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GLOBAL ONLINE LEARNING ALLIANCE

ONLINE VIDEO MEETING REPORT – 25th November 2020

MENA SPECIAL:
SKILLS AND INNOVATION FOR JOBS OF THE FUTURE

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GOLA Report

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SECTION 1. Format & Participants

1.1 Introduction

The purpose of this private video meeting for government and civil society officials in the Middle East and North Africa (MENA), organised in partnership with Intel, was to discuss 21st century competencies and how to better embed skills and innovation into education without the need to change or disrupt existing curricula. Participants were encouraged to discuss the actions of their governments and institutions, and to make policy recommendations where appropriate.

The MENA region is undergoing considerable transformation, with governments and stakeholders committed to building long-term innovative societies and huge investments are being made in education to develop the next generation of creative and entrepreneurial Arab students. Uncertainty over the types of jobs of the future has long been a part of any digital transformation discussion, yet now, in light of Covid, we are in a time of greater unpredictability with policy makers needing to ensure we have both the appropriate technologies and the right frameworks for skills and innovation.

After several meetings of government education officials in response to Covid, a common theme has emerged: the need to ensure that learning outcomes better reflect the real-world challenges students will face. Accordingly, this meeting of officials addressed how skills and a mixture of competencies should be embedded in education as part of the post-pandemic process. Key issues revolve around developing the problem solving and critical thinking skills of young people and the need for greater innovation and entrepreneurship.

During the private break sessions of the meeting, officials were encouraged to address the following questions:

COVID -19 has created immense pressure on current education systems but how are you taking advantage of what COVID has forced you to do to get students ready for the 4th Industrial revolution?

With minds now focussed on the certainty of blended learning in the future, before rushing into new technologies, is there a need for a rethink of what technology we are buying for education?

With the inevitable growth of blended and online learning is there also a need to look at the design of school spaces with more intelligent digital estates, what are often referred as “makerspaces”?

How much more are your teachers going to need to focus their own efforts on AI and new technologies, not just to keep up to date but to transform education practices that better reflect real world needs?

Many education systems have already introduced coding and robotics. What is the natural progression to further enhance the STEM curriculum in your respective countries?

To better embed skills for innovation and create future jobs do we now need to re-think assessment and invest in more continuous evaluation that takes advantage of the likes of AI and digital experience learning?

1.2 Executive Summary & Key Findings of the Meeting

Our opening speakers discussed the importance of developing digital estates, or makerspaces, and leveraging the power of new technologies such as artificial intelligence to support education. Now is a wonderful opportunity to re-think and re-engineer education but we must be absolutely cognisant of the fact that one size does not fit all and in the MENA region we see a wide variance amongst the Arab countries. What is critical is that we must now invest in the development of mindsets, skillsets, and the higher order thinking of students, as well as making sure that we build self-correction into the system to ensure adaptation to future technological disruption. The following are not exhaustive, but 12 important issues drawn from this meeting are:

Covid has underscored the role of technology and the opportunity to modernise education systems.

The experience of 2020 has erased many of the pre-existing taboos around online and digital learning.

In most countries we are seeing how the pandemic has fast-forwarded existing technological initiatives and accelerated the use of digital technologies.

We need to take a considered evidence-based and hard look at assessment, as online learning has exposed how methods of evaluation need redesigning.

What we have really witnessed during the Covid pandemic is not proper online learning but in fact remote emergency learning.

Particular challenges remain around technical and vocational education where a large part of courses require practical skills and techniques that are not appropriate in the online world.

We have witnessed the blurring of lines at home with students needing appropriate space and parents faced with the increased burden of supervision.

With the investment in new technologies, we must see a matching commitment of resources into teacher training and continuous professional development.

Covid will prove to be the catalyst for new pedagogies and methods of learning.

We will only see true only learning with more disruptive technologies and particularly the development of 5G that will bring connectivity speeds 1,000 times faster.

We are now entering a new period of Education 4.0 to match the 4th industrial revolution with expectations that artificial intelligence will play a huge role in the future of education.

New techniques need to be developed to support learning to learn, gamification, programming and applying the appropriate technology to the age and experience of students.

1.3 Format of Video Conference & this Report

In section 1.4 we list the one hundred and ten participants of this video conference on skills and innovation. The most immediate lesson of online video conferencing is to ensure that every participant has a voice. Small groups are essential. So, after opening statements the event was broken into small groups each with a moderator to take notes and provide a summary.

Prior to the break-out rooms there were opening statements from: Sheikha Noora Humaid Rashed Al-Nuaimi, Director of AjmanX, UAE; H.E. Hussain Al-Mahmoudi, CEO Sharjah Research, Technology and Innovation Park, UAE; and Veerappan Swaminathan, advisor to the Government of Singapore and content developer for Intel's skills and innovation program. Although all discussions were recorded and transcribed for the purpose of this report, none of the quotes or what was said during the private break-out rooms is made attributable to any one person.

The following was the video conference format:

Part A: Opening statements Sheikha Noora Humaid Rashed Al-Nuaimi, Director of Ajman X, UAE; H.E. Hussain Al-Mahmoudi, CEO Sharjah Research, Technology and Innovation Park, UAE; and Veerappan Swaminathan, skills and innovation advisor to the Government of Singapore.

Part B: Fifteen break-out groups were formed, each with a moderator to record discussions and take note of the key points raised.

Part C: All participants returned from their break-out groups. Taha Khalifa, CCG Director of the EMEA region for Intel gave a closing presentation on reinventing the role of technology in education.

The total time of the video conference was 110 minutes

After introducing the participants in 1.4, the format of this report is structured around the policy issues and non-attributable quotations. The participants hold senior positions in education from multiple countries and expressed what they are experiencing as well as their own policy recommendations.
In this report we have done our best to identify the main subjects taken from what participants said to provide a disseminated report that flows as follows:

Interventions and Covid as an Accelerator and Catalyst for Change

Blended and Online Learning

Teaching, Assessment and Skills Development

Future Technology and Artificial Intelligence

1.4 Participants

We would like to thank all those for participating and providing such outstanding contributions. The opportunity for them to openly converse in small break-out groups provides us with a discerning judgement on the key issues, immediate policy recommendations and their own insights into future sustainability. It is an honour for the organisers to host such a distinguished gathering. Everyone committing their time during this ongoing period of uncertainty is a true testament to their desire to ensure strong decision making and reform of educational practices where appropriate. Participants are listed by country, alphabetically:

BAHRAIN: Latifa Albunoodha, Assistant Undersecretary for General & Technical Education, Ministry of Education

BAHRAIN: Dr Mohamed Alseddiqi, Director of Technical and Vocational Education, Ministry of Education

BAHRAIN: Ebrahim Ali Burshaid, Director, Director of Secondary Education, Ministry of Education

BAHRAIN: Dr Gurmullah Alghamdi, Rector, Arab Open University

COMOROS: Yousef Ahmad Muin, Secretary of National Committee for Education, Ministry of Education

COMOROS: Ben Aboubacar, Deputy Director in charge of Programs and Studies at the University of the Comoros, Ministry of Education

EGYPT: Ahmed El-Ashmawi, Member of the Advisory Committee for the Reform of Technical Education, Ministry of Education and Technical Education

EGYPT: Dr Mohamed Abd El Rahman, Member of Advisory Board, Ministry of Education and Technical Education

EGYPT: Dr Mahmoud Diab, Advisor of Deputy Minister for Technical Education and Competence Based Curriculum, Ministry of Education and Technical Education

EGYPT: Dr Ghaith Fariz, Director and UNESCO Representative to Egypt, UNESCO Regional Bureau for Sciences in the Arab States

EGYPT: Ghada Farouk, Business Development Director, El Sewedy Education

EGYPT: Moamen Ghanem, Deputy Executive Director, Centre for Sustainable Development, Heliopolis University

EGYPT: Ingy Abass, Business Consumption Egypt, Intel Corporation. *Moderator*

EGYPT: Mohamed Shahawey, Enterprise Technical Sales Specialist, Intel Corporation. *Moderator*

FRANCE: Annemijn Perrin, CEO, Digital Skills Foundation. *Moderator*

IRAQ: Dr Ra'ed Khalaf Al-Janabi, Head of Institutional Development and Government Coordination, Ministry of Education

IRAQ: Dr Tarek Sha'ban Rajab, Director of Curricula, Ministry of Education

IRAQ: Dr Isra Taleb Tawfiq, Assistant Director of Curricula, Ministry of Education

IRAQ KRG: Dr Dawood Atrushi, General Director of Engineering and Projects, Ministry of Higher Education and Scientific Research

JORDAN: Ibtisam Ayoub, Secretary General - Jordan National Commission for Education, Culture and Science, Ministry of Education

JORDAN: Dr Yosef Aboushaar, Director of the Directorate of Planning and Educational Research, Ministry of Education

JORDAN: Dr Nael Al-Adwan, Director of Investment and Promotions Department, Ministry of Digital Economy and Entrepreneurship

JORDAN: Shahed Atieh, Director of Digital Skills Development, Ministry of Digital Economy and Entrepreneurship

JORDAN: Dr Nouh Alhindawi, Director of Information Technology and E-Transformation Directorate, Ministry of Higher Education and Scientific Research

JORDAN: Malak Al-Massad, Head of English at the Directorate of Curriculum & Textbooks, Ministry of Education

JORDAN: Lama Al Natour, Executive Director of Program Development & Planning Unit, Ministry of Education

JORDAN: Wafa Makhamreh, Head of Professional Development Policies Division Managing Directorate of Supervision and Training, Ministry of Education

JORDAN: Eng Lama Arabiat, Acting Head of Artificial Intelligence (AI) Division, Policies and Strategies Department, Ministry of Digital Economy and Entrepreneurship

JORDAN: Dr Haneen Abdo, Program Advisor - Jordan Youth, Technology & Jobs Project, Ministry of Digital Economy and Entrepreneurship

JORDAN: Passant Sobhi, TVET and Higher Education Officer, UNESCO

JORDAN: Reem Bsaiso, Founder & Managing Partner Global Outreach & Head of Middle East Government Relations, Brains Global

KUWAIT: Dr Ziad Najem, CEO, KFAS Academy

KUWAIT: Prof Omar Al-Jarrah, Vice President for Planning and Development, Arab Open University HQ

LEBANON: Dr Fawzi Baroud, Assistant Vice President for Information Technology, UNESCO Chair on Open Educational Resources for Access and Success, Notre Dame University

LEBANON: Dr Milad Sebaaly, Curriculum Development Expert, Centre for Education Research & Development

LIBYA: Prof Mokhtar Jwaili, Chief Advisor on TVET & Entrepreneurship, Ministry of Education

LIBYA: Dr Masauda Elsawed, Director General - Centre for Training & Education Development, Ministry of Education

LIBYA: Dr Talal M Amara, Assistant Professor - Education, General Centre of Training & Education Development, Ministry of Education

LIBYA: Prof Majdeddin Al Ghadban, Founder & Innovation Policy Manager, Libyan Authority for Research, Science & Technology

OMAN: Dr Zahra Al Rawahi, Director of Innovation Capacity Building, Ministry of Higher Education, Research, and Innovation

OMAN: Maimoona Al-Abri, Director of Educational Content & eLearning, Ministry of Education

OMAN: Yahya Al-Jahwari, Head of English Language Curriculum Section, Ministry of Education

OMAN: Dr Intisar Ambusaidi, Educational Expert, Advisor in the General Directorate of Human Resources, Ministry of Education

OMAN: Fathiya Mohammed Al Maawali, Senior English Supervisor, Ministry of Education

OMAN: Afef Sayhi, Principal, Madinat Al Sultan Qaboos School

PALESTINE: Eng Osama Shtayeh, Director General of Vocational Training, Ministry of Education

PALESTINE: Rania Jaber, Director General of Technological Innovation and Creativity Centre, Ministry of Telecommunications & Information Technology

SAUDI ARABIA: Dr Nasser Aluwaishiq, Chief Officer, Content and Technology Solutions, Tatweer Company for Education Services Ltd

SAUDI ARABIA: Abdullah Alasmari, General Director of Professional Development, Tatweer Company for Education Services Ltd

SAUDI ARABIA: Abdullah Al-Dukhayyel, Director General of the General Directorate of Curricula, Technical and Vocational Training Corporation - TVTC

SAUDI ARABIA: Abdullah Aljably, General Director eLearning & Training Centre, Technical and Vocational Training Corporation - TVTC

SAUDI ARABIA: Abdo Ahmad Azibi, Head of the Equivalency, Assessment and Curricula Certification, Technical and Vocational Training Corporation - TVTC

SAUDI ARABIA: Eng Ali Al-Shehri, Development Supervisor in eLearning & Training, Technical and Vocational Training Corporation - TVTC

SAUDI ARABIA: Dr Abdulaziz Alfayez, Assistant Professor of Educational Technology, Curriculum & Instruction Department, College of Education, King Saud University

SAUDI ARABIA: Dr Hamdan Alamri, Consultant for The National e-Learning Centre, Saudi Arabia. Assistant Professor of Learning Design and Technology, King Saud University

SAUDI ARABIA: Dr Hussain AlJahdali, Assistant Professor in Research for Aerospace & Aviation, King Abdulaziz City for Science and Technology (KACST)

SAUDI ARABIA: Ahmad Alqabbat, Account Executive Saudi Arabia, Intel Corporation. *Moderator*

SINGAPORE: Veerappan Swaminathan, Advisor to Government of Singapore & Founder of Edm8ker. *Opening Speaker*

