educational Technology (IET), The Open University (UK). He holds a PhD in Learning and Technology from the University of Oxford, an MSc in Education (Oxon)

It is a challenge to try to align education with the requirements of the job market. If the sole purpose of education in-general is to prepare students for jobs, it would be a disaster. **"Education has got to be about far more than training for jobs",** according to Dr Holmes who has been involved in, EdTech and education research for more than 25 years. Holmes welcomes a situation when industry leaders and other employers contribute by offering suggestions on what skills they require; such conversations could contribute to developing education where it's more in-sync. But economics mustn't become the primary factor driving education policy.

Education is about individual self-fulfilment, engaging with ideas that we are not aware of, collaborating with people that we may not understand. **Education should give us an awareness of where we are now and where we might be tomorrow.** Educated people are usually better citizens, and enjoy a better life, part of which is influenced by what we do for a living and how much we earn, but that's not the whole thing. Employability can surely be a good by product, but it mustn't be the main motive obtaining good education.

There are certain skills pertinent to school education, like language skills, where industry experts could bring in evidence that levels are unsatisfactory for the work environment, then education providers must address the matter as an issue.

Country-specific factors: According to Holmes, exam assessment can be something that can be revisited according to the country. At the moment, we are still in a knowledge-based system, but students must be given the opportunity to tell us what they read by analysing material and assessing it, instead of being us assessing them over how they absorbing it – this is one area where technology can help. Students in Tunisia need to learn different things to their counterparts in the UK, this is specifically important because education needs to tell students who they are, their identity. However, while on a trip to China, Holmes observed how similar teaching could be when it comes to subjects like maths. In the learning process, teacher-student relations are very similar, regardless of the national context. **"Teachers in China overestimate the abilities of their pupils just as we do in the UK, learning is the same. It's a mixture of identity and cooperation."**

Rostom Bouazizi
COO & Co-Founder, KAOUN

As a tech company, we find the engineering talent in Tunisia to be highly qualified. Yet, hiring talented engineers constantly proves to be a challenge despite rising numbers of graduating IT engineers (about 10,000 each year). This is because we are not only competing with local companies but also with European companies, which can pay salaries that local players cannot match particularly given the significant devaluation of the Tunisian Dinar. This brain drain only continues to get worse every year.

To face this structural issue, Tunisia should foster an entrepreneurship culture, and encourage students to explore innovative solutions to our most pressing issues. Some Startup incubators are playing this role through competitions and conferences. However, I believe education providers also have an important role to play by making the curricula more holistic. Such curricula will help spark student interest in various fields such as humanitarian work, development studies, environmental issues and help them explore various potential applications of their technical skills in their communities, the economy, and the environment.

Tunisia is witnessing the birth and growth of many tech start-ups, some of these are changing the status-quo of how business is done, purchase behaviour, and advertisement strategies, etc. Kaoun is the first start-up in Tunisia to allow for legally recognised remote identification, which customers can use to perform seamless mobile peer-to-peer (P2P) merchandising, e-commerce and bill payments. The start-up aims to provide an alternative for millions of unbanked adults in Tunisia as well as provide more reliable and affordable services to the already banked.

Kaoun employs many modern-day technological tactics in their continuous effort to disrupt the tech ecosystem. The start-up processes interbank payments using blockchain technology, which allows them to ensure that all transactions are securely and conveniently completed within four seconds.

For Kaoun to thrive, its people must be tech-fluent, but most importantly, they must be familiar with the intricacies of Tunisia's financial, legal, and policy frameworks. Certainly, knowledge-based education will serve well, but critical thinking and enterprise skills would be essential.[22]

These are examples that trigger the knowledge versus skills debate, but what about other debates around the education policy?

[22] Startup Scene (2019) "This Fin-Tech Startup is Aiming to Make Tunisia Cashless" available here https://thestartupscene.me/BehindTheStartup/This-Fin-Tech-Startup-Is-Aiming-to-Make-Tunisia-Cashless

Where politics comes in:

If knowledge-based education is still the most prevalent form of teaching and assessment at the school level, we asked why it is so despite the criticism it received in the past. Could we encourage individuals to know more but question less? Would the industry benefit? Dr Holmes thinks this might be the case within mass production, where it may be much more convenient for employers that workers simply follow instructions for linear processes. Nevertheless, progressive and fast-growing enterprises like Google want their people to have critical thinking and bring in their own ideas and challenge existing ones.

In July 2018, Tunisian Minister of Education Hatem Ben Salem said "The education sector, spearhead of socio-cultural and economic development in Tunisia since independence, has been undermined since the start of the famous reform of the school. In the past decades we have seen the emergence of a multi-speed school; an unequal system that does not exempt children from the same quality of education or the same treatment."[23]

In section 2, this report highlighted the notion of egalitarianism in education reform. In a July interview, the Minister of Education touched on the same matter, emphasising that reform is a necessity, not a choice. Languages were another area of concern for Ben Salem who highlighted the important efforts to overcome challenges with improving English education with the help of the British Embassy and the British Council in Tunisia, with whom the ministry has signed agreements.

