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e - LEARNING EXCELLENCE

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Preface

Innovation Arabia 8, was held under the patronage of His Highness Sheikh Hamdan Bin Mohammed Bin Rashid Al Maktoum, Crown Prince of Dubai and President of HBMSU. Innovation Arabia 8 took place in the Address Hotel, Dubai Mall, in Dubai during the period 16 to 18 February 2015. The main theme of this year conference is "Innovate, Collaborate, and Differentiate: Honouring the Past, Treasuring the Present, and Shaping the Future". This theme reflects the belief that, innovation is the path towards growth, progress and a better tomorrow for the Arab World. Innovation Arabia is a scientific refereed event where thought leaders, academics, and the professional community searching to exchange ideas, discuss trends, solutions and challenges in the development of sustainable economies and societies in the Arab World through innovation. Innovation Arabia will feature four important tracks:

- Quality and Business Management
- Smart Learning
- Health and Environment and
- Islamic Banking and Finance

The main objectives of Innovation Arabic are:

1. To discuss theoretical and applied research related to innovation in quality, e-learning, Islamic Banking and Finance and Health and Environment.
2. To analyse current issues and challenges facing the Arab World and the role of innovation in creating sustainable development.
3. To provide a forum for exchange of research ideas and practices and the creation of new ideas to assess the current state of knowledge and development of the discipline in theory and practice.
4. To provide an environment for free discussion of new concepts, research developments, and applications in innovation in quality, e-learning, Islamic Banking and Finance and Health and Environment.

One important purpose of the conference was to highlight the significance of innovation to enhance the UAE and the Arab world's economic competitiveness. Innovation Arabia was the outcome of our belief that, innovation is the path towards growth, progress and a better tomorrow for the Arab World. Innovation Arabia should help to capitalize on the successes and the potential of this community.

This conference represented a small step forward, by giving scholars, researchers, thinkers and practitioners the opportunity to share thoughts, debate issues, exchange knowledge and create consensus on the 'future' and what might or might not happen.

The conference featured many other activities including many formal and informal networking opportunities including an exclusive gala dinner, bringing together researchers, industry leaders from international organizations, local and regional government entities and the corporate sectors and NGOs to discuss and address trends, solutions and challenges in the development of sustainable economies and societies in the Arab World through innovation.

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Education Transformation: A Proactive Approach for Schools to Change with Changes in Society

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Abstract

Education is ripe for transformation given the world's social and economic development and needs for new skills. Education systems around the world are looking for ways to leverage as well as contribute to the growing climate of innovation and creativity all while keeping up with changes in society. Advancing education reform particularly in countries with a growing youth population will encourage responsible citizenship, develop their human capacity and support their transition into a knowledge based economy. In recent years, education has been transformed from a teacher-centered approach to a learner-centered one. Innovative applications in education such as digital games, virtual reality, and robotics have gained importance to support learners and teachers with this transformation and to develop 21st century skills of learners such as problem solving, collaboration, creativity, and critical thinking. Information-age society and the workforce expect students to possess these skills. In addition, studies show that ICT can help increase student engagement, motivation and attendance. Educators ought to bring innovative applications to classrooms and benefit from their motivational power to prepare students for their future.

The potential for eLearning to improve performance on core subjects and foster the development of 21st century skills depends on the schools ability to model student-centered, highly personalized learning environments supported by innovative teaching practice, administrative support and transformative policies to enable these learning strategies. Intel's Education Transformation Model is a proven, holistic

model to facilitate successful change. Grounded in research, this model provides a holistic framework that encompasses seven essential elements: Leadership, policy, professional development, information communications technology (ICT), sustainable resourcing, research and evaluation, and curriculum and assessment. The Model reflects evidence-based best practices that have emerged from Intel's collaborations with school systems and governments in more than 100 countries to advance their visions of education transformation. Using this model, stakeholders can address the practicalities of deep, large-scale, long-term change with ICT, to create sustainable improvements in student learning.