SOUTH AFRICA: Sven Beckmann, Regional Sales Manager, Public Sector, EMEA, Intel Corporation. *Moderator*

SOUTH AFRICA: Joao Fidalgo, Account Executive Africa, Intel Corporation. *Moderator*

SOUTH AFRICA: Koketso Letoaba, Industry Technology Specialist EMEA, Intel Corporation. *Moderator*

SPAIN: Juan-Pablo Ferrero, Director, Public Sector & Education Europe, Intel Corporation. *Moderator*

TUNISIA: Prof Mohamed Jemni, Director of Information and Communication Technologies, Arab League Educational, Cultural and Scientific Organization - ALECSO

TUNISIA: Dr Neo Mothobi, Chief Education Specialist, Arab League Educational, Cultural and Scientific Organization - ALECSO

TURKEY: Ediz Altun, IOT Partner Scale Manager EMEA & India, Intel Corporation. *Moderator*

UNITED ARAB EMIRATES: Sheikha Noora Humaid Rashed Al-Nuaimi, Director, AjmanX. *Opening Speaker*

UNITED ARAB EMIRATES: H.E. Hussain Al Mahmoudi, Chief Executive Officer, Sharjah Research, Technology & Innovation Park. *Opening Speaker*

UNITED ARAB EMIRATES: Aalya Mesmar, Smart Learning Specialist, Ministry of Education

UNITED ARAB EMIRATES: Halawa Al-Shehhi, IT Advisor, Ministry of Education

UNITED ARAB EMIRATES: Maryam Al-Ketbi, Systems Specialist, MBRSLP, Information Technology, Ministry of Education

UNITED ARAB EMIRATES: Mohamed Moustafa Zayed, Senior Knowledge Analyst, Ajman X

UNITED ARAB EMIRATES: Jude Hamod, Senior Business Development Manager, Sharjah Research, Technology & Innovation Park

UNITED ARAB EMIRATES: Eman Ahmed Rashed, Business Development Executive, Sharjah Research, Technology & Innovation Park

UNITED ARAB EMIRATES: Hamda Al-Ali, Project Executive, Sharjah Research, Technology & Innovation Park

UNITED ARAB EMIRATES: Khuloud Al Owais, Head of Talents, Sharjah Education Council

UNITED ARAB EMIRATES: Khadeeja Ismaeil, Technical Supervisor, Sharjah Education Council

UNITED ARAB EMIRATES: Dr Essa Al Bastaki, Chancellor, Dubai University

UNITED ARAB EMIRATES: Prof Akin Fadahunsi, Acting Dean, Ajman University

UNITED ARAB EMIRATES: Prof Tammer Elshandidy, Professor of Accounting College of Business Administration, Ajman University

UNITED ARAB EMIRATES: Dr Chuloh Jung, Director of Innovation Centre, Ajman University

UNITED ARAB EMIRATES: Mohamed Osman Baloola, Deputy Director of Innovation Centre, Ajman University

UNITED ARAB EMIRATES: Dr Christopher Hill, Associate Professor Faculty of Education, Centre for Research for Digital Education, The British University in Dubai

UNITED ARAB EMIRATES: Dr Khaula Alkaabi, Chief Innovation Officer, United Arab Emirates University

UNITED ARAB EMIRATES: Joseph Flynn, Managing Director, St. Mary's Group of Schools

UNITED ARAB EMIRATES: Nargish Khambatta, Vice President Education - Principal and CEO GEMS Modern Academy, GEMS Education

UNITED ARAB EMIRATES: Taha Khalifa, CCG Sales Director EMEA, Intel Corporation. *Moderator*

UNITED ARAB EMIRATES: Adib Rajji, Account Executive – Gulf, Intel Corporation. *Moderator*

UNITED ARAB EMIRATES: Sameh Helmy, Solutions Partner Director META, Intel Corporation. *Moderator*

UNITED ARAB EMIRATES: Baghwan Ramnani, Digital Transformation Manager, Intel Corporation. *Moderator*

UNITED ARAB EMIRATES: Eslam Kandiel, Regional Technology Manager MEA, Intel Corporation. *Moderator*

UNITED ARAB EMIRATES: Stephy Savier, Industry Technology Specialist EMEA, Intel Corporation. *Moderator*

UNITED ARAB EMIRATES: Dalla Sucgang-Renard, Marketing Specialist for O2D Growth Initiative, Intel Corporation. *Moderator*

UNITED ARAB EMIRATES: Amr Elkholy, Executive Manager, Innovatech LLC

UK: John Glassey, CEO, Brains Global. *Host*

UK: Claire Urie, Head of Government & International Relations, Brains Global

UK: Victoria Tate, Head of Education Partnerships, Brains Global

YEMEN: Radwan Naji Ali Al-Azzi, Director General, School Mapping, Ministry of Education

YEMEN: Mohammad Ahmad Sharaf-Eddin, Director, e-Learning, Ministry of Education

YEMEN: Jamal Ghailan Al-Haj, IT General Manager, Ministry of Education

YEMEN: Walid Ahmad Hashem Al-Hashimi, Head of Coordination and Monitoring Unit, Ministry of Education

YEMEN: Shukrieh Ali Al-Ba'dani, Coordinator of the Teaching Group at the Ministry, Ministry of Education

DISCUSSIONS

SECTION 2. Discussion

2.1 Opening Statements

The opening statements were provided by Sheikha Noora Humaid Rashed Al-Nuaimi, Director of AjmanX, UAE; H.E. Hussain Al-Mahmoudi, CEO Sharjah Research, Technology and Innovation Park, UAE; and Veerappan Swaminathan, advisor to the Government of Singapore and content developer for Intel's skills and innovation program.

Sheikha Noora Humaid Rashed Al-Nuaimi

The opening statement of Sheikha Noora Al-Nuaimi is in conjunction with the presentation as per appendix A.

Sheikha Noora introduced the practices of AjmanX in leveraging 21st century technologies and accordingly their role in the labour market and future job creation. Attention is paid to the application of technological tools in the educational process and how such activities connect the students with the job market. As elucidated by HH Sheikh Humaid bin Rashid Al Nuaimi III, the ruler of Ajman and member of the UAE Supreme Council, the country is committed to knowledge and innovation as the most valuable resource to ensure economic prosperity and enhance the human development skills.

AjmanX seeks to develop and support technological innovation through a variety of support initiatives to contribute to the growth of the Emirate. This includes an open working platform for government agencies to achieve the future now, through innovation, research, and development. Government departments are connected with the private sector, universities, and research institutes to solve challenges by adapting future technologies, provide workshops and a program of raising awareness amongst students, employers, and civil society actors across a range of sectors.

AjmanX also has its own smart digital facility, or makerspace, to support the empowerment of youth and encourage their own entrepreneurial and innovation skills. Artificial Intelligence (AI) is being leveraged to further develop educational practices and give the young people a competitive edge in the global knowledge economy. This has included the launch of their 'programmer initiative' to develop technology skills, robotics, programming, and AI amongst children between the age of 6 to 15, who receive specialised training with the support of edtech companies, academic institutions, and leading solution providers. Part of the methodology is to teach the young people how to train others using simple language and techniques such that they pass their skills onto the next generation. They have recently graduated 250 junior programmer students in this course.

The impact of the Covid pandemic has meant the launching of a matching online initiative which allowed them to sustain the training in areas such as robotics until schools returned in September 2020. Other initiatives include the hosting of junior programming competition with ideas across many sectors that can be transferred to start-ups. One of the key initiatives is the AjmanX interactive online platform with a wide variety of subjects and up to 4,000 courses offered to UAE nationals, in computer programming, robotics, AI, blockchain, risk management and decision-making. Accredited certification is obtained as a result of partnerships with over 160 international universities and top technology companies.

So far, these initiatives have attracted more than 6,070 Emirate participants, keen to improve their expertise and advance their careers in just four months. 2,143 have completed their courses, giving them priority placing in nominated job interviews. The AjmanX Academy is a 10-week experiential program for government employees to immerse themselves in a journey of disruptive innovation, providing them with all the key technologies, methodologies, and the key components of innovation in governmental management. The Academy includes mentoring from top consultants and technology experts as well as getting participants out into the field to gain experience from technology companies such as Intel and Huawei.

In summary the entire infrastructure of the

AjmanX system is aimed at promoting the next generation of scientists, engineers, programmers, skilled technicians, and disruptive entrepreneurs. Furthermore, in partnership with the educational community it gives a competitive edge and key opportunities in the job market. This is just the beginning, a glimmer into the future of the Emirate of Ajman and the strategic aim of ensuring young people have the necessary digital skills and literacy to face the real-world challenges as we witness the acceleration of the 4th industrial revolution.

H.E. Hussain Al-Mahmoudi

His Excellency recognised the challenging times we are now in, and accordingly the need to re-think how we approach education and skills development and address how enablers work together. Fundamentally, we must recognise that there is no "one size fits all" and consideration needs to be made for local environments that require tailor-made solutions for the challenges we face. This is exactly the approach taken in the Emirate of Sharjah and reflected in the activities of the Sharjah Research, Technology and Innovation Park (SRTIP). Of course, there are plenty of outstanding best practices in the global context, but they do not always address local issues.

The UAE has a national innovation strategy that focuses on certain industries in aerospace, transport, logistics, healthcare, and education with local adaptations made where appropriate. SRTIP was created as part of the Government of Sharjah's overall 35 – 40-year strategy to position the Emirate as an educational hub. For example, they now have the "University City" with 45,000 students in 22 universities that has already produced over 2,000 doctorates. So, the natural step is to take that educational excellence from theory into practice, to create a platform that engages the private sector, government, and academia all in one place – promoting collaboration, open innovation, and best practices.

One example of the achievements so far is the Sharjah Open Innovation Lab, one of the biggest in the region, equipped with cutting-edge technologies from 3D printing to rapid prototyping to CNC machinery and electronics. This is the platform in which they can engage with K12 schools, universities, and entrepreneurs. Another key activity is to look at the needs of an ever-evolving market, which involves addressing concerns over how the education sector can produce individuals with the right skills appropriate for the market. In this regard, communication is the key. His Excellency expressed how we often take such things for granted when often there is a communication gap between the various sectors – education speaks one language; business speaks another language and government speaks its own language. The better the synergy between these sectors, the better results will be.

Furthermore, in Sharjah, they have identified key areas by creating enablers and allowing students and entrepreneurs to engage in a manner that brings out the best in education and the private sector. For example, 3D printing will be of great importance in the coming years, yet we do not have a platform that brings this industry closer to students. Other examples include both augmented and virtual reality which are industries set to explode, particularly as we see the rollout of 5G communications. The work of SRTIP is aimed at focussing on these disruptive technologies to both enhance education and fulfil the aspirations of industry and government. The same applies to AI as its uses are adopted more in our daily lives.

The Sharjah Open Innovation Lab is determined to create enablers by identifying key areas of future development. For example, they now have the largest additive manufacturing facilities in the country, printing metal, plastic, and concrete – aiming to give students real life illustrations of the processes that can apply across industry from agriculture to logistics. Such programs enhance student competencies from leadership to communication to entrepreneurship – supporting the overall journey of innovation. These activities are not just for students but also for the private sector and government. This is just the beginning.

Over the next 50 years, the UAE wishes to become a world-leading knowledge-based economy and the government is mobilising every resource to fulfil this aspiration. They have a global vision with a local mission: develop talent, develop technology, and create ventures. All keeping in mind that the core resource of the UAE is its human talent.

Veerappan Swaminathan

The opening statement of Veerappan Swaminathan is in conjunction with the presentation as per appendix B.

Veerappan shared the experience of skills development in Singapore and specifically the drive there towards job creation. One of the challenges was that before the 1980's in Singapore, they were largely dependent on a foreign investment model, whereby multinationals were invited to come in and then bring the jobs as well. So around 20 years ago they started the process of enabling job creation within the country and encouraging entrepreneurship amongst young people. This has

accelerated in recent times, further accentuated by the experience in 2020 of Covid. The key takeaway is that everyone is affected by digital technologies, jobs are going to based around digital skills and not all students are particularly ready for such a future. The key question is thus: how do we transform our young people from job seekers to job creators in the technologically driven world?

Clearly, the answer is to focus on mindset and skillset development, but that requires coherence. A coherent strategy and joined up government from manpower to education, across various sectors, across government agencies and with the private sector deeply involved in the process. This process leads to three key questions to address:

- What mindsets and skillsets are needed to help support job creation?
- How do we bring skills development to the broad base of students?
- How do we ensure the system has built-in self-correction to account for ever-changing technologies and systems?

Regarding the first question, in October 2020, the World Economic Forum released its jobs report data [slide 5]. What we clearly see is that analytical thinking and innovation are top of the chart, followed by problem-solving and self-management skills and social skills including the ability to collaborate and work with other people. In the job landscape we see a growing demand dominated by technical skills from data analytics to AI and machine learning specialists. Whereas the likes of administration, accounting, factory, and operations management are in decline – although these are areas we still recognise as being the output of schools and universities. It is now strategic to focus on innovation and higher-order thinking skills. To fulfil this future change in demand, the education system must emphasise social and emotional competencies to produce confident, self-directed learners. One strategy is to promote entrepreneurial failure – failure is a good thing because learning from it encourages more risk-taking, which is quite something in a risk-averse country such as Singapore.