By the end of this year, more than 170 teachers, pedagogic assistants, and inspectors will have been to London for training and qualification courses. Ben Salem added: **"A very interesting dynamic is taking shape today and it will improve the quality of training for our teachers, an opportunity they have not had throughout their entire professional life"**. (We will look at examples of such dynamics in section 4)

Back in the UK, the use of technology in education has been very difficult, according to experts like Dr Holmes, it hasn't offered a huge amount of opportunity at the school level. Implementation of technology in schools has been so far very patchy and inconsistent. "While there are individual schools where technology is used effectively, it is still not present at a systemic level. This has been the case in education technology for a long time."

Teacher Resistance:

When asked about instructor resistance to new tech models of teaching or assessment, Dr Holmes said it can be the case. but that could be due to the technology infrastructure, which has its issues and it could get in their way "You could be running a class and you're dependent on an internet connection which then fails, you're stuck and need to change what you're doing."

"Teachers do not resist acquiring new methods, they just see no point in automating existing ones."

In the past decades we have seen the emergence of a multi-speed school; an unequal system that does not exempt children from the same quality of education or the same treatment.

[23] TN24 (2019) "Le Sauvetage de L'école Publique est une Question de Sécurité Nationale" available here https://tn24.ween.tn/fr/article/tunisie-le-sauvetage-de-l-ecole-publique-est-une-question-de-securite-nationale-tonne-hatem-ben-salem-164487

Another challenge with technology is that it replicates what we already do, but what we do is not always pedagogically sound. For example, in Artificial Intelligence, there are a lot of technologies that refer to intelligent tutoring systems. Dr Holmes fears that such technologies end up spoon-feeding pupils and that would not be the best way to use technology.

In classrooms, teachers are always under pressure, a module to go through, a curriculum to follow, examinations, etc. These things can get complex, yet teachers have to deal with them on a daily basis. When we introduce technology to the classroom, what typically happens is that tech is used to just do these things. **A much better way is to integrate technology in collaborative learning.**

AI technologies are able to develop such solutions, but this has to be encouraged by the attitudes of pedagogy experts.

This is where resistance exists mostly, it is not easy for those involved to engage, when criticised or told that their pedagogic approach isn't the right one.

Exams are another area where results do not necessarily tell us everything we need to know. According to Holmes, assessment is important, but the current examination model in the UK is still largely devised by those who have excelled at examinations and students sitting for two or three hours in an exam room is not fit for the 21st century.

Dr Holmes explains why automated assessment can sometimes be counter-productive, despite freeing-up time for teachers. If a teacher doesn't read what the student has written, there is no way to understand some parts that the student has produced. Outside multiple-choice marking, artificial Intelligence cannot tell as much about the work of a student, in a 300-word answer, for instance.

4B. WHAT MAKES A SCHOOL INNOVATIVE?

"The prevalence of AI in the workplace makes a difference to how our education systems need to be"

Professor Rose Luckin

University College of London, Director of London SME and EdTech developers' hub EDUCATE

In a All-Party Parliamentary Group on Artificial Intelligence evidence meeting (February, 2019) on Education, Professor Rose Luckin emphasised: "The prevalence of AI in the workplace makes a difference to how our education systems need to be"

So how can AI be used in different learning environments and how can AI impact assessment and help them identify a student's strengths? According to Luckin, the most powerful way in which AI could be used as a tool in education is to create an intelligent infrastructure. This entails a carefully designed analysis of multi-model data that is collected as learners interact. This data can provide such an intelligent infrastructure that can inform both teachers and learners about the details of the learning process. This is fundamentally important for enabling students to learn how to learn.
As to the learning environment and student experience, wisely-used artificial intelligence can positively impact learning because students would be much better informed about their own abilities and development areas, which is very important because as we enter a world where human hacking is likely to happen on a widespread scale, we will need to know ourselves really well. If we are going to keep a step-ahead, we need to ensure AI makes us smarter. Currently there is a huge risk of AI dumbing us down. If we get AI in EdTech right, it would give more time for human interaction between students and their teachers and more time for students to work with each other and less time even with the technology itself. **The impact on teachers will be profound as we steer away from the emphasis on a knowledge-based towards intelligence-based curricula**. There is a need for teachers who have an advanced state of literacy because they will need to interpret the data that is produced by such an advanced infrastructure. Teachers need to spend time mentoring students where they communicate to them what the data is saying, where they can both interpret it to improve the learning process. The impact on teacher starts with an enormous need for continuous professional development, changes to initial training must be significant. As we see more emphasis on collaborative problem-solving where inter-disciplinary teams work together, teachers working as teams to ensure each problem is tackled from multiple perspectives will impose a difference on the environment. There will be a need for a change in the environment in which the learning takes place, because there will be a need for teachers to work together, spaces need to be larger.

What do Local Education Professionals Think?

Zahra Mouakher
Associate Professor at the University of Jendouba

While Tunisia is attempting to implement English teaching as of a very early school level, the language isn't taught in context. Students are only taught English as a language, in terms of its grammar, vocabulary, etc. When in secondary school, English is not used for subjects like science, maths.

While credit can be given to this attempt at incorporating English, the national level is still on the low end and it would take time, unless if there was a more radical approach.

As to tech fluency, things depend on what branch students follow at the secondary school level. This varies between humanities and sciences curricula. What is true in both of them is the lack of technology in the classroom. However, this could be sometimes compensated thanks to the very good syllabi in the Tunisian system.