Introduction

A profound shift is occurring, largely because a number of big changes are happening concurrently in the global economy, information technology sector and current social conditions.

Global Economy

In today's most challenging economy, the requirements for both competition and collaboration are greater than ever. The 21st century is characterized by exponential advances in ICT and globalization unimaginable to earlier generations, in addition to an ever-increasing pace of change and the constant creation and application of new knowledge. These fundamental economic, social, political, and technological changes that have taken place so rapidly over the last two decades have fuelled a global achievement gap. The gap is between what students are taught versus what they need to succeed as learners, workers and citizens in today's global knowledge economy (Wagner, 2008).

In order to live and succeed in a global economy, students should be prepared to meet the challenges of the new century. Mastery of basic skills is not sufficient; they will have to be comfortable with ideas and abstractions, good at both analysis and synthesis, creative and innovative, self-disciplined and well organized, able to learn very quickly and work well as a member of a team and have the flexibility to adapt quickly to frequent changes in the labor market as the shifts in the economy become ever faster and more dramatic (Darling-Hammond, 2010).

Technology Innovation

Regardless, of which side of the 'technology disrupting the classroom' argument, one supports, there is no doubt that technology has grown by leaps and bounds in the last decade enabling low-cost and widespread applications such as high-speed mobile networks, tablet devices, processing of huge amounts of data, sophisticated online gaming and adaptive-learning software. New data-mining software is able to predict when a student is likely to fail at reading or mathematics without special attention, allowing the teacher to intervene before it is too late (The Economist, 2013).

The remarkable ways technology have influenced several aspects of our lives - how we purchase products, communicate, transfer money, and more - promises to impact the education world as well, to name a few: autonomy, productivity, collaboration and data-driven decision making. Technology may have direct impact on self-directed learning by means of facilitating on-demand access to both information resources and online expertise (Candy, 2004).

Teachers can benefit from productivity gains through lesson plans, activities and assessment creation tools while students can use tools to organize assignments, create study groups and take notes. Collaboration tools facilitate efficient communication and management of group activities and resources. Information is the key to improved performance, technology solutions efficiently collect and analyze students' skill mastery and provide timely feedback to advance their learning and to drive differentiated instruction.

All of these features: self-direction, collaboration, productivity, and data-driven decision making combined, create a personalized learning environments that meet students where they are, determine where they need to be, and find and scaffold the right zone of proximal development to get them there (Patrick, et al., 2013). Our technologically enriched society and today's tech savvy generation expect a relevant, flexible, engaging, and customized education that helps them acquire 21st century skills.

Employment and Economic Growth
The macroeconomic situation deteriorated substantially during 2011, both at the global and Arab regional levels. The wave of uprisings that started in Tunisia and Egypt at the beginning of 2011 expanded across the Arab region, restraining economic growth in a number of other countries. Moreover, the world is confronting a worsening youth employment crisis with young people three

times more likely to be unemployed than adults and over 75 million youth worldwide seeking meaningful employment. The International Labour Organization has warned of a "scarred" generation of young workers facing a dangerous mix of high unemployment, increased inactivity and precarious work. Moreover, high levels of unemployment is a detriment to economic growth.

The Arab world is young; one in five people are 15-24 years old and 50-90 million young people are expected to enter the job market in the coming decade. The Arab region is the only region where unemployment exceeded 10% in 2011 for the population aged 15 years or older (Mirkin, 2013). Youth unemployment has been at very high levels for decades in this region and rose sharply in the wake of the Arab Spring to be the highest in the world and twice the global rate for youth (Mirkin, 2013).

Twelve million additional jobs need to be created by 2025 in the Arab Region to prevent youth unemployment, currently at almost 30% in the region, from increasing even further (Mirkin, 2013).