With respect to skills development, particularly technological skills there is a tendency for such technical education to become gender-skewed in favour of boys. This needs to change to meet the desire for broad base skills development. Such notions of a technology bias towards boys need to be changed and one strategy for doing so in Singapore is what they called ALP – Applied Learning Program, rolled out in 2017 across all secondary schools in Singapore. Effectively what this means is the combining of learning skills with real world applications. Last year they rolled it out at primary school level also. The idea is that if you want to induce the joy of learning with students and create authentic learning experiences then you must address the basic question all students ask – "why am I learning this?" As they are doing in Sharjah, the students need to see real world applications of what is presented to them in the classroom. This gives the learning experience greater authenticity.

The third question is the one of self-correction. We cannot be overhauling policy all the time, so must find a way to ensure adaptability and resilience into the education system. One way this can be done is to introduce lifelong learning which in Singapore has been a crucial element in the country's national human resource development. The way to do this is to create a culture of lifelong learning, affected through policy and action. Regarding the lifelong learning framework, there are two elements viewed as key enablers [slide 10]. The circular diagram on the left-hand side shows technologies for learning and the capability of learning to learn. Such a lifelong learning policy is not just something that happens at the school level, it also needs to translate into workforce level, or at the later workforce, or even, semi-retirement or middle working life situation.

We recognise that such cultural changes cannot happen overnight. The expectation is that it will take a decade or two before fully manifesting itself, but such an approach is certainly worth investing in. Learning how to learn is going to be a key enabler. Putting it all together requires substantial

reform – involving the whole system of education policymakers, school leaders and teachers. With big changes there always comes resistance, so an effective approach is to supplement first and then supplant the change as people adapt. Finally, we have embedded all these lessons into the Intel Skills for Innovation Program which can make real substantive changes in all educational settings without disrupting existing curricula.

2.2 Interventions and Covid as an Accelerator and Catalyst for Change

The pandemic has underscored the role of technology in education and Middle Eastern countries were quick to respond. Bahrain has seen a widespread uptake of e-learning solutions because of Covid mainly carried out through the dedicated education portal set up by the Ministry of Education and the Bahrain Information and eGovernment Authority. In Sharjah, an e-platform designed to train teachers on digital transformation was set up by the Sharjah Private Education Authority. The UAE's Ministry of Education partnered with the Hamdan Bin Mohammed Smart University on distance learning programs to support teachers in developing their online pedagogical skills. The shift to online learning has generally been well-managed and with it there has been recognition from policy makers of the need for more initiatives from digital literacy training to the establishment of stronger policy frameworks and guidelines.

Many believe that the Covid pandemic can be seen as a huge opportunity for education systems to modernise. Decisions around distance learning are now easier and the use of technology in education give students the mindset to be ready for the 4th industrial revolution. Education systems should benefit from this, but a concern is that, after Covid, we return to the old brick and mortar model without learning the lessons of 2020. We have seen an acceleration of the use of technology over the last 10 months, with schools utilising blended learning. Where some schools have not had the requisite bandwidth, it has forced governments to pay attention and provide the connectivity. If education is for all then the connectivity must be equitable for all.

When the Covid crisis started, the UAE was in a fairly strong position in terms of having a mature ICT infrastructure and several strands of government policy already in place regarding remote and e-learning. The country's ICT fund had already been well-established since 2012. There was not a substantial disruption to the education system, maybe just a week or two as people and institutions adapted to the changes. Schools and universities were in a strong position to switch to remote learning during March/April 2020, but this was not necessarily smart learning. The government immediately stated that education must continue, and so it did. The standards for smart learning had already been in place since early 2019, with technology implemented over the previous six years. Now the movement from remote to smart learning is where we will see a greater uptake of developing interactive and effective virtual learning environments, using technologies such as augmented and virtual reality. The e-learning must be interactive to create full smart learning.

In Jordan, the aspiration of introducing technology into schools has been around for nearly 20 years, starting with the training of teachers in digital and computer skills. But progress has been slow, and although the Ministry of Education had prepared teachers and online platforms before Covid, one could estimate that the school system was maybe around 60% prepared. When introducing online learning in March 2020 it was apparent that the lessons were just 'one-way' from the teacher to the students with little scope for interactivity. The Ministry has been concentrating on training teachers in how to better deliver lessons in the online setting. Of course, not all schools and not all infrastructures are equal so there is concern of inequity, creating an imbalance in the educational experience across the school population.

Some have found that at first it took time for students and teachers to adapt to the remote learning from home but have soon got used to it – enjoying the ability to work and study from home. Will this become the new normal accepted in education? If so, then what will the impact be on social interaction and activities such as physical education?

In education in Saudi, they have responded positively in seeing how the Covid pandemic can become an opportunity for the better use of technologies and for teachers and instructors to be enablers. The Training and Vocational Training Corporation has 200 centres nationwide that train the trainers and instructors in the technology and learning management systems. They have also taken the time train the students in how to use the technology and utilise virtual platforms. There still remain challenges, such as the delivery of e-content, even though they have numerous courses it is necessary to encourage the teachers to develop their own content.

Schools in Middle East countries have oriented towards more problem-based learning, trying to teach methodologies with enhanced critical and analytical thinking. This has been one of the

noticeable impacts of Covid. The desire amongst policy makers is that schools continue to adapt to the technological changes. At the same time parents are understanding more about the technological tools.

In Saudi, they started distance learning immediately in March 2020. The country does have some more remote areas, so the government acted by utilising twelve TV channels to deliver the necessary educational content. The discussion now is how much of the e-learning will continue. The concern is not so much the technological capabilities to continue with e-learning but rather the regulatory framework. E-learning did not previously have the credentials and as a result of Covid, now the government has started accrediting e-learning.

In Oman they have an education innovation program to develop makerspaces and incubators in schools to let the kids take part in workshops with mentors and experienced people from the private sector. The methodology is design thinking, whereby the students are encouraged to solve problems using the tools available in the incubator. The Ministry of Higher Education, Research and Innovation has established technology transfer offices that are mandated to develop makerspaces, allowing students to play and practice at innovation along with developing their entrepreneurship skills.

In Saudi Arabia, prior to the pandemic they had already started digitising all of the curriculum content which allowed for a shift to online learning fairly rapidly. Technology was not the main challenge, but rather one of the teaching culture. So, change management was a priority of the policy makers in government to allow for teachers to adapt to virtual learning environments. The impact of Covid has accelerated the process of change management, which requires developing new blended learning and digital training programs. These actions are necessary to reduce anxiety amongst teachers as well as students and parents. The most important policy of the government of Saudi has been that nobody is left behind.

The digitisation of Jordan started over five years ago with the roadmap of digital transformation running until 2025. One of the important pillars of this strategy is developing digital skills in schools and universities, including activities such as digital bootcamps, which has already produced positive results with 90% of students finding a job easily. With Covid this model has expanded with further plans for digital skills to be part of the curriculum.

Some might say that the situation caused by Covid has contributed to erasing the taboos around digital and online learning. Now we need to assess the value of online education that is being given to the students. In Egypt, the Ministry of Education had been moving towards digitisation a few years ago, such as establishing the Egyptian Knowledge Bank that started in 2018. The secondary education exams, Thanaweya Amma, have been reformed with assessments being done online with tablets distributed before Covid, yet Egypt has a very large system with over 23 million students and more must be done for the whole ecosystem.

The consensus amongst participants was that Covid has definitely been an accelerator of policies and actions that were already being implemented. From the adoption of smart learning in UAE to Education 2.0 in Egypt to Vision 2030 in Saudi Arabia the aim of digitising education has been a key strategic pillar of Middle Eastern governments. That said, the impact of Covid still opened the eyes of policy makers and leaders to prioritising digital reforms in education.

Even though we were not prepared for the pandemic, in education it has revealed itself as an opportunity for students to develop themselves in ways that may not have happened so rapidly before, particularly regarding their own self-management, collaboration and developing 21st century skills. Equally the same applies to teachers who have been forced to teach online even though they have not had any prior training. Of course, this has highlighted the need for greater investment in teacher training and building capacity in digital literacy. Also, there seems to be anecdotal evidence of parents changing their views of education and their expectations of the future jobs of their children. The vision of many participants is that this represents a huge potential shift from the classical way of teaching to a more learner-centred collaborative approach.

Covid has fast-forwarded some plans and initiatives in Saudi, that were harder to implement before, so they really took advantage of accelerating the use of digital technology. That said, ICTs have been well-developed across multiple sectors with industry investment in the likes of AI and big data, yet the dominant mindset towards education was the qualifications, the grades of an individual. The realisation of needing core analytical and problem-solving skills has been established and that allows for better adaptation to the ever-changing knowledge content. The initial shock of Covid has been replaced with embracing ideas of human development and focussing on the mindset, not just of students but the educational institutions and the culture of learning.

With the return to schools, amidst the Covid pandemic, Saudi Arabia launched a new learning

platform, called *Madrasati* to facilitate online learning. So far it has already been visited 230 million times by more than 4 million students in public school and 400,000 teachers. More than 45 million virtual classes have been delivered and more than 8 million assignments have been created on the platform. Furthermore, they have been able to connect it with the Ministry of Education information management system strengthening the governance and monitoring of outcomes. There were some challenges at the beginning as can only be expected from large-scale information technology deployments and also issues over connectivity in the most remote areas of the country. But that latter point has allowed the government to identify those areas that need the most urgent investment in the ICT infrastructure.

2.3 Blended and Online Learning

In the Arab world there is a wide range of different circumstances with some countries already having established e-learning platforms and methodologies, while there were others who were not ready, and the pandemic came as shock. So, it is clear that blended learning will be essential in the future to cope with any unexpected shocks but also to take advantage of new technologies. E-learning can improve the quality of learning and give the student more opportunities, so long as the most appropriate technologies are deployed. There is an opportunity to redesign the classroom, but the big challenge will be the cost and the allocation of resources.

One concern raised in the context of what comes after Covid, is the dangers of negative effects of online learning, such as effects on social and physical interaction amongst young people. Will online learning be just an emergency response, or will it be established as the normal method of education in the long-term? Humans are social beings and interaction is an essential part of our lives, so educators and policy makers need to be very cognisant of social and emotional skills.
With the greater uptake of online learning then the methods of evaluation need redesigning also. Digital and online assessments have certain practical difficulties, particularly in relation to monitoring and trusting the authenticity of the assessments. Education has not caught up with technology's ability to subvert the system. For example, in the UAE Ministry of Education has mandated that cameras must be turned on all the time during assessment. So, one of the silver linings of this pandemic may be that educators have the opportunity to reflect on the purpose of assessment and what we want students to achieve when they graduate.

As well as the greater use of technology in education and the advance of online learning, there was also discussion of the structure of physical schooling from the timetabling to the nature of classroom spaces. Maybe there needs to be greater flexibility from the traditional 45-60-minute lesson, maybe this is an opportunity to redesign spaces within schools that inspires more learner-centred education and peer-to-peer collaboration amongst students. Along with this we could see a change in curricula with more attention paid to project-based learning to encourage problem-solving and self-management amongst students.

Such changes to educational infrastructures must be considerate of parents and families. Parents were brought up under a different system, so their expectations need to be part of any change management. Some families may have three or four children. Does that mean they need three or four laptops at home? This is a tremendous burden on top of ideas of redesigning timetables – after all the structure of the school week synchronises with the structure of the working week for parents. Any efforts to re-engineer education will have to come with agreement and support of parents otherwise governments will simply not be able to make such changes.

Saudi has invested considerably in e-learning since 2006, starting with the trainers and the teachers. So, when the pandemic started, the move from face-to-face learning to full e-learning took just

one day because of the investment in technologies and training. That said, teachers have still faced difficulties in using some technologies and how to employ tools effectively. So, they have designed a training kit for teachers in order to employ online tools that ensure students are fully engaged. The good results in the last semester have shown that the system has adapted quickly to the change.

It is still too early to judge what works and what is effective in hybrid education. More research and analysis is required to determine frameworks and to aim for a more complete and integrated solution. This may involve using artificial intelligence, determining suitability for online assessment, and choosing which types of curriculum resources are utilised. Any such complete solution clearly requires far greater investment in the ICT infrastructure and equipment.

Regarding online learning in the context of Covid, it was mentioned several times, that what we have seen over the last few months is not really online learning but rather emergency learning. This may lead to confusion over the type of technologies used for e-learning. Certainly, prior to Covid, the extensive use of platforms such as Zoom and Teams was never considered a central feature of e-learning. The experience has uncovered failings in infrastructure that need urgently addressing, but time must also be taken to properly assess and determine the true nature of online learning and its desired outcomes.

If committing to greater blended learning, then engaging with parents is essential for policy makers. Current e-content is often not attractive to students and so parents need to spend more time with their children to teach them the most important skills. What are we going to do about content for grades 1 to 4 if the impact of COVID-19 continues? The content requirements for older students are very different, so policy makers need to differentiate between grades and governments need to give more guidance to the parents.

Jordan has formed a national committee for directing online learning and developed an online platform. Now they have asked the universities to maximise their learning management IT infrastructure. They have distributed devices to the poorest students and asked the telecommunications operators to give the students a good internet package. An important initiative in Jordan is a cooperation between the ministries of digital economy and education to allocate a budget over the next 5 years to cover the cost of purchasing laptops. The distribution will be done according to the government databases that identify the low-income families and prioritising them first. The program will distribute 160,000 laptops to students from low-income students with laptops and internet access fully paid for by the government to facilitate online learning.

The adjustment to online classes has been met with particular challenges in both the arts and TVET education. Performance-based arts involve collaboration and support from classmates as well as a great deal of social interaction that is missing in the online setting. As for TVET education the, where large parts of courses are practical, the challenge has been particularly pronounced and online classes have simply not been able to meet the requirements of technical and vocational training. Practical skills are the hallmark of TVET, learning-by-doing occurs in schools and workshops and programs have struggled to adjust to distance learning. Some TVET students participating in programs that have work-based learning have been lucky to be able to continue where businesses have managed to remain open, but of course we have seen widespread closure of business locations or extensive social distancing that is limiting the opportunities for students to meet the certification requirements.