Students can acquire skills when they go abroad or face their career environments, but **if rich knowledge can translate into skill, it would then be safe to assume Tunisian graduates will have a lot of it.**

Even though education in Tunisia is more theoretical than practical, it is still enriching to have so much knowledge that graduates can then make use of when need be, whether when they pursue university education or at the workplace. Unfortunately, there is a lack of material but there is no compromise on knowledge and theoretical competence.

Disciplines: Quantity or quality, looking at Tunisia and Scotland

In Scotland a primary school student is given six subjects: Maths literacy PE and ICT Music art and Topic work, while in Tunisia they have 13 subjects, which can be overwhelming. Focus on quantity rather than quality in the curriculum and this should be reversed.

As to English skills, there is a major issue where teachers are giving English courses even when they are not qualified as English teachers. They could simply be a maths teacher who would end up teaching English. This is not only indicative of the level of seriousness in dealing with English as a skill, it also raises concerns about the same situation being replicated where a teacher specialised in Arabic, might end up teaching disciplines of which they have no adequate qualification.

This suggests that with the quality-quantity dilemma, it is not only about the quantity of subjects taught, but also the delivery quality and subject matter expertise, especially in regions where there is a shortage of teachers in certain subjects—perhaps most notably, English.

Suggestions:
School clubs can enhance creativity and leverage the potential and competencies of Tunisian students. Arts, sports, and other subjects like politics or finance and technology.

Projects at schools in secondary schools are supposed to be an alternative for theory-based assessment. Unfortunately, we hear that such projects are more about physical improvements within schools and not something that the student may have wanted to create outside the classroom environment.

Libraries and research skills:
Libraries are a major issue due to lack of basic technology that could help students locate the material they need. A total absence of digitised libraries means students cannot explore and develop their interest in certain subjects. The reason why libraries are important is because they could be a hub for developing research skills, and while there are large libraries in the country, they aren't put to good use.

Recommendations:
Equal distribution of reform across regions
Note: The question is, will it be more efficient to buy access to international libraries that are already digitised, or digitise the ones in the country?

Skill Weaknesses:
Computer skills are the biggest weakness, due to theoretical learning when it comes to machines, the best way to learn is by doing.

Curriculum drawbacks:
The curriculum's biggest drawback is the same one which we would also identify as its strength, it is very intense in terms of subjects and that can be overwhelming. It's current format works well, but only for those who can keep up with it. Another main weakness is most certainly English language where students need to reach a level of adequacy, if not fluency. Prof El-Mouakhar adds that while Tunisia is a diverse country, exposure to the 'other' is essential to bridge any divide. Whether it is cultural and sub-group awareness, **learning about others would enable students to be more comfortable when exposed to different environments in their life.**

4C. EDUCATION ECOSYSTEM: SHARING RESPONSIBILITY IN DEVELOPING FUTURE SKILLS

The potential of implementing AI in education is enormous, it can amplify and accelerate various aspects of education systems.

But while it brings in many opportunities, some argue this will lead to a revolution in education, something we might not all be ready for. Just like in other sectors, the potential of AI is remarkably high, but it is difficult to predict precisely the direction of the change it will impose. This is due to the priorities that will vary eventually as AI practices become more prevalent in the education sector.

One of the big questions is *who* determines the priorities and who should be consulted to make sure AI brings about the improvements that matter most. Teachers are in direct contact with students and observe their learning patterns, and they are the ones who have deep knowledge of current curricula. Through inspectors, teachers are also in touch with ministries who govern teachers and their rights and activities. Raising awareness is essential, not only about the effect innovative EdTech (that works) has on the quality of education for students, but also the way it makes teacher experience more efficient and more engaging. Such awareness should be targeted at both ministries and teachers. An improved teaching experience means teachers have less problems and it could prompt them to engage more actively and positively in policymaking. The only obstacle in this would be resistance to change, which is a global dilemma--there is no other choice but to embrace. Part of learning how to handle to the change is within the implementation itself.

Government is without a doubt the natural regulator for education policy, just like with other sectors. The Ministry of Education, however, can consult other stakeholders and industry experts with proven experience in tech implementation. Regional inequalities can be avoided if policy consultants represent all regions nationwide. According to the Social Mobility Commission report in 2017, children from underprivileged environments in the North of England have far less access to quality high schools compared with other regions[24]. **While AI can provide tremendous opportunities in education, it can also worsen inequality and social mobility and government must ensure this doesn't happen.**

[24] Social Mobility Commission (2017) "State of the Nation 2017: Social Mobility in Great Britain"

Imen Acheche

Senior Key Account Manager, Smart Tunisia

Smart Tunisia is a Public Private Partnership between the Tunisian Government and *Fondation Tunisie*, a private entity. Smart Tunisia aims to increase foreign investment and attract company offshoring, by being the focal point for those interested to invest in the ICT sector in Tunisia. We interviewed Imen Acheche, told us how their multi-stakeholder approach with global outreach illustrates how shared responsibility is a better approach. Smart Tunisia work with foreign investors, foreign trade departments, local government, training centres and education providers. They enable the Tunisian framework to be more accessible to both regional and foreign investors through providing sector-specific insights and statistics.