The data also demonstrate that unemployment in the Arab world disproportionally affects individuals with higher educational attainment – a phenomenon which is unique in the world (Chaaban, 2010). One of the factors behind this phenomenon is the global issue of skills mismatch. Skills mismatch is the gap between the skills required on the job and those possessed by individuals. This issue has become more prominent in the global economic crisis and a high priority policy concern across the world. Many employers around the world complain about their inability to fill job vacancies due to a lack of soft skills, namely team work, interpersonal skills, leadership, knowledge of foreign languages, readiness to learn, problem solving and ICT skills (Helve, et al., 2014). Taking in consideration that unemployment rates are highest among the most educated and employers frequently cite the lack of suitable skills as an important barrier to hiring, this suggests that education systems in the region fail to produce graduates with needed skills (Ahmed, et al., 2012).

Education outcomes, especially, the cognitive skills of the population, rather than mere school enrolment, are powerfully related to economic growth (Hanushek & Wößmann, 2007). Cognitive skills include the capacity to acquire knowledge, interpret, reflect, reason, think abstractly, digest complex ideas, solve problems, and extrapolate based on the knowledge acquired. These skills are high in demand in all labor markets.

It's time for education systems to embrace their role in preparing students for jobs that might not exist today, particularly, in the Arab world where the growing youth population will lead and shape societies and governments in the near future.

Technology to Become a Bridge between Challenges and Opportunities
With the emergence of an information-age society, our focus has become transforming educational methods for students to meet changing societal needs (Aslan & Reigeluth, 2013. Today's students, who are referred to as digital natives, are born in a technologically-rich world (Prensky, 2001). According to a recent study by Common Sense Media (2013), 72% of children (at the age of 8 and under) have used a mobile device (e.g., smartphone, tablet, or a similar device). More interestingly, among children under 2, the study identified that 38% have used such a device for different applications (e.g., playing game and watching videos).

Transformation from a teacher-centered approach to a learner-centered one requires innovative new methods for instruction and assessment in education rather than simply bringing technology devices in classrooms. Among a variety of innovative applications that schools are practicing in their classrooms today, the most prominent ones are digital games, virtual reality, and robotics.

Digital Games
According to Squire (2006), digital games are important means for improving students' 21st skills in education. In addition to increasing motivation of students towards learning, educational games can improve students' collaboration and problem-solving skills. Trespalacios, Chamberlin, and Gallagher (2011) conducted a study on the effects of video games. The results showed that the students got more motivated through multiplayer games than one-player games because interaction among peers increased collaboration and competition.

In another study, Hwang, Wu, and Chen (2012) designed an experiment with two groups: One implementing a web-based problem-solving activity through a digital game and one implementing a traditional problem-solving activity. The results supported that the competition and challenges of the game increased the motivation of the students in the experiment group. Incorporating the digital gaming approach resulted in improving students' learning achievements. Additionally, the

students in the experiment group were found to perform better in active participation, concentration, motivation, and problem-solving.

To investigate use of serious games with 8th grade students, Sanchez and Olivares (2011) conducted a quasi-experimental study. The researchers investigated the differences between the experimental group (implementing class activities based on Mobile Serious Game (MSG)) and the control group (implementing traditional class activities). A special mobile device was designed for this experiment where students played an educational game in groups of four. Each student had different roles in the game. They were asked to actively collaborate and find solutions to the problems as a group to win the game. The researchers compared the experiment results between these two groups in terms of collaboration and problem-solving skills. The results showed that the students in the experimental group achieved higher in terms of collaboration and problem-solving skills.

Virtual Reality

As a means to enrich instructional content through interactive 3D simulations, virtual reality can be used in education as an innovative application of technology (Pantelidis, 2010). Empirical research studies supported that applying virtual reality in instruction improved students' 21st century skills including problem-solving, creativity, critical thinking, leadership, self-direction, and peer mentoring.

Hwang and Hu (2013) research showed that geometric learning achievement of students in the experimental group was higher than the control group. The results also supported that peer learning behaviors made the process of geometric problem solving easier. The students were able to share opinions with each other and discover multiple representations of abstract geometric concepts from their peers.