One of the key issues around online learning is the question of engaging the learners and creating interactivity. With the sudden need to switch to online lessons, many have been 'learning on the job'. One speaker reflected how the format of this meeting (small break out groups) was what worked best in their experience. When you create breakout groups online you eliminate some time wasting and can be more attentive to the individual students. Small online lessons seem to create strong team bonds amongst the participants. It is not just the intellectual engagement but the human engagement that is essential in making an online lesson work. That said, effective online teaching requires much more planning and more effort than the traditional classroom set-up using the same material. Some tips for teachers include constantly asking for feedback, encouraging peer-to-peer evaluation, holding quizzes, and using links to videos and other resources. The latter point of linking other technological resources will no doubt see a revolution with the advent of 5G.

Technical and vocational education has certain complexities and nuances that have made continuing such education during the pandemic much more challenging. For example, the evaluation of technical education course may be of the order 40% theoretical and 60% practical. Educators cannot conduct classes for the practical in the remote learning environment. This has been a notable problem in Bahrain, faced during the pandemic,

which they have managed by doing their best to give students practical projects with teachers observing the process.

The Arab Open University adopted the blended learning approach prior to the pandemic so it was relatively simple to switch to the full online learning. They use Teams for delivering lessons and assessment being replaced with online activities as well as final take home exams. The most notable problem was the digital divide of connectivity and device between students, and even some faculty staff. Another challenge was, and still is, the difficulty of constructing a methodology for assessing learners online. Artificial Intelligence could well be the technology that helps with the assessment conundrum.

An interesting feature of the effects of the school closures has been the blurring of lines between the professional and home space for teachers. Online activities can happen all the time, but this can cause stress whereby students may be wanting to have meetings online without reference to any timetables, which is in stark contrast to the normal schooling experience. A noticeable challenge of the switch to online learning is the engagement of students. Maybe some classes have as many as 100 students and it is impossible for the teacher to control and engage with eveyrone.

Another important point raised was the concept of an actual learning space in the home. Sometimes for many students there may not be the specific dedicated space in their home with the ideal environment for learning. How to find the learning space in the home and how the parents create the learning environment in the home is a fundamental question moving forward. Student engagement online is a major area that needs addressing and the technology must provide solutions – such as artificial intelligence techniques and data analytics that can be built into learning platforms. Policy makers need to ask what technology is fit for purpose as well as answering concerns over where data resides and protecting privacy online.

2.4 Teaching, Assessment and Skills Development

Concern remains over the pressure that teachers are facing, the children are tech savvy, and often the teachers may feel that some students are better than them at using technology. In Saudi Arabia they have carried out extensive training programs for teachers, but not forgetting there are more than half a million teachers in the country and this huge task to train them to be up to date experts in the latest technologies. Maybe a small percentage of teachers will be experts in new technologies, and these are the ones who can also train their colleagues; hence teacher-to-teacher collaboration will be an important ingredient, especially when they return to school after the Covid pandemic. What is important here is to implement programs with more instructional designers who are available within schools to support the teachers. It is not practical or reasonable for all teachers to themselves be instructional designers, but it is essential that the support mechanism are in place.
An important lesson from Covid is that governments need to now focus on many ways to deliver education. Furthermore, many have commented that now is the time to review the curriculum and to work more on developing the critical and analytical skills of students. The focus now must be on skills more than deductive and abstract learning. Students need the necessary 21st century skills, they need to become lifelong learners, to manage learning themselves, to be critical thinkers and problems solvers. Covid has demonstrated the need for this along with utilising technology to achieve all those competencies.

In Saudi Arabia they have STEM centres within selected schools, focussing on technologies such as robotics, aerospace, and telecommunications. The centres are well-equipped with the latest technologies such as 3D printing and students attend for a couple of hours each week with a focus on scientific knowledge. The plan is to have more makerspaces in the future. The Ministry of Education has decided to start teaching coding from Grade 4, increasing the amount of time spent on such technologies.

Within the UAE curriculum they started 'Fab Labs' a number of years ago, with the purpose of introducing new digital technologies from 3D printing to coding software design. There is another stream for STEM education that is also embedded within the curriculum and introduced coding from Grade 1. The aim is to combine knowledge with science and technology to build the capabilities of the students and present them with real world problems and not just the theoretical aspects of the curriculum.

UNESCO in Jordan has been especially working to support teachers and the higher education sector in Jordan to provide practical guidelines in response to the Covid pandemic. Particularly, this is around the pedagogical and methodological skills required for online learning. These are not cognitive skills but practical skills that both the teachers and students need to master.

In Bahrain they had to train all the teachers in how to use the Ministry of Education platform as well as

best utilising online video technology. Accordingly, they ran teacher training programs in how to use the digital technologies from June to September. The platform existed before Covid, but was optional, not all of the teachers had to use it. For TVET they use the e-learning platform for the theoretical part but for the practical parts they have been postponed until next year. The practical skills required in technical education have proven to be the biggest challenge in the last few months. Another noticeable challenge is the level of interaction during online lessons, plus it is difficult to assess how much the student is paying attention.

Student mindset remains one of the most under-explored aspect of education strategy. Changing the mindset is like seeding the ground to enjoy the harvest later. Part of this involves changing the mindset of the parent body who are used to job security, whereas millennials will probably be changing their jobs multiple times in the future. Parents are yet to come to terms with that as they grew up in a different era. Leadership from the educational institutions is essential as digital transformation progresses and educators act to equip students with new skills and competencies.

A noticeable trend, that the experience of Covid has certainly highlighted, is the greater encouragement of skills versus qualifications. In Saudi, the Ministry of Education has started the initiative of mini academies within schools as well as the regular education. These will be focussed on technical skills alongside soft skills, entrepreneurship, and digital literacy. These are all activities of building the student mindset. Introducing mindset content starts from Grade 10.

The discussion is not just about technology but the trends that are happening, demographic trends, the networked society and globalisation. Education is based on a linear model from basic education to higher education to the qualifications for specific jobs. But with the changing nature of jobs this linear model of standardised education and fixed curricula is becoming more outdated. There is now the potential for a real shift in the educational model that accounts for new skills alongside the development of robotics, AI, big data, and analytics. The question is how much our curricula and educational institutions can adapt to the changes, because already some of the teaching material is obsolete such that by the time a student graduates the previous requirements for their jobs have become obsolete.

Instead of a linear model, we should be thinking about more of a multi-disciplinary model with the cross-over of skills. Some refer to this as the consilience model that is non-linear education. There is a need to have skills and competency-based education rather than pure content. Such developments require greater collaboration, and that students and faculties work in a more collective manner using open educational resources. Historically there has also been an element of an elitist attitude towards online learning, especially amongst tertiary institutions where an online qualification does not have the value and cache of an 'on-campus' degree. Yet, with Covid as an accelerator, everyone is required to invest in online learning – which for the moment is more emergency learning than fully-scoped online learning.

Another idea in reforming the education system is the concept of 'digital badging' – the presence of achievements or specific skills that are recognised by institutions and then used by people on sites such as *LinkedIn*. This concept of micro-credentials is gaining traction whereby there maybe input from multiple providers, government agencies and industry.

The big issue that will face teachers is the issue of assessment. So how do we get teachers to be ICT ready for the different forms of evaluation? The tools available for teachers now are mainly in the form of summative assessment but not yet digitised. The big gap is how do we get teachers on hybrid platforms to deal with formative assessment on an ongoing basis? Formative assessment needs continuous feedback to the children such that it is taking the learning forward. Enabling

a digital platform to do that would be an ideal. That said, the procurement of such tools will most likely first happen with wealthier private schools, with the gap remaining in the broader public sector. The concern with summative assessment is simply if children cannot attend schools how can they take exams in a controlled space. That comes back to the design of the assessment.

Some educators suspect that the actual amount of learning has been much lower than people think, and assessment online is a particularly challenging problem. In the UAE, the Ministry of Education wants schools to think about schooling once the Covid pandemic has passed, and to retain a distance learning capability. That may well help in being better prepared for the next crisis but still students learn better while in school and we really need genuine evidence-based research on the effectiveness of all this learning using Zoom. That said, requiring that students master the art of distance learning at home coincides with the real changes of the 4th industrial revolution and its consequences of needing the ability to self-manage and problem solve. Older students certainly have used this as an opportunity to take the initiative but for younger kids it is a completely different story where the structure of the school day and the pastoral care it offers is essential.

An important, and often forgotten policy is the necessity to have social and emotional learning (SEL) built into instruction. How do we help children understand the new ways of behaving given social distancing and the necessary changes taking place in schools? These are real challenges for school leaders and teachers. If there is a greater uptake in virtual education, then lessons need to be specifically constructed for the virtual environment. It is no use just digitising existing information and posting it online. That is not a lesson. So, policy makers should be looking at bringing together a whole gamut of key actors including coders, designers, gamers, curriculum developers, trainers, and teachers in developing proper digital content under an appropriate pedagogical framework.

In terms of professional development, the challenge many face is having the capacity to build expertise around high-quality online teaching, because currently there is a great variance in quality and furthermore it depends on the type of edtech that has been employed. All participants spoke of their expectations of how online and blended learning is going to be a permanent feature of education and thus teacher training and continuous professional development is critical. We need to adapt training and pre-service qualification such that online learning and virtual lessons are included in the curriculum of teacher training colleges.

Many participants concurred that, in the future there will be far more emphasis on continuous assessment, though there is still a great deal of uncertainty of what that looks like. Summative assessment has the advantage of being standardised, whereas continuous, project-based evaluation will be much harder to set criteria for international standards. In a globalised world where the 4th industrial revolution predominates and is a determinant of what students need to learn, then who sets the benchmarks? Will artificial intelligence have a major influence on evaluation? This assessment conundrum will be a difficult problem for policy makers for years to come.

One of the participants, who had studied in the West, pointed out that in developing critical thinking there is a particular cultural binding amongst Arab students of not wanting to criticise someone more senior and experienced, such as a university professor. This is a specific cultural barrier that needs to be crossed to further critical thinking skills amongst young Arabs.

Since 2018, Saudi Arabia has implemented a nationwide project under the Ministry of Education for the teaching of digital skills. The main goals have been to provide students with computational thinking skills, programming skills, physical computing skills and to promote the responsibility of digital citizenship. Starting at elementary school level the project has been supported by substantial investment into equipping schools with the technology, devices, labs, digital workspaces and upgrading of internet connectivity. The Covid pandemic demonstrated the need to have these skills in place and fully justify long-term investment that includes teacher qualifications in digital literacy and providing the appropriate equipment for supporting student creativity.

In Egypt, where the Moodle platform has been accessed by more than 8 million students, they have implemented programs to improve the digital skills of teachers. These programs start with use of the application, through to building lessons digitally and onto how to construct different forms of online assessment. This kind of program has become an important feature in the professional development of Egyptian teachers.

As some types of job disappear and new jobs emerge, then countries need to prepare future generations to have the necessary skills to match the required competencies. Education in the Arabic region has traditionally focussed on students achieving grades and qualify to the ‘next level’,

so for academic institutions there needs to be a stronger drive in producing new forms of knowledge and promoting scientific research. Policy makers have realised this for some time and recently have been looking at methods of reform such as the implementation of Education 2.0 in Egypt. Before thinking of technology, the question then becomes one of building a framework of sustainable development and thereafter integrating new technologies, such as artificial intelligence, within that framework, to enhance education in Arab countries.

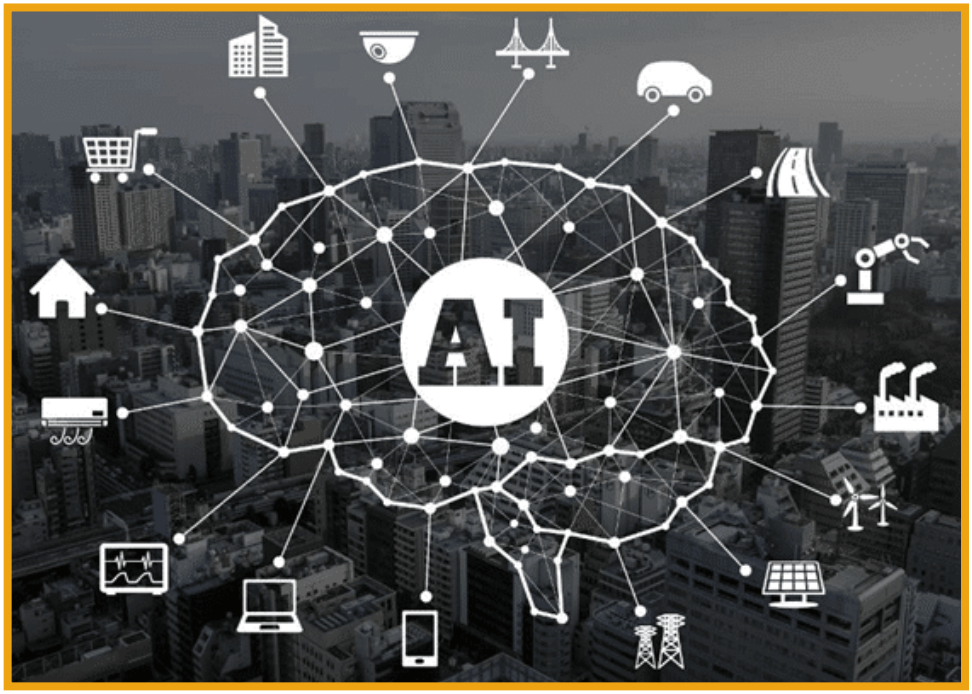
Some of the participants voiced their concerns over the dangers of cheating when trying to assess online. Many teachers remain hesitant to include evaluation because of the potential of compromising academic integrity. There are already virtual proctoring technologies, but they may not be part of the school's e-learning infrastructure. That said, there are techniques that can help support more robust online assessment such as setting questions that require higher order thinking and an authentic demonstration of understanding. This approach certainly matches the skillset development as elucidated by opening speaker Veerappan Swaminathan.