While the aim is to curb the exodus of qualified Tunisian graduates, such insights on current levels of alignment or mismatch between education and labour market demand - are key indicators that could help shape education policy vis-à-vis economic needs. From various conversations with stakeholders, the overwhelming conclusion is that the Ministry of Education, Smart Tunisia (and similar organisations), foreign education partners, do complement each other and share the responsibility, despite differences in the ways in which they cooperate on education reform and national innovation/skilling.

The way in which stakeholders operate imposes a challenge and most importantly determines how successful their cooperation is, but this not just in Tunisia. In the UK, stakeholders observe a gap between what solution providers and education experts suggest, and what government is prepared to go forward with. This is not necessarily due to issues with budget, it is sometimes about government capacity to fully-appreciate the need for change.
In Tunisia, input from stakeholders supports hands-on solutions like parliamentary committees that engage expert advisors from the private sector, who can give evidence-based input. As the legislative branch of Government, the Tunisian National Assembly committees could then give policy recommendations (where applicable) and help inform parliamentarians prior to drafting legislation. These committees can also be involved in prototyping feasible EdTech and other education solutions, they would benefit from use-cases from national, regional, and international contexts.

4D. THE LEARNING EXPERIENCE: THE POTENTIAL OF IMPLEMENTING NEW TECHNOLOGIES

This subsection looks into areas where there is proven potential for education technologies in the classroom, and how these would be useful to address issues mentioned in section 3, including enhancing skills as part of the learning experience.

With the recent leap in our ability to invent and change what we can achieve, we are now utilising a new power, and it has redefined the boundaries of even our own imagination. Like steam during the industrial revolution; electricity; telephones; today, we are faced by another leap: Artificial Intelligence – and it can be very unsettling.

The future with AI is not merely about what it will enable us to do, but who will have access to control and leverage its power. If it delivers on its promises, **AI will be capable to drive economic and social change for the next generation and beyond**.

In this case, should policymakers and other stakeholders be encouraging an open debate that enables better planning to help us be prepared? and what does this mean for education providers?

The wealth of opportunities AI and similar technologies bring to our world is unparalleled. The present view in most corporate environments is that AI brings hope in the considerable reduction of process-reliant jobs.

Those who formulate the algorithms behind AI could exercise immense supremacy and influence on a whole society. In the employee's world, this has resulted in fear that once AI goes mainstream, it would be too late to look or go back. What makes things slightly better is that this fear is shared by the employer too. As a society, we are inclined to think it's best if we leave it to the experts, those 'techies' in silicon valleys around the world; they'll handle.

Unlike other experts like a chemist or a medical researcher, a team in a tech lab could be applying the exact same concept across the board, from AI in healthcare, finance, mass production, legal, and many others. These disruptive technologies would mean studying these trades will no longer be about exhibiting mastery in the subject matter per se. Pre-existing models will not necessarily be obsolete, but there will be ongoing amendments within the programmes where all aspects affected by disruptive tech innovations will be amended.

With their programmes being shorter, universities can be more agile than schools where programmes go for more years. But in certain industries, even an updated university course might not be valid for too long. This has led business leaders, tech experts, and education providers to agree on an ongoing need for self-development.

Through algorithms, machines can now learn and develop their own functions, and this is exactly what humans need to do to stay ahead. **AI-based systems are not only adapting, learning, and predicting, they are deciding**. The threat of such high-intelligence systems is that they are consistent, less vulnerable to external factors like stress, fatigue, frustration, or pain, which often affect our judgement and performance.

Learning how to cope with a world of automated functioning is not an easy task. Education that enables humans to be more agile, would enable them to cope better with what is yet to face them. One coping mechanism would be to un-learn the theories that are no longer pertinent or feasible, a challenging practice for us creatures of habit.

Proven School Solutions

There are a wide range of EdTech tools being used in world schools and colleges today. We have grouped tools in three broad categories (with the recognition that some products combine features from multiple categories): learner-facing, teacher-facing and system-facing.

1. Student-facing

When we usually think of EdTech, we think of student-facing tools: software that students use to receive and understand new information, which respond to an individual student's needs. Learner-facing tools are often referred to as smart tutoring systems, or personalised learning platforms that are adaptable, they're able to:

- Source and come up with learning materials based on student needs
- Measure strengths, weaknesses or gaps in a student knowledge
- Provide automated feedback
- Facilitate collaboration between learners

"Many current AI tools are simply variations on adaptive learning platforms." However, advances in machine learning raise the possibility of a more sophisticated version "rather than having students follow one of a static set of pathways designed by a human, machine learning algorithms try to pick up strengths, weaknesses and gaps in knowledge to build on and support learning, with the aim of providing a greatly increased level of personalisation"

- Dr Wayne Holmes

Learner-facing tools empowers students to learn at their own pace, and a customize experience of learning.

These tools, as mentioned in a report focusing on AI in education[25], are also "used to carry out homework, or to facilitate flipped learning, where students familiarise themselves with new concepts via intelligent tutoring system outside the classroom, with classroom time used to develop understanding of those concepts."