Morales, Bang, and Andre (2013) study of the relationship between social interaction and student learning demonstrated that peer-mentoring and collaboration existed in the learning environment and facilitated construction of knowledge. Additionally, global cooperation and social-networking activities contributed to improving student learning. In addition, both teachers

and parents observed improvement in students' creativity, problem-solving, critical thinking, leadership, self-direction, and peer mentoring.

Robotics

Robotics can provide authentic learning environments for students to enhance their technological literacy skills by interacting with the modern world (Castledine & Chalmers, 2011). Related literature support that personal skills of students such as self-confidence, problem-solving, creativity, and communication can be improved when students get involved in robotics-related activities in schools.

Khanlari (2013) investigated perceptions of teachers about impacts of robotics on students' 21st century skills. The results indicated that robotics encouraged students to be more creative, collaborative, self-directed, and also developed their communication, social, and cross-cultural skills.

In another study, Castledine and Chalmers (2011) investigated the correlation between problem-solving skills of students in performing LEGO robotics activity and the skills of these students to apply such techniques to real-life situations. The results indicated that metacognitive and problem-solving abilities of students improved when the students interacted with robots.

Stakeholders of Change

It is crucial to respond flexibly to complex problems, communicate effectively, manage information dynamically, work and create solutions in teams, use technology effectively, and produce new knowledge, continuously (Griffin, et.al. 2012). Studies on effective integration of technology in education show the opportunities ICT provides to help increase student engagement, motivation, and attendance—key requisites for learning. The potential for eLearning to improve performance on core subjects and foster the development of 21st century skills depends on the schools ability to model student-centered, highly personalized learning environments.

In a study of the educational impacts of the Berkshire Wireless Learning Initiative (BWLI), teachers overwhelmingly reported improvements in student engagement and motivation resulting from their participation in a pilot program that provided 1:1 technology access to all students and teachers across five public and private middle schools in western Massachusetts. Teacher survey

responses indicate that 83% of the teachers felt that engagement had improved for their traditional students, compared to 84% for at-risk/low achieving students, and 71% for high achieving students. Similar to the results on student engagement, teachers overwhelmingly found that the 1:1 pilot program enhanced their students' motivation. 76% of 1:1 teachers reported that student motivation improved for their low achieving students compared to 73% for traditional students and 59% for high achieving students. (Bebell & Kay, 2010)

Furthermore, responses from 388 district technology directors indicate that about half of those surveyed in a recent study on teacher Web 2.0 use reported an increase in students' familiarity with technology. Similarly, almost half of these teachers indicated that the students are more motivated to learn as a result of Web 2.0 use in their district. Other outcomes identified in the study include: an increase in student academic engagement (39%), and improved students' collaboration skills (38%)." (IESD, 2011) In addition, elementary teachers indicate the greatest impact on student success may be attributed to their motivation to learn (62% vs. 44% for high school teachers). (Project Tomorrow, 2011)

Today, 15 of 21 countries with high-performing education systems studied reported ICT standards for students that were either embedded in other academic content standards or in separate documents. (US Dept. of Education, 2011)
Teachers' perceptions overwhelmingly indicated that certain student competencies related to 21st century skills were improved for their students (autonomy, organization, search and ICT). Results from a two year study of a pilot program for tablet PCs in the classroom indicates that using tablet PC's requires more collaboration and project-based work. (Universidad Autónoma of Barcelona, 2010)

Blended learning provides a personalized experience that allows each student to work at his or her own pace, supplementing the school curriculum. By leveraging technology, blended-learning programs can let students learn at their own pace, use preferred learning modalities, and receive frequent and timely feedback on their performance for a far higher quality learning experience. Online programs can capture student performance data in real-time across the school, allowing teachers more time to help students who need it. (Horn et al, 2011)

In addition to blended learning, students and parents express interest in online environments. When asked about why they would like to take an online class, middle school students identified a desire to be in control of their own learning (45%), to get extra help in a challenging subject (44%) and to work at their own pace (42%). Today, five times as many parents stated they would incorporate online classes into their vision of the ultimate school for their child, an increase from those who responded in a similar way in 2008. (Project Tomorrow, 2011)