The general feeling amongst educators is that assessment will move to formative and project-based models in the coming years. Such continuous evaluation will then be able to utilise interactive digital content and with the possibility of integrating artificial intelligence we should see much more beneficial personalised learning systems. With the advent of new technologies such as AI and applications that are still yet to be invented, the key will be to develop higher order thinking skills in learners, so they are best equipped to deal with rapid change throughout their working lives.

Prior to Covid there has been ongoing discussion amongst educators about revising pedagogy, yet now we are hearing more openly about the push for change and certainly with the expansion of blended learning, new pedagogical ideas are essential. The key drivers of a new pedagogy are the demands of the knowledge-based economy, the influence of new technologies, the changing expectations of young people, and the fast-changing world of work. The development of new pedagogical practices come from a combination of the acceptance of blended learning being the norm in the future, more of a collaborative approach to education, the use of open educational resources (OERs), informal online learning, student self-management and the move towards more formative assessment models.

2.5 Future Technology and Artificial Intelligence

A key observation is that currently the technology is not mature enough to deal with smart education. For example, virtual reality is still in very early stages, however augmented reality is becoming more mature and with the roll out of 5G and IP version 6 we will start seeing greater disruption in the ICT for education sector. The speed and low latency of 5G will make a huge difference in using the likes of artificial intelligence, robotics, remote laboratories, and other cutting-edge technologies. Once the technology is mature enough to deliver these then the education system will become more flexible – with flexibility for students, teachers, and location. The learning system can effectively be live 24 hours a day. This may have a massive impact in the future in which the likes of a degree that may take three years could be completed in one year. This is the potential in the future, but there needs to be flexible government policies. Policies must be able to respond to a variety of different scenarios. We will see major disruption to education in the coming five years if government policies are responsive to the changes and the ICT infrastructure is reliable, fast, secure, robust and with low latency. Smart education may take the next two to three years, but disruptive



education will take five to ten years.

A common consent amongst participants was the concern of avoiding a 'one size fits all' approach. We cannot expect the same policies to apply equally to all countries. Local policies are needed that understand the local culture and demographics; for example, if one looks at the number of students in K12 education in the UAE, just over 150,000 and in Egypt with over 20 million primary and secondary education students.

Regarding STEM education in the future, everything will be 'tech' – Fintech, Greentech, Biztech – so it is essential for students to understand technology. Programming does not need science and we can teach this to anybody, so coding should be part of curriculum because future jobs will require this competency. Artificial Intelligence may not be so much part of learning but using it on a daily basis will be part of schooling. This is important for MENA countries to compete with the world as all future jobs will have some 'tech' element. Courses in technology will start from much younger ages. Turning from technology consumption to technology production and leadership. Arab youth should have the ability to drive changes in the world and the education system must be an enabler for such skills.

The UAE's efforts, since the launch of smart learning, has been to focus on building the capacity of teachers and students and the use of technology along with the government ensuring the necessary investment in infrastructure to allow e-learning to flourish. The next stage is now not on how to use technology because the confidence is already there, rather the attention is the quality of education using new digital technologies. Although it is hard to say how much the current blended learning activity will continue, but the capabilities and skills have been built into the students and so the next step is how to make such activities more productive. For online learning, quality is now the hottest topic – how it can be best provided and how the learning outcomes can be assessed. That said, it remains that the physical and social activities must remain as key components of the learning environment. Nothing will replace the physical part of a child's growth and development.

Now is an important time to scout and filter out the technologies that have the highest socioeconomic impact and make sure they are properly embedded into to the ecosystem to succeed. Edtech has had a mixed history so far – especially when it comes to integrating so many different platforms and technologies. How do school leaders and policy makers in the ministries of education differentiate between the most promising edtech and technology that is just purchased for technology's sake without impacting outcomes? Implementing technology in education is complex and it must make a demonstrable difference. Testing needs to be extensive and considerate of both the teachers and the students to avoid mass deployments that become under-utilised and a waste of resources.

Regarding investing in technology, some school operators were previously doing it as a choice, but now there is no choice and that is the stark difference that has arisen out of the pandemic. A teacher may have earlier been able to choose to use certain learning technologies but now they are compelled to use them. The training has already been in place and the period of lockdown just accelerated the implementation. The challenge was how do we teach students who are at home and in school? In the case of GEMS Education, they implemented a three-part teaching model based on research. They found around 70% of the students enjoyed the program but there was a more mixed reaction from parents. Hence, it was a time for experimentation and everyone bringing their own innovative skills to the fore.

ALECSO recently published a book on the use of artificial intelligence (AI) to combat pandemics in light of Covid. It is a guide for teaching AI to pupils from nine to fifteen years with exercises and applications. From 2021 ALECSO will run two sessions, the first about coding and focussing on the training of trainers because in Arabic countries they found that the introduction of coding in primary schools is of key importance. Instead of just being consumers the aim is for young people to be the producers of technology. The second program is about artificial intelligence and in particular its use in education and how it can be introduced into the curriculum. Ultimately the aim is to prepare young Arabs for jobs of the future.

The issue over the development of artificial intelligence was discussed widely, with countries like the UAE infusing AI into subjects. They already have a ministry of artificial intelligence and Saudi Arabia has been developing a national plan for AI. Yet the situation remains different from one country to another with a wide variance amongst Arab countries. Recent discussions between Arab ministers of higher education have addressed the issue of bringing AI into curricula but this must be aligned with a national strategy and most importantly one cannot introduce a new field if there are not the teachers trained to deliver it. AI has the potential to give teachers insights into their students and can help not just with academic performance but with life and 21st century skills.

In response to the 4th Industrial Revolution is the proposal for "Education 4.0" where human skills and technology are aligned to enable new possibilities. For this change we must revisit the educational paradigms and focus on the areas that need rethinking to adapt to the fast-changing technologies and information overload. Information needs to be accessible and students need to learn how to find that information rather than it just being taught to them in a rigid structure. Certainly, considering Covid, governments around the world are looking at the potential of redesigning educational structures.

The investment in new technologies and educational resources is likely to put additional economic pressure on countries and this experience in 2020 could be an opportunity for greater collaboration, especially between Arab states. Open educational resources, online tools, videos, artificial intelligence, e-learning platforms all have the potential to be shared amongst cooperating countries. Such cooperation could then lead to more standardisation of technology and better collective bargaining with the private sector solution providers.

Regarding investment in e-learning and other educational technologies, it is important to consider the training of the teachers first. Not just their training in a specific technology such as a learning management system, but rather training them in being able to adapt to the evolution of technology, because it will always change – and now faster than ever. For example, we are now seeing the roll-out of 5G which will completely transform mobile communications and connectivity. It may well be one of the most revolutionary technologies of our times. At peak speed 5G will be 1,000 times faster than the average 4G connection we see today. The point is that this huge infrastructural change will bring about new technologies and applications that are yet to be invented and often unpredictable, which will impact the education space. 3G gave us high-quality audio calls, 4G gave us video streaming. So, what will 5G gives us? Augmented and virtual reality, holographic projections, 2-hour movies downloaded in 10 seconds and a wealth of as yet unknown educational applications. So, the key is training the trainers and teachers to be ready and adaptable for the next technology revolution as opposed to just focussing on being trained in a specific technology that could easily be out of date in the next 5 to 10 years. Learning to learn will be the future mantra of education – for both teachers and students.

A lot of existing educational technologies and platforms have been centred around supporting the institution – whether it be the ministry or the school, such as record keeping, information management and timetabling. But these are not value-added educational services. So, if blended learning is the future and if investment in technology continues on its upward curve then policy makers need to think strategically about which will truly add value to educational outcomes. Maybe the impact of Covid has allowed us to embrace such thoughts given the huge disruption it has had on the education ecosystem and the fact that digital and disruptive technologies do have an important role to play – so long as that role best prepares our young people for an ever more unpredictable future.

Learning to learn seems to be one of the most common messages in the future proofing of education. Specific learning skills will need to be at the centre of teaching strategies. These include establishing goals, determining what information is essential, the finding of patterns and the grouping of information, planning and prioritisation of time, and the mindset to seek help wherever necessary. These form a set of social and emotional skills specific to the learner that give students a sense of self-efficacy and set them up to be better equipped for a fast-changing unpredictable world.

Several educators in the Middle East are talking about the introduction of gamification in learning to leverage competitiveness and increase the engagement of students. Educational material can be made more exciting and entertaining, and good gaming techniques play on the psychology that drives

human engagement. Another benefit of gamified learning seems to be that it helps retain knowledge through the excitement and the impact of competing. Enhancement of the learning experience can be seen when learners witness the real-world applications and have real-time feedback from their activity. Certainly, it seems there is more scope to unlock the student's imagination through gamification and more evidence-based research should be carried out to identify which applications can improve learning outcomes.

All participants spoke of the importance of bringing coding into education at the earliest ages as possible. Python programming has been introduced as an ideal language for first-time coders in a lot in schools in the Middle East because of its versatility. Python has substantial online documentation and as a first language can be applied from web development to machine learning to data science. The increase in bootcamps and labs in countries thus requires a strong backbone of supporting teachers who have received programming language training as part of the continuous professional development. Importantly for the students, having such ability at a young age will serve them well in having the right skills for jobs of the future.

An important consideration is the procurement of technology for education. We keep buying things based on what is available in the market but what evidence-based research and evaluation of the technology has been made? There is no doubt of the potential of technology in addressing the needs of a modern education system, but policy makers are faced with an overwhelming choice of solutions and applications without a clear assessment of what works and what does not. Rigorous academic research into the usefulness of technology and how it contributes to the entire education ecosystem would certainly help governments and institutions make evidence-based policy decisions.

The appropriateness of technology for education is closely tied to the infrastructure and the particular circumstances of each individual country. In the MENA region there is a wide degree of variance between countries and within regions of the same country. So governmental institutions, schools and universities need to have capacity development programs that identify appropriate technology and the human experience of using technology within education.

For many, artificial intelligence has the prospect of being the game-changer in education, particularly as we commit to blended and online learning, but the question of how we can make sure it is ethical was also discussed. Education 4.0 will deliver a more adaptive, personalised learning experience that can use techniques such as predictive analytics that will assist teachers in assessing learners and intervening in a student's well-being. For now, we have no framework of the ethics of such interventions and what is ethical AI. Certainly, we will wish to include diversity, fairness, accountability, the protection of privacy, inclusivity, and the absence of bias. Evidence already shows that there is bias within data, that can be skewed towards certain findings. Furthermore, is the question of accountability. AI can arrive at decisions without it being apparent of how such a decision is reached. There are no rules telling us who is accountable when things go wrong, and this could certainly lead to major concerns when it comes to student assessment. So, the inclusion of ethical standards in AI courses will be essential and its use in education will need to start with a cautious approach.

There is a groundswell of change taking place around the world and policy makers in the Middle East are responsive to this also. Innovative applications of technology to teaching and learning are being developed and assessed, while this experience of remote teaching during the pandemic is teaching everyone new lessons, both the success and for failures that are already giving insights into the design of education in the future.

2.6 Closing Synthesis

Note: the closing synthesis was provided by Taha Khalifa of Intel and is accompanied by the presentation in Appendix C.

Taha Khalifa spoke of how technology is being reinvented for education now and into the future. Intel's purpose of creating technology that enriches people's lives started with PCs, across all areas of computing, up to servers, networking solutions, fuelling the cloud to the HPC tools that are helping with genetic research and genome sequencing. Intel has been working hard with partners to support the healthcare and education sectors in response to Covid with research in HPC and robotic solutions. One key area is their online learning initiatives to support education ecosystems around the world.

Online learning requires accessibility to the technology, virtual learning resources, study guides and help with transition and change management in the education sector. Bad organisations are destroyed by the crisis, good organisations will survive, and great organisations will flourish and be improved. This applies across all sectors into government ministries and institutions. From these break-out meetings we have learnt how ministries

of education have reacted to Covid with it being a catalyst for change, using existing infrastructure, developing technologies for the classroom, and supporting teachers in delivering blended learning in the future.

The Covid pandemic has enabled ministries to learn lessons, take a look at their current status and plan ahead in utilising this opportunity for online and virtual classes. Intel has been looking at some of the skillsets and technologies that will be critical for job creation over the next decade, and to better prepare students for jobs of the future. Virtual reality, artificial intelligence, big data, and analytics will all have an impact on education and training. So, all these technologies are critical for students to have the requisite skills in and build their capabilities in mastering new and disruptive technology.

If we look at any of these technological solutions, they need to capture three elements:

- Infrastructure that is reliable, secure, and scalable to support the teaching and learning environment. It must focus on the educator and give them the skills necessary to build immersive content, develop assessment strategies and provide personal and adaptive learning.
- Building the mindset and skills of students such that they are prepared for the unknown jobs in the future, whether it be computational thinking, coding, simulation, or artificial intelligence.
- Change management and planning for future disruption. The framework for a program of skills for innovation needs a modular and gradual approach that starts with proper planning and close collaboration between policy makers and educators. Such plans for educational change must include the training of our educators on the use of new technologies and how they can work as facilitators and enablers for this journey of learning.