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[25]AI-Edu.io. (2019) TRANSFORMING EDUCATION WITH ARTIFICIAL INTELLIGENCE. Retrieved from https://www.learn-tech.io/wp-content/uploads/2019/08/Education-for-the-Age-of-Intelligence-V13-Aug-7th-2019.pdf

2. Teacher Facing

Teacher-facing EdTech can help teachers reduce their work load but also to focus on better learning environment through deeper understanding into what students want and is probably struggling with. As the report on education with AI summaries, it supports with a combination of benefits, and including:

- **Automating** tasks (such as assessment, feedback or administration)
- **Providing insights** about the progress of a student or class, and performance analytics
- **Helping teachers** to innovate and experiment (for example: facilitating different methods of teaching or helping teachers organise students into small groups based on shared characteristics).

Teacher-facing tech solutions present hugely exciting opportunities to evolve the role of the teacher. For example, time saved through the automation of tasks could free up a teacher's time to invest in other aspects of teaching.

Insights gained about students' progress could enable teachers to target their attention more effectively.Virtual teaching assistants could enable teachers to experiment and innovate in their classroom, through facilitating small collaborative groups, or by planning class seating plans that reduce behavioural problems Although some AI technologies are often feared to replace teachers (and some CEOs of technology companies are quite open about this aim), research suggests that this is neither possible (in the foreseeable future) nor desirable. Instead, as Professor Luckin notes **"It is teachers who will be the orchestrators of when and how to use AIEd tools."**[26]

Virtual teaching assistants could enable teachers to experiment and innovate in their classroom, through facilitating small collaborative groups, or by planning class seating plans that reduce behavioural problems.

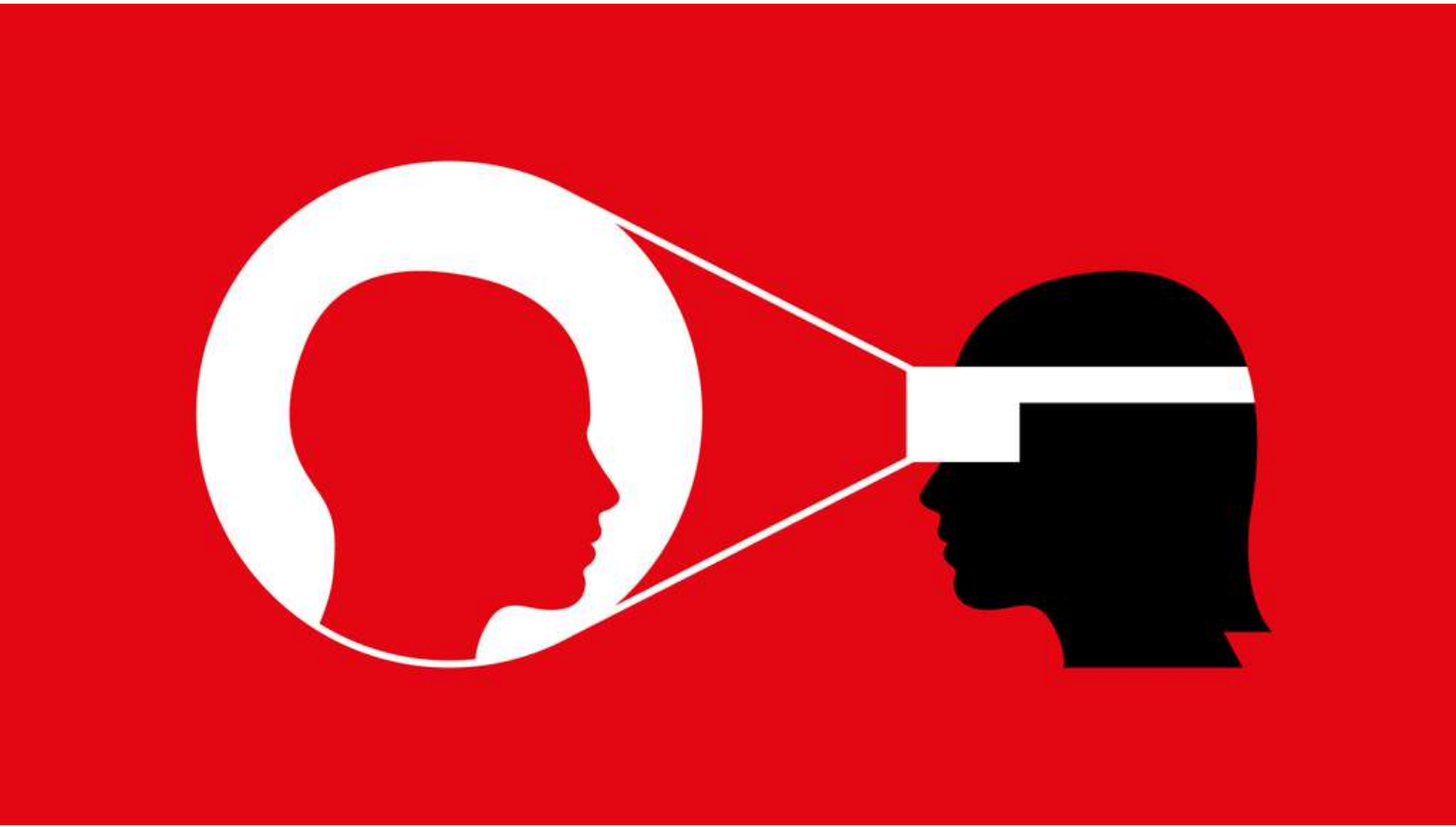
[26] Based on evidence given at an All-Party Parliamentary group at the House of Commons (2019)

3. Administrator/System Facing AI

System-facing EdTech helps inform decisions made by those managing and administrating schools or the education system as a whole. But system-facing tools often require sharing of data between schools and colleges, which may in part explain the relative shortage of tools. System-facing tools are used for a wider range of tasks than educator or student-facing tools, with applications ranging from organising timetables to predicting inspections. The response to this underdeveloped category of AI-based EdTech from interviewees working in schools was positive.