As a result, when technology is implemented properly, schools with a 1:1 student-computer ratio outperform all other schools both academically and in reduced disciplinary actions and dropout rates with increased student graduation rates. (Greaves et al, 2010)

In understanding ICT impact on teaching, researchers have reported that issuing laptops to teachers, or helping them purchase laptops, can empower them to teach better, increase lesson planning and preparation productivity, gain a more positive attitude about their work, and improve efficiency of management and administration tasks. There remains a tension between technology and pedagogy where technology-driven innovations outnumber pedagogy driven innovations, limiting the educational potential. If so, the link between technology and pedagogy must be improved in order to utilize technology for effective learning strategies. (OECD, 2010, Global)

The quality of the type of work a teacher assigns strongly predicts the quality of the work that a student completes. Based on the rubrics for learning activities of 21st century skills, over 90% of the variance in student work scores was due not to differences in the students but differences in the classroom learning activities the students completed within the classroom. (SRI International, 2010)

Results of a study to investigate any change in student teachers' intentions and actions in integrating technology into their teaching following participation in a course to provide more pedagogical knowledge about how to integrate the technology in their future teaching showed increases in each of the following: their intentions to use ICT for student-centered learning, their intentions to be a facilitator in class, and their confidence level in playing a leadership role in integrating ICT in schools. (Choy et al., 2009)

Although results of specific implementation and outcomes of the 1:1 initiative varied, teachers reported that within months of the initial student implementation, teacher and student use of technology increased dramatically across the curriculum in nearly all of the participating classrooms. On average, teachers reported widespread adoption of new and novel approaches across their traditional curriculum. (Bebell & Kay, 2010)

Administrators also report using a wide variety of technology tools and services for their professional tasks. Almost all administrators at 99% are tapping into communications tools to connect with peers or parents. At 66%, slightly more administrators are creating multi-media presentations than teachers. Administrators are also demonstrating some advanced technology skills by participating in webinars (66%) and professional online communities (60%). (Project Tomorrow, 2011)

The International Development Bank has observed multiple justifications for implementing 1:1 programs. Policy makers include educational initiatives to improve the economic competitiveness of their countries by preparing students for a technology-saturated workplace. Other reasons focus on equity of access to digital resources and reducing the digital divide. Other initiatives' primary focus is to improve the quality of education through new practices such as student-centered learning. (Severin & Capota, 2011)

Intel Education Transformation: A Holistic Model

A proven, holistic model to build success is Intel's Education Transformation Model. It facilitates second- order change for educational technology initiatives. Grounded in research, this model provides a holistic frame-work that encompasses the seven essential elements shown on the right. Intel's Education Transformation Model reflects evidence-based best practices that have emerged from Intel's collaborations with school systems and governments in more than 100 countries to advance their visions of education transformation. Using this model, stakeholders can address the practicalities of deep, large-scale, long-term change with ICT, to create sustainable improvements in student learning.

Figure 1: Intel Education Transformation Model
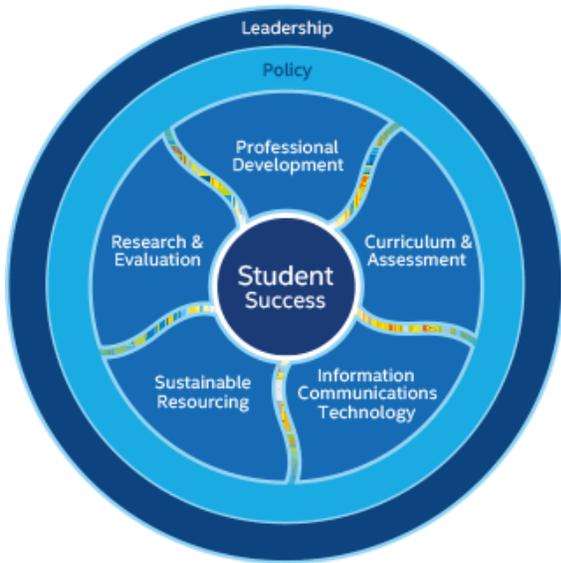
For the context of this paper, we will provide a summary of the Leadership and Policy elements only.