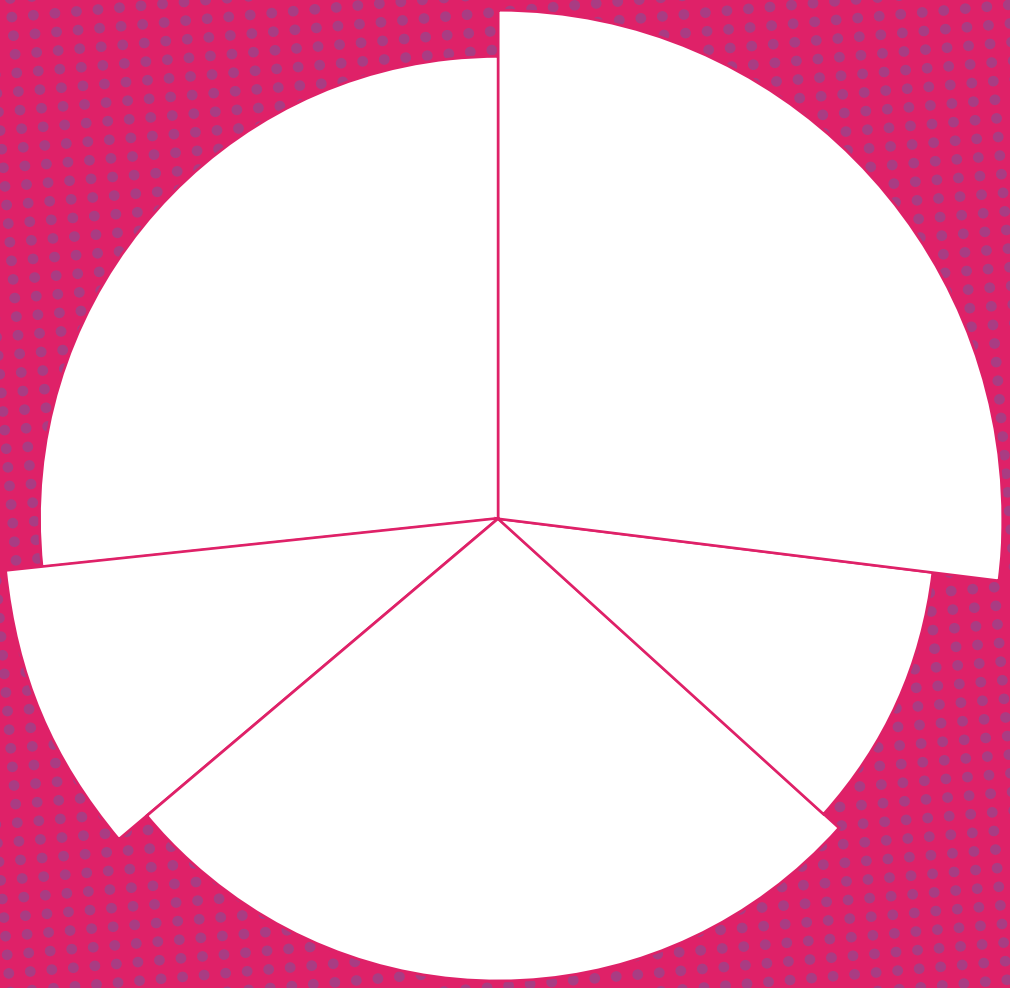
Intel is working closely to adopt the technologies and scale to a larger model. They have very specific planning tools that include workshops, planning sessions and introducing educators to best practices worldwide. At the local level Intel can support ministries of education with up to 60 hours of training for educators to facilitate skills development for innovation. They have content and material supporting about 70 different types of activity over 140 hours that can be mapped into curricula and support the development of both physical and virtual innovation spaces.

Intel is committed to supporting governments, ministries of education and educational institutions in developing local skills for innovation frameworks. As Robert Noyce, the co-founder of Intel stated:

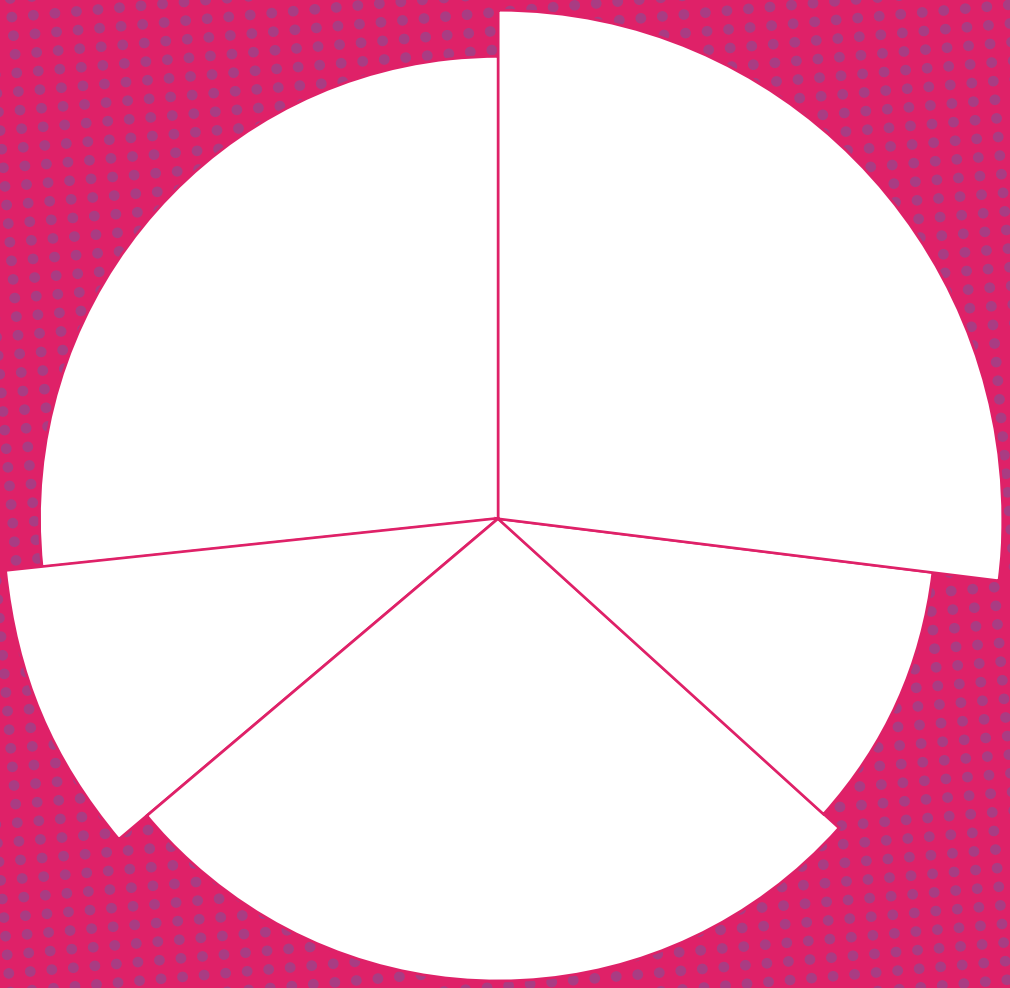
“Don’t be encumbered by history, just go out and do something wonderful.”

- End -

For further details or copies of this report, please contact john.glassey@brains.global



APPENDICES



APPENDIX A

Skills & Innovation for Jobs of the Future

Practices From Ajman Emirates

Sheikha \ Noora Humaid Al-Nuaimi
Director Of AjmanX

Emirates is flourishing by the Education and knowledge

Humaid bin Rashid Al Nuaimi
ruler of the emirate of Ajman,
member of the UAE Supreme Council of the Union

About AjmanX

AjmanX as Ajman's Growth Engine

- Innovation is the most valuable resource for the emirate of Ajman, that is crucial to economic prosperity.
- AjmanX is a **Growth Engine**, which seeks to further develop and support technological innovation through various support initiatives that will contribute to the **economic growth** of the emirate.

VISION

Achieving the Future now.

MISSION

Adopting future technology projects that meet and achieve the future of Ajman and provide distinctive future services to all sectors.

Investing of AjmanX as a Smart Digital Hub or “makerspace” to support the enablement of young people in innovation and entrepreneurship.

We Invest

on the young to engage innovation
and the programing with the education

Qualify Young Emarati Trainers

10

We Train More Than

250 Junior Programmer

Our Strategic Partners

جمعية عجمان للتنمية الاجتماعية والثقافية
Ajman Society of Social & Cultural Development
1981

INNOVATECH
IT Information Technology L.L.C

الهلال الأحمر الإماراتي
Emirates Red Crescent

مبتكر
MOBTAKER

We process of development and learning in the field of technology to qualify citizens

and raise their competition opportunities in the future job market.

6,070+

Participant from UAE Citizen

4,000+

Available Course in different sectors

2,143

Participant Completed Courses

Our Strategic Partners

وزارة الموارد البشرية والتوطين
MINISTRY OF HUMAN RESOURCES &EMARATIZATION

coursera

intel

Sharaf DG
Yes, Your Electronics Destination!

AjmanX Academy

10-week experiential program for Ajman government employees to immerse in a disruptive innovation journey to disrupt and address challenges that Ajman and the world are facing.

Purpose

Educate – Engage – Create – Implement

We Gather In 1st Cohort **4** Government Entities

Participate More than **20** Participant

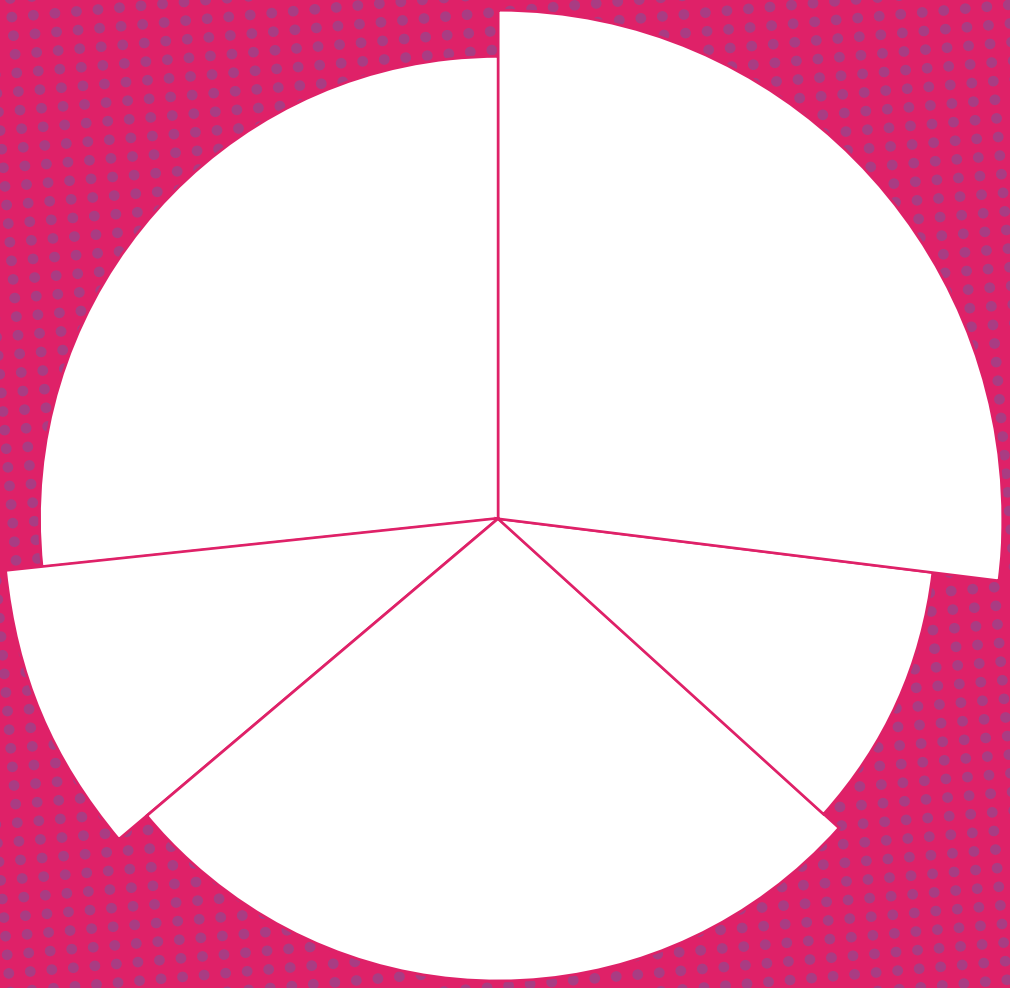
And we get out by **4** Innovative Project

Participation Entities

Our Strategic Partners


AJMAN
عجمان

Thank You



APPENDIX B

Group of business students showcasing an IoT-enabled bicycle parking station developed over 48 hours at NTU ideasinc event.

edm8ker

Innovation Skills for Job Creation

VEERAPPAN SWAMINATHAN

CEO, EDM8KER |VEERA@EDM8KER.COM

Covid-19 is accelerating transition

Why COVID-19 Is Accelerating the Future of Gender Equity

Katica Roy Follow
Apr 20 · 5 min read

Source: https://medium.com/@katicaroy/why-covid-19-is-accelerating-the-future-of-gender-equity-b9daeae900a4

Covid-19: Accelerating digitalisation

Friday 10 April 2020

According to the port of Gothenburg in Sweden, the coronavirus outbreak could accelerate digitalisation in what is an otherwise conservative shipping industry.