According to experts like Rose Luckin Assessment is one of the key areas where implementing new technologies at school makes the biggest case for EdTech. Formative assessment enabled by a smart infrastructure would free students from the pressure of exams, critical to their academic success. Depending on the culture, we may opt to keep such tests in the education system, when there are outcomes that we particularly value. **What is important is to determine what we assess and then workout how we assess it.** AI can tell us what is succeeding and who is succeeding. This means assessing student workload through a blend of continuous formative assessment, portfolio production, and self-presentation. In school education at the moment, we are assessing the things we can automate before determining what we should be assessing.

While it frees teachers from the risk of subjective assessment based on their own impressions of students, how can we ensure that such a risk is not transferred to AI-based assessment, especially knowing how algorithms work. Can these systems combine both tracking performance of the individual student and ensure objectivity with assessment? While we want student-specific data and analytics, we also need to ensure assessment is impartial.



CASE STUDY: A School of Multidisciplinary Learning

Although the deployment of AI and other emerging technologies in education is still at its early stages, there are some regions in the world already experimenting with innovative projects that are completely disrupting the school experience for students.

One of these is a group of innovative schools called AltSchools set up across California and New York. These schools are learner-centred, meaning students organise their own learning pathways consulting teachers and other experts throughout the journey. Personalised learning is at the very core of the experience these schools aim to promote.

The founder and CEO of AltSchools was previously the Head of Personalisation at Google, and his ambition was to create a learning environment in which students will learn given their own unique preferences and abilities and teachers will be able to provide individualised attention to student progress.

The schools are made up of one third educators, one third engineers, and one third business individuals. Therefore, together, the diversity of backgrounds a comprehensive and holistic learning experience for the student.

A combination of technologies, including AI, allows the student to progress in both academic subjects and social skills using software on his/her tablet. A 'portrait' provides a record for each student of their progress while a 'playlist' guides them in their daily and weekly tasks/assignments. The algorithms help teachers and students build tailored curriculum and objectives to guide the individual with their own personal goals. Furthermore, students are given real-time feedback and insight on their progress, with tools validating competencies across academic and social-emotional learning. Lastly, the tablet provides a dashboard in which one can easily track competency-based learning and create a summative view of student progress hence showing a comprehensive outlook of what is going on in the 'classroom.'

Suggestions Applicable in Tunisia

Currently, assessment focuses on schools who compete through league tables. A shift to focus attention on learners would help build a system that values student intelligence where it's leveraged to increase overall performance. If education policymakers change how students are assessed, changes will surely follow.

Accept that significant change is inevitable, both teachers and students must be helped to garner the cognitive fitness and resilience they need in order to cope with change. While Artificial Intelligence and other disruptive technologies are causing the change in the labour market, they must be seen as agents that will help us in the process of shifting. Education tools that help foster intellectual capacity must be given a proper place within the curriculum.

A lot of EdTech solutions offered to schools are AI-based. In Tunisia, it might be more feasible not to limit technology to AI. Database-management, filing, multiple-choice exams, and online courses are not AI-based, and they provide great administrative benefits that save time for both teachers and students.

TUNISIA: TOWARDS FUTURE-PROOF EDUCATION

TUNISIA: TOWARDS FUTURE-PROOF EDUCATION

It is not enough to just grow Education Technology as a sector, the quality and effectiveness of AI and other Ed-Tech applications must be regularly improved to meet demand.

Any EdTech solution that is not informed by pedagogy will risk lacking user appeal. Users must be able to see the purpose and benefit of the technology, especially teachers who need to see how it can empower them, not an imposed dysfunctional gadget.

There are some obstacles to implementing AI-driven technology in education. Accessing expert information, teacher confidence and skills –testing products in real scenarios at the learning institution, mainly the school, is not an easy task due to the way it disrupts the ongoing process in the classroom. While Tech giants like Google deploy special teams to experiment with products in a classroom scenario, smaller tech providers do not have the same resources or the goodwill and trust that tech giants enjoy amongst education providers.

There is a need to gather evidence-based feedback about the efficacy of tech implementation in education. This would enable schools to differentiate products based on tangible deliverables and feedback from other purchasers.

It is essential to establish taskforces that can work together to co-devise strategy that allows tech experts to know the education system better, and any changes within it. Results would be better if tech providers and education policymakers work with and understand the role of all main stakeholders in the education system.

Ideally, such experts will be graduates of the local education system in Tunisia and therefore know its strengths and weaknesses and are familiar with its methodologies. The remaining knowledge required will be system and framework knowledge, which will be acquired by focused discussions in a committed taskforce. Such a model can work far better than simply ordering services from EdTech vendors.

Within an education ecosystem (under the authority of the Ministry of Education - MOE) such taskforces can make a tremendous difference in Tunisia by enabling more access to selected partners and enabling further interconnectivity between Ministries and their departments, as experienced in UK, Australia, amongst other. Education reform is an across-the-board and a gradual long-term shift.