Leadership

It takes effective leadership to achieve major changes. Leaders establish a long-term vision, communicate it clearly, and promote organizational and educational transformation. They inspire teachers, parents, community members, funding bodies, and others to believe in the vision and work toward achieving it. Effective leaders also align education transformation goals with larger national objectives through a master plan for national, state, or system-wide implementation.

The Model recommends 6 steps to leading an ICT in education initiative: (1) **Define your vision, (2) Develop a master plan, (3) Inspire enthusiastic support, (4) Create organizational policies, (5) Develop a budget, and (6) Incorporate measures to evaluate and improve.**

Policy

The policy framework creates the conditions for success. Policies can accelerate progress toward transformational use of educational technologies, or present roadblocks that slow progress.

Learning must drive the use of technology. Technology must not drive learning. Effective policy can bring for example teacher-leaders to act as coaches for other teachers in their subject area, or bringing in scientists, artists, researchers and others into schools even though they do not have traditional certification. These outsiders can bring a perspective and help teachers reframe the learning conditions.

Effective policies are flexible, practical, action-oriented, and evidence-based, focused on learning outcomes, support fairness and equity, encourage local autonomy and innovation while ensuring accountability, and are consistent and coherent across school, state, and national levels. Moreover, policies for educational technology initiatives should optimize the use of technology as a platform for learning and teaching while protecting students and maintaining data privacy (Koh, 2014).

Classroom Impact

For over a decade, Intel has engaged in educational initiatives to provide millions of teachers and students around the globe some of their first experiences with the principles and practices of education through the effective integration of technology that enables project-based-learning strategies. By virtue of Intel programs, for example, teachers have developed lesson plans for implementing project-based learning, teens have created multimedia presentations on local social issues, student groups have discovered ways of representing content-specific data and ideas using novel online tools, school administrators have assessed learning outcomes using performance-based methods instead of tests focused on information recall, and schools have implemented personalized learning strategies.

From the early stages of this work Intel has also engaged independent researchers to monitor and evaluate its efforts to answer questions about the impact of these programs. As a result, studies have supported the emergence of critical insights and understanding of education transformation. The data collected in association with the Intel education initiatives around the world shows that educational ICT can support change, positively affecting an array of educational outcomes such as improving school attendance, deepening conceptual understanding in core school subjects, and promoting critical thinking skills.

Recent education transformation research designed to meet the emerging questions of all actors interested in transforming education systems through the integration of ICT included review multiple reports and studies, to identify patterns, similarities, and differences in the experiences of initiating 1:1 eLearning initiatives. In addition, exploratory case study methodologies were utilized to conduct observations and interviews of classrooms, teachers, and students around the world.

One example studied the Todos En La Red, or All Kids Online program in Argentina, a 1:1 laptop program designed especially for students to provide a collaborative, interactive learning experience for access at home and school. The research team sought to understand how technology fits into the complex realities of classrooms and how computers could be used in the classrooms of the developing world. Besides the devices and connectivity, the program included opportunities for students, resources and training programs for teachers to provide them with new teaching strategies. Classroom observations provided evidence of how the ICT resources had become a daily part of learning in the classroom through a mix of pre-existing teaching and learning strategies, but enriched and modified by the technology. The tablets were being used as frequently as typical Argentine students use a combination textbook, workbook, study guide, and notebook referred to as a "copybook". As a result, having the technology in the classroom provided increased access to educational resources, increased efficiency in classroom management by placing personalized learning materials directly onto the device, and, the technology served as a portfolio of work so parents and teachers can monitor each student's progress more effectively.