Source: https://www.heavyliftpfi.com/news/covid-19-accelerating-digitalisation/

COVID-19 ACCELERATING PHYSICIANS' ADOPTION OF TELEHEALTH AND CHANGING PRESCRIBING PRACTICES SAYS NEW SURVEY FROM ABELSONTAYLOR

Source: https://www.pharmalive.com/covid-19-accelerating-physicians-adoption-of-telehealth-and-changing-prescribing-practices-says-new-survey-from-abelsontaylor/

Opinion **Technology sector**

How Covid-19 is accelerating the shift from transport to teleport

We are fast moving to a world where more economic activity takes
orm

Source: https://www.ft.com/content/050ea832-7268-11ea-95fe-fcd274e920ca

Covid-19 Accelerating Energy Transition, Study Suggests

17th April 2020 jburke

Source: https://dieselgasturbine.com/covid-19-accelerating-energy-transition-study-suggests/

Commentary: The COVID-19 pandemic will accelerate a shift to digital payments

More than half of people in developed economies believe that cash will always be around, but COVID-19 may change this, say observers.

Source: https://www.channelnewsasia.com/news/commentary/coronavirus-covid-19-digital-payment-cash-infect-china-europe-us-12583302

edm8ker

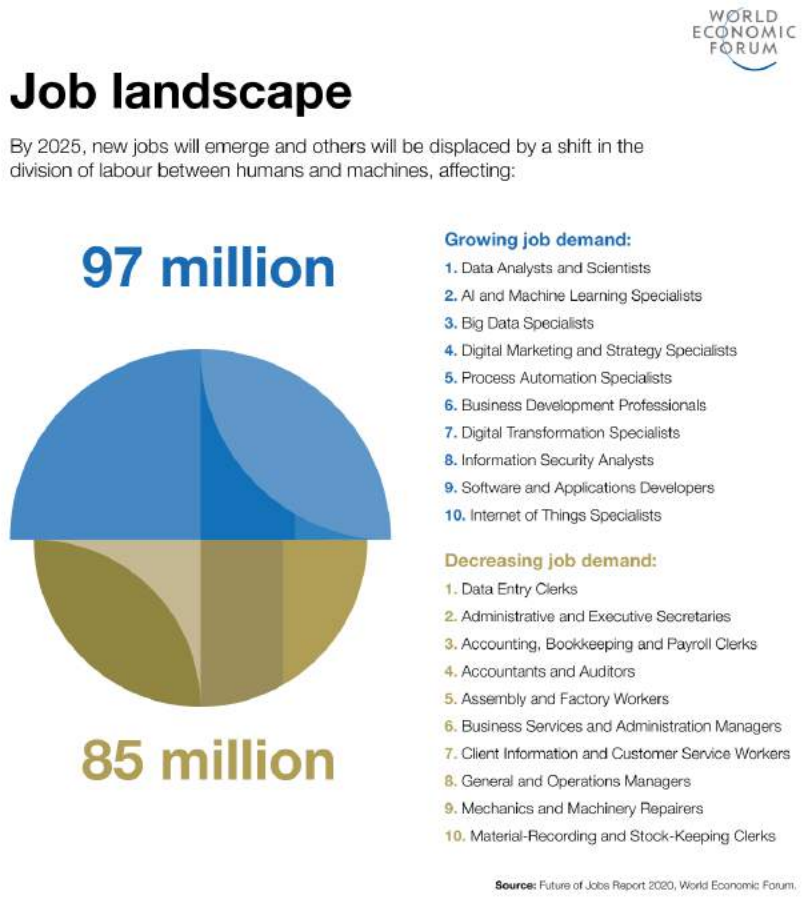
How do we transform our young people from job seekers into job creators in a technologically driven world?

CLEARLY, WE SHOULD FOCUS ON MINDSET AND SKILLSET DEVELOPMENT… BUT HOW TO MAKE IT COHERENT?

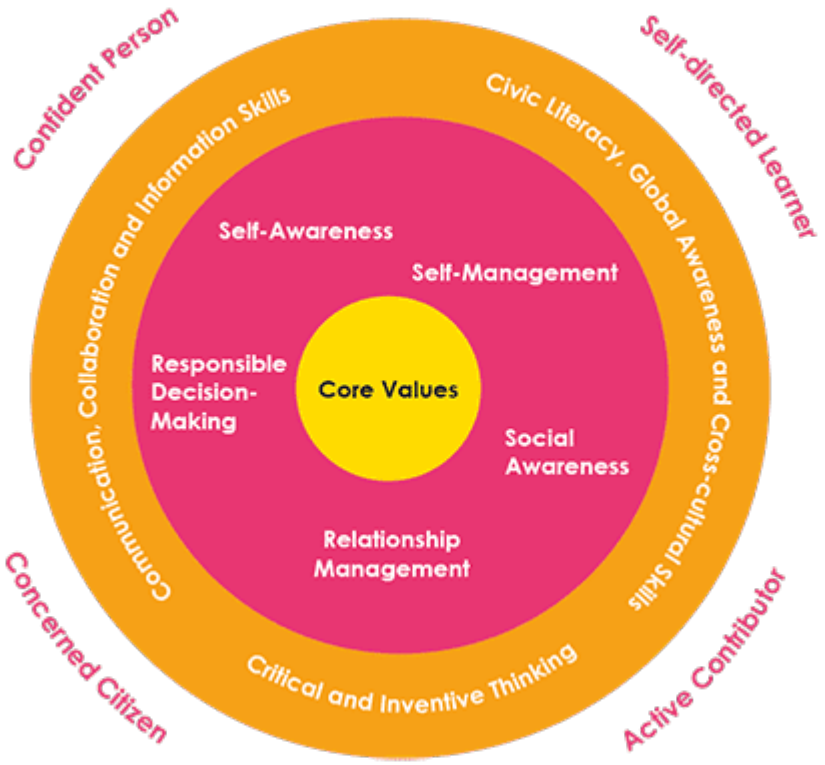
3 Key Questions

1. What mindsets/skillsets help to support job creation?
2. How do we bring skills development to the broad base of students (who tend to be non-technical)?
3. How do we leave in a place a system that will self-correct for the future?

Strategic to focus on Innovation & Higher Order Thinking Skills



Framing Innovation & Higher Order Thinking Skills



Source: Singapore Ministry of Education

- **Social Emotional Skills**
- **Innovation Mindsets**
  - *Design Thinking, Computational Thinking, Systems Thinking, Futures Thinking etc.*
- **Technology Skillsets**
  - *Data Science, Modelling, Simulation, Machine Learning, Programming etc.*

3 Key Questions

1. What mindsets/skillsets help to support job creation?
2. How do we bring skills development to the broad base of students (who tend to be non-technical)?
3. How do we leave in a place a system that will self-correct for the future?

Combine Skills Learning with Real World Applications

Applied Learning Programme (ALP): A Possible Enactment of Achieving Authentic Learning in Singapore Schools

Low June Meng

National Institute of Education/Nanyang Technological University (Singapore) & Teachers' College/Columbia University (USA)

junemeng.low@ri.edu.sg

ABSTRACT: As a response to global challenges and the need to equip its citizens with 21st century competencies, the Ministry of Education (Singapore) (MOE) announced two key programmes to enable the acquisition of these key attributes. One of them, Applied Learning Programme (ALP), serves to enable authentic learning achievement by introducing 'real world' skills to the students in Singapore schools. Having been informed by theories that surround the notion of authentic assessment and authentic learning, this paper attempts to apply these theories to the discussion on ALP, using the concept known as Work-integrated Learning (WIL) as a possible ALP reference point. Implications of its enactment, including the intractability of assessing values and desirable attributes and its impact on the traditional role of the teacher are also discussed in this paper. While the author agrees that ALP holds promise in achieving authentic achievements as a long term and sustainable form of learning that can positively influence student learning, equip students with 21st century competencies and ensure positive future outcomes, there is a need for greater scholarship discourse in the area of authentic assessment and authentic achievement and their roles in the enactment of ALP.

Source: National Institute of Education, Singapore

- Rolled out in all secondary schools in 2017.
- Rolled out in all primary schools by 2023.

Source: Science Centre Singapore

3 Key Questions

1. What mindsets/skillsets help to support job creation?
2. How do we bring skills development to the broad base of students (who tend to be non-technical)?
3. How do we leave in a place a system that will self-correct for the future?

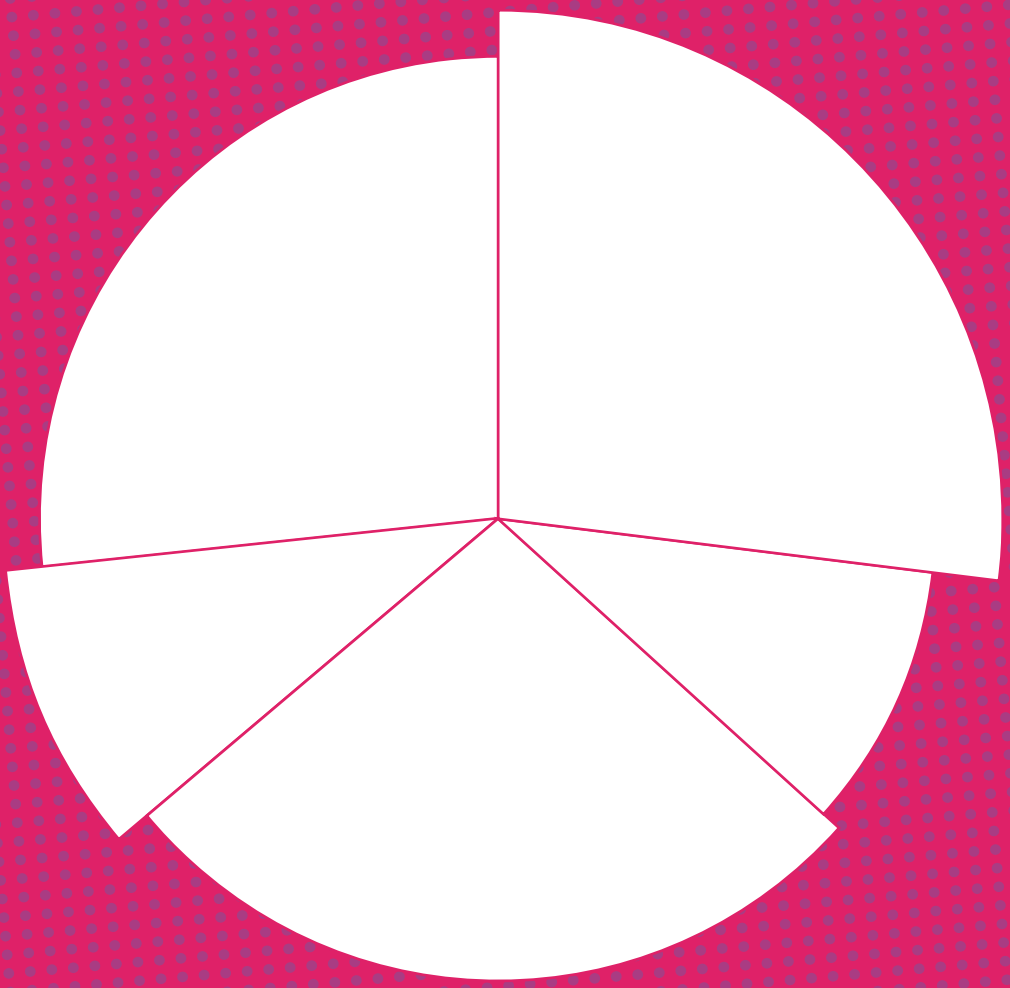
Create a culture of lifelong learning through policy & action

Source: Civil Service College and Ministry of Manpower, Singapore

edm8ker

Putting it all together

- Involve Whole-of-System – Education Policymakers, School Leaders and Teachers.
- When it comes to change, supplement first. Then perhaps, supplant.
- These approaches have been embedded into the Intel® Skills For Innovation program.



APPENDIX C

Reinventing the Role of Technology in Education: Now and into the Future

TAHA KHALIFA
EMEA-T Director,
Client Computing Group Sales
at Intel Corporation

Nov 2020

intel®

Our Purpose

To create world-changing technology that enriches the lives of every person on earth.