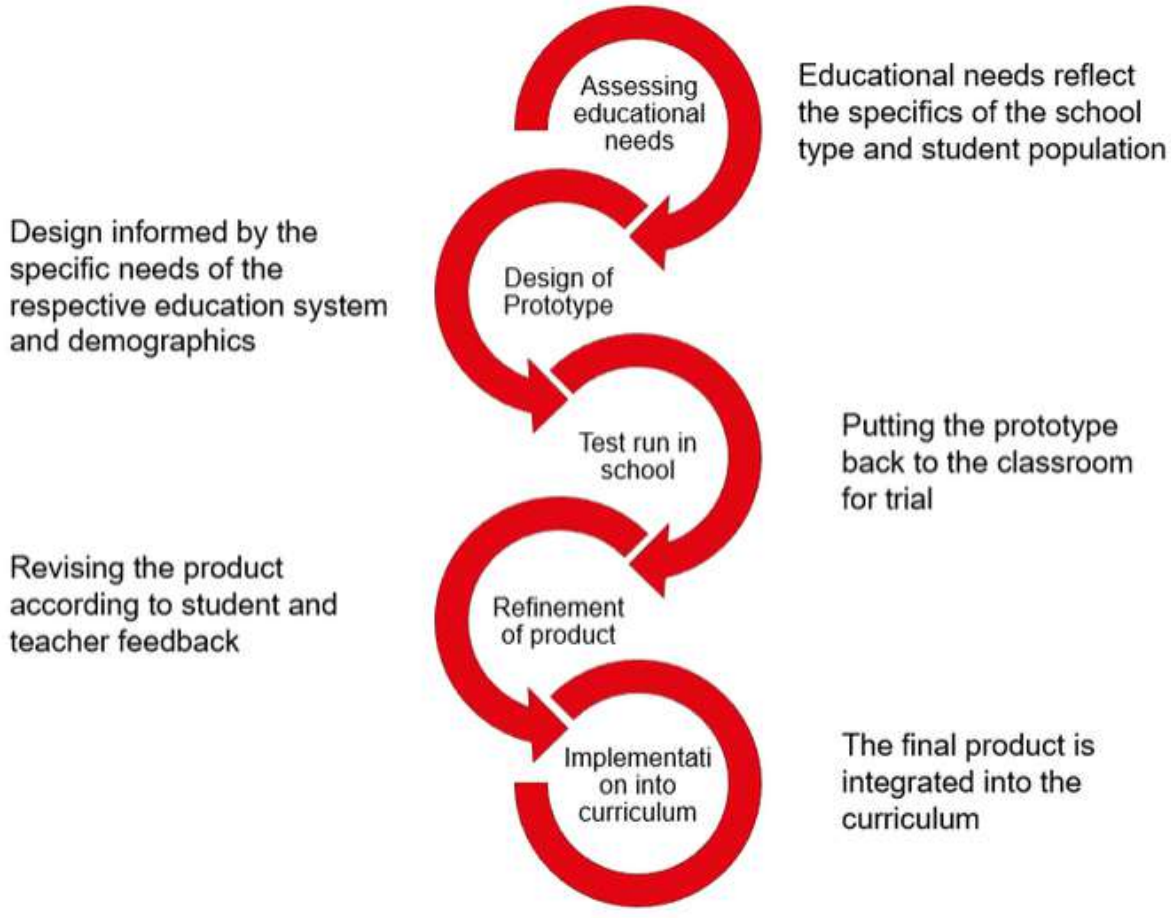
Similarly, no matter how knowledgeable foreign or local education tech providers may be, they need to develop their understanding about the Tunisian education system and its technological and functional needs. Providers must have a deep understanding of how the education system is governed and how it functions. It is essential that they know exactly where their product fits in the education system and how it is used and its impact on students, teachers, and parents. Such knowledge can only be exchanged throughout ongoing evidence-based information transfer between all stakeholders. This will provide access, foster an environment of common ambition, and establish trust amongst partners.

At the School Level

It is important to prototype the efficacy of suggested reform or material implementation, whether it is technology or just methodology. Establishing good practices to compare how different products fit in before and as they are procured could be done in liaison with relevant departments and tech providers. Schools are well-placed to organise in-school prototyping if they can find time and space for that. It could be helpful to collaborate with representatives from foreign or Tunisian schools where such technology has been previously implemented to scrutinise it and advise on strengths and weaknesses, while observing country-specific requirements.

Throughout the prototyping process, participating schools should be incentivised to collaborate, especially with the limited time that they can dedicate to in-school activities.

Fig. 11 example of prototyping and product finalisation of EdTech Applications



Tackling Teacher Resistance

Having established there is a worldwide trend of teacher scepticism, it is important to ensure adequate training is provided before integrating new Tech or non-tech methodologies in the curriculum.

Teachers representing different school levels and multiple regions in Tunisia should be involved in the procurement process, to ensure they buy into it and play a part in tweaking it to their and their students' needs.

Despite tremendous success in the global EdTech sector and firms competing to put innovative digital tools into the classroom, some educators observe a disconnect between some products and what their schools actually need.