Intel's COVID-19 Response

CEO message

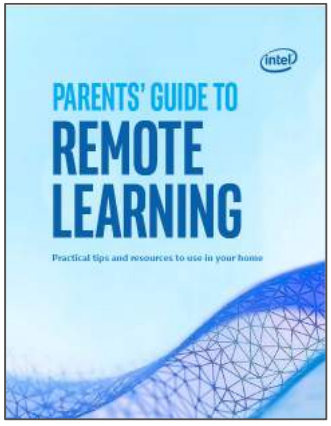
$50M PRTI

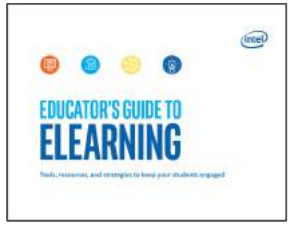
Intel experts

#WFH Tools

Online Learning Initiative

- PC Donations
- Device Connectivity Assistance
- Online Virtual Resources
- School Districts
- Study-at-Home Guides





Activity Cards

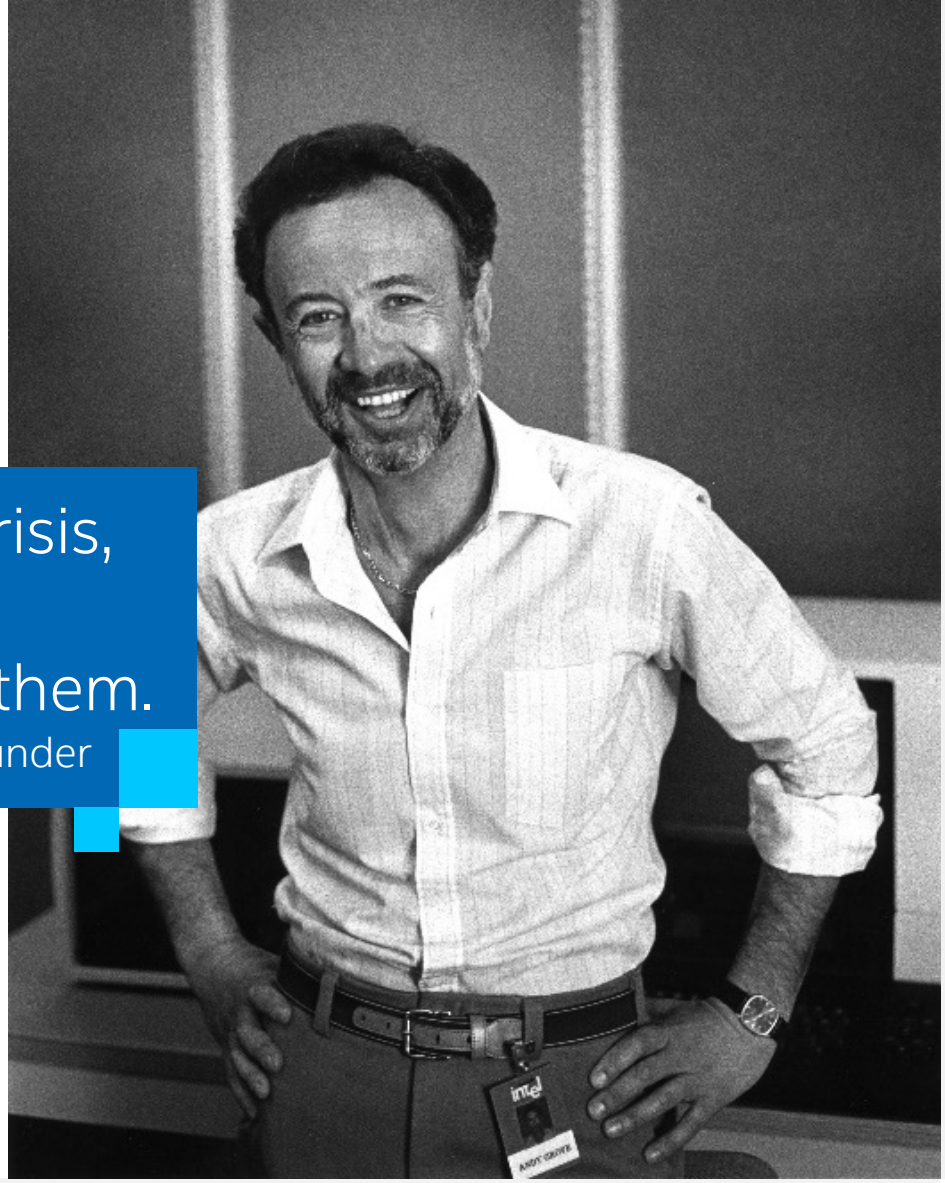
Intel.com/education

Source: https://www.intel.com/content/www/us/en/corporate-responsibility/covid-19-response.html

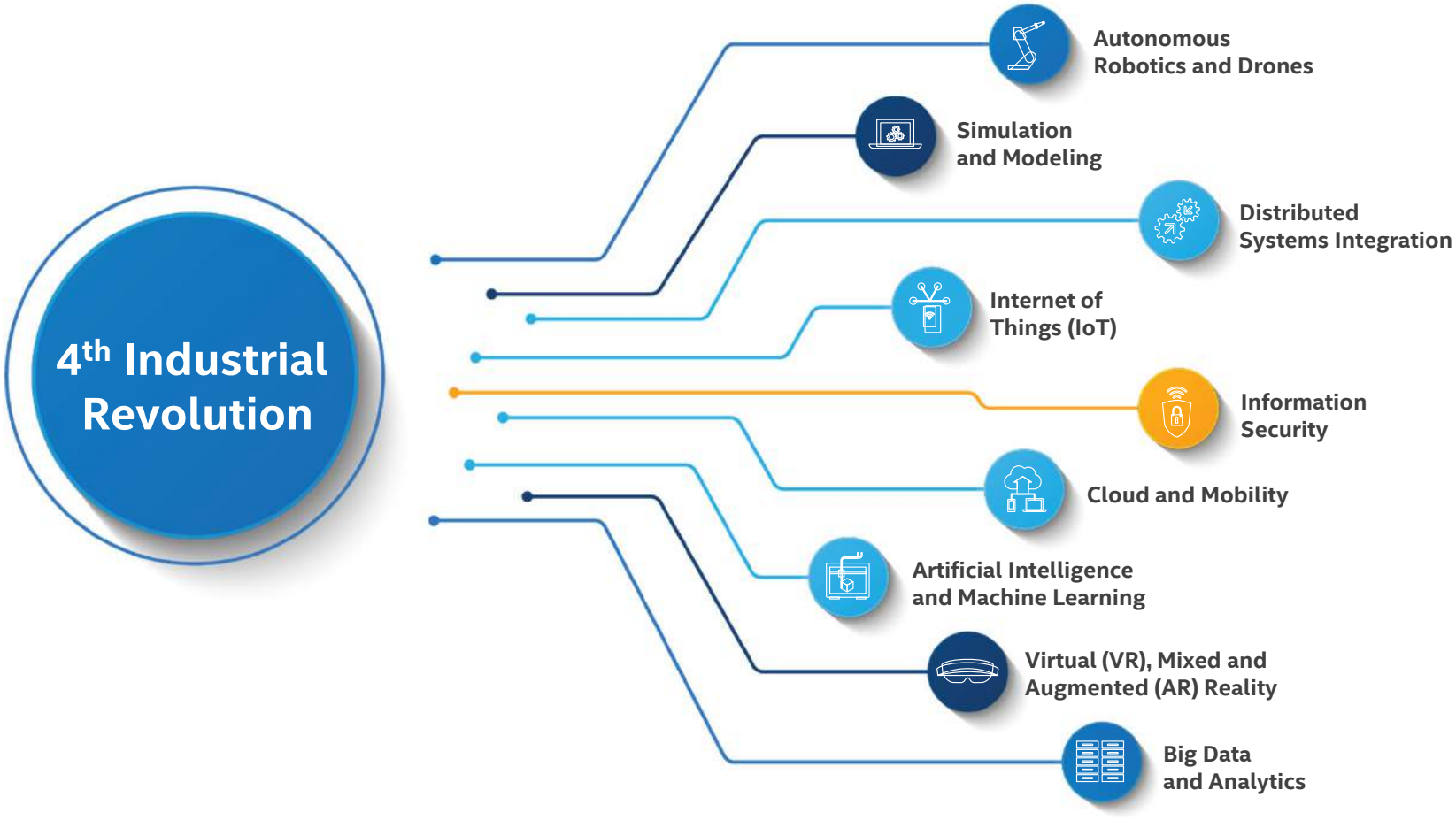
Navigating Through Crisis

Bad organizations are destroyed by crisis,
Good organizations survive them,
Great organizations are improved by them.

- Andy Grove, Intel Co-founder



The Workplace Continues to Adapt and Evolve



Introducing Intel® Skills for Innovation

Solutions for Skill Building

STUDENTS

Solutions to Practice

Design & Computational Thinking
Coding, Programming, Simulation & Modeling
Data Science
AI & Machine Learning

LEARNING & TEACHING ENVIRONMENT

Solutions to Ensure

Reliability & Scalability
Security Manageability
Collaboration

EDUCATORS

Solutions to Employ

Skill Building Activities
Immersive Content
Personalized/Adaptive Learning
Skills/Risks Assessment

Path to Adopting Intel® Skills for Innovation (Intel® SFI)

01 PLAN

Understand new skill requirements. Rethink technology's role to foster skill building. Align stakeholders and facilitate creation of action plan.

Resource: Intel® SFI Planning Toolkit

02 TRAIN

Develop educators' competencies to facilitate higher-order skills development in their students.

Resource: Intel SFI Professional Development

03 TRIAL

Experience technology used for skill building in the actual learning environment and verify viability.

Identify best practices for wider adoption.

Resource: Intel SFI Starter Kit

04 DEPLOY

Adopt technology-supported, skills-based learning models across the entire education system.

Resource: Intel Technology Solutions from Partner Network

Intel provides support along the multi-step path to integrating Intel® Skills for Innovation into an educational system

Path to Adopting Intel® Skills for Innovation (Intel® SFI)

01 PLAN

Understand new skill requirements. Rethink technology's role to foster skill building. Align stakeholders and facilitate creation of action plan.

PLANNING TOOLKIT
(FOR DECISION MAKERS)

Enables education decision makers to experience Intel® SFI and create an action plan to be ready for the Fourth Industrial Revolution.

02 TRAIN

Develop educators' competencies to facilitate higher-order skills development in their students.

PROFESSIONAL DEVELOPMENT
(FOR EDUCATORS)

Enables educators to facilitate development of skills for innovation in students.

03 TRIAL

Experience technology used for skill building in the actual learning environment and verify viability.

Identify best practices for wider adoption.

STARTER PACK
(FOR SCHOOLS & EDUCATORS)

Enables schools to support the development of physical & virtual innovation spaces with lesson plans & activities.

04 DEPLOY

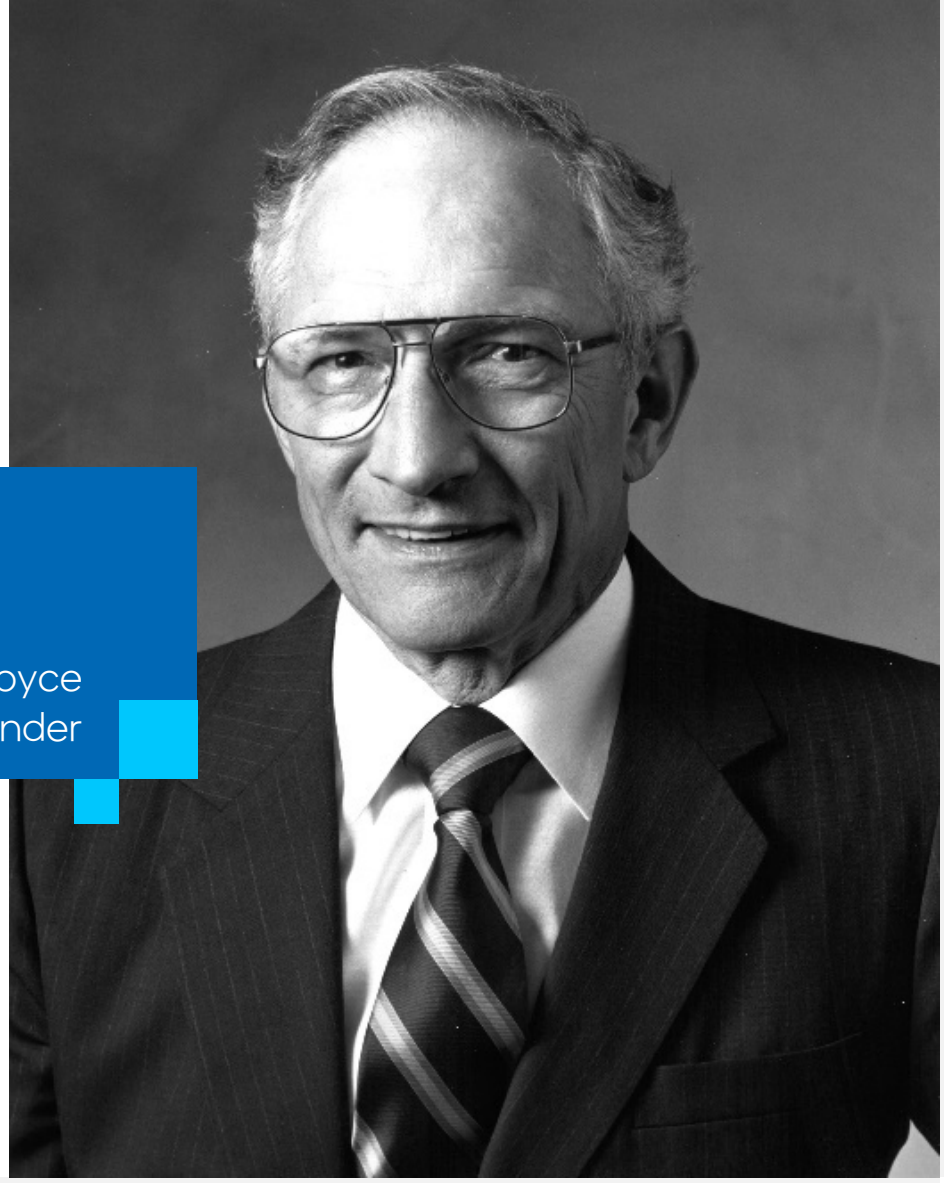
Adopt technology-supported, skills-based learning models across the entire education system.

ENGAGE WITH INTEL PARTNER ECOSYSTEM

Allow decision makers and educators to understand, experience, and implement the SFI Vision

Don't be encumbered by history.
Go off and do something **wonderful**.

- Robert Noyce
Intel Co-Founder



Taha Khalifa, taha.khalifa@intel.com