Eva Moskowitz, founder of New York-based Success Academy Charter Schools, told an audience of around 200 entrepreneurs and investors at the New York Ed-Tech Week : "I think there's a tendency to see ed tech as the saviour of American education, and I do not believe it is […] I do not believe you can get to equality through ed tech."[27] Moskowitz focuses on the argument that technology cannot replace teachers, or build equal level of enthusiam in education as teachers. It highlights on the fact that, as in many countries if teachers are over burden, it is humanly difficult to enthuse students in any case.

Susan Enfield, superintendent of Highline Public Schools in Washington State who was also at the EdTech week emphasised: "Don't build what you think we need, have conversation with us about what we need. So many things don't meet a need we have. Don't assume you know what our needs are." Solutions work better when adapted to local environments and local conditions and serviced locally. If imported, local technology experts and educators must be part of the process.

While the marketplace in Tunisia is seeing considerable growth in the technology and innovation sectors, the implementation of AI inEdTech in Tunisia should be well structured to affect national economy significantly.

Furthermore, aligning the goals between industry and education can give better opportunities to graduates with skills while avoiding skills-gaps, unemployment or a push for the youth to emigrate

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[27] EdWeek Market Brief (2017), "Charter School Founder Eva Moskowitz Sees Benefits, But Too Much Hype, in Ed-Tech" available here https://marketbrief.edweek.org/marketplace-k-12/charter-school-founder-eva-moskowitz-sees-benefits-much-hype-ed-tech/

Overcoming Tunisia-Specific Challenges

The examples below emphasise the importance of collaborating with industry in boosting the effectiveness of new technologies when to fill competency gaps. Constant coordination with traditional and emerging sectors is encouraged to ensure that the teaching of programmes is aligned with the need for new skills.

Emerging technologies do not only affect emerging industries, they are also affecting the ways traditional industries function. As a consequence, education must be periodically revisited to accommodate such change.

Continuing collaboration between the Education, Higher Education, Labour Ministries and key industry is necessary to share the training 'burden' of bridging skill gaps. Industries that benefit from a large tech-fluent talent pool should also invest in training and upskilling, recognising that bridging the AI skills gap is not the education sector's sole responsibility.

Questions to Ask

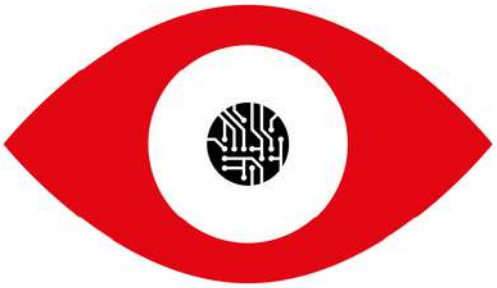
- If any, what are the obstacles that stand in the way of such collaboration?
- What is the best way to collaborate? (select committees, taskforces)
- Would there be a need for reform consultants to be involved on a regular basis?
- Modes of communication? What can be synchronised and what cannot? How to readapt the system where communication avenues are more direct to ensure expedited delivery of new programmes in education.
- What levels from each stakeholder group should be engaged directly in the execution and who should be in advisory capacity?

Curricular Suggestions

- Adjusting the curriculum by shifting it to project-based learning, using updated technologies. Update technology in schools to move students from tech literacy to tech fluency far before they reach the stage of tertiary education, and consequently a high-tech workplace.

- Student trends must be taken into consideration as part of the change process, not only because they are a key beneficiary of introducing tech in education, but also because the new products must be tailored to their specific needs.

- Students can deliver valuable input to the development of EdTech tools. Having a personal say in the development process will familiarise them with the new tools and thus lower their potential resistance to the introduction new methods.



Teacher Advice (Gathered from talking to teachers both in Tunisia and the UK)

- We need a continued broad and balanced curriculum where classroom tasks should be challenging but achievable. Students should better understand how to make good choices from the tools available to achieve the target task.
- Problem/solution-based learning should include assessed individual, and collaborative/team activities.
- Students and staff must continue to be challenged as to how they use technology for their subjects. Sound training should be available to all staff, whether CS or other subjects.
- National guidelines should be available to all newly introduced material to ensure consistency nationwide.

Tunisia Start-up Act and the importance of a multi-stakeholder approach

The Tunisia Start-Up Act has been a successful model for further legislative processes to encourage awareness, transparency, and stakeholder participation. Similar initiatives that become policy can make education reform more comprehensive. Establishing groups of key stakeholders or committees, allows more flexible forms of advocacy beyond the usual structures, while including them under a new framework. Moreover, the use of both digital communication channels and direct dialogue with policymakers through field visits, abroad and in Tunisia, maximise awareness and thus the interest of both decision makers, at the MOE and its subsidiaries.

Starting Point

The Fourth Industrial Revolution has arrived, acknowledging it is not enough. If we are to approach this with a certain degree of realism, education reform has to accompany this revolution. With exams results no longer being the sole indicator of general competence, the relationship between skills and education has to change. This change is not for the sake of finding better jobs as much as it is to enable graduates to acquire and employ skills in their own lives to be more productive, positive and happy in the ways they achieve what they want, not just what their employers need.

While this report samples issues from Tunisia and abroad, solutions that work in Tunisia could only be decided by stakeholders on the ground. Big Innovation Centre hopes that the report's findings and suggestions, could trigger further conversation , ideas and scenarios planning within Tunisia.

A collaborative approach can ensure education thrives.

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