The challenges of learning new ways of instruction are often considered during times of reform. However, the researchers observing these classrooms found that although some of the teachers visited also were experimenting with innovative practices, such as project-based learning, in their routine daily practice, the teachers were not abandoning their old resources or teaching models nor were they resisting ICT. Rather, they were adapting old practices to work with their new, technology enabled classrooms by infusing ICT into established practices (Light & Pierson, 2012).

The reports that synthesize the findings can be found at this location and reports that highlight guiding principles for the design and implementation of eLearning initiatives can be found here.

Conclusions
Education was never more important than today. It has become top priority on the agenda of governments, NGOs, civil society, and private sector worldwide that are increasingly working closer together in multilateral alliances on local and global levels. Quality education for all is not only a human right but a necessity for the socio-economic development of all countries. The

ultimate goal is to improve students' learning progression and readiness for work and life today and in future. The magnitude of the challenge is obvious and the road to improvement will involve major institutional and structural changes not simple expansion of resources.

Technology is a powerful instrument. It has changed the way we live and work, and when used properly is catalyzing change to education systems to transform learning, and provide a profound and lasting difference to students' lives, and their nations' economic destiny in the 21st century. A holistic systemic transformational approach to student success is critical for equity, quality and sustainability. Intel Education Transformation Model include all vectors necessary: Leadership and Policy, Professional Development, Curriculum and Assessment, Information and Communications Technology, Sustainable Resourcing, and Research and Evaluation.

As more and more countries and schools adopt the Intel Model, best practices of effective technology integration in teaching and learning will continue to be informed by research and shared with all governments, NGOs and private sector interested in shaping together education transformation processes in countries all over the world.

References

Aslan, S., & Reigeluth, C. M. (2013). Educational Technologists: Leading Change for a New

Paradigm of Education. TechTrends, 57(5), 18-24.

Ahmed, M., Guillaume, D. & Furceri, D., 2012. Youth Unemployment in the MENA Region: Determinants and Challenges. s.l., World Economic Forum.

Bebell, D. & Kay, R. (2010). One to One Computing: A Summary of the Quantitative Results from the Berkshire Wireless Learning Initiative. Journal of Technology, Learning, and Assessment, 9(2). Retrieved from: http://www.jtla.org.

Candy, P. C., 2004. Linking thinking: Self-directed learning in the digital age, Canberra: Department of Education, Science and Training; DEST Fellowship Scheme.

Castledine, A., & Chalmers, C. (2011). LEGO Robotics: An Authentic Problem Solving Tool? Design and Technology Education, 16(3), 19-27.

Chaaban, J., 2010. Job creation in the Arab economies: Navigating through difficult waters, s.l.: United Nations Development Programme, Regional Bureau for Arab States.

Choy, D., Wong, A.F.L., Gao, P. Gao, (2009) Student Teachers' Intentions and Actions on Integrating Technology into Their Classrooms during Student Teaching: A Singapore Study. Journal of Research on Technology in Education. 42(2), 175–195. ISTE (International Society for Technology in Education).

Common Sense Media. (2013). Zero to Eight: Children's Media Use in America 2013. Retrieved from:

https://www.commonsensemedia.org/research/zero-to-eight-childrens-media-use-in-america-2013

Darling-Hammond, L., 2010. The Flat World and Education: How America's Commitment to Equity Will Determine Our Future (Multicultural Education Series). New York, NY: Teachers College Press.

Fullan, M. (2011). Whole System Reform for Innovative Teaching and Learning. ITL Research. Retrieved from: http://www.itlresearch.com/images/stories/reports/ITL%20Research%202011%20-%20Findings%20and%20Implications.pdf

Greaves, T., Hayes, J., Wilson, L., Gielniak, M., & Pierson, R. (2010). The Technology Factor: Nine Keys to Student Achievement and Cost-Effectiveness. MDR

Griffin, P., McGaw, B., Care, E., (2012) Assessment and Teaching of 21st Century Skills. Introduction Kozma, B., Roth, M. Springer.

Hanushek, E. A. & Woessmann, L., 2010. The high cost of low educational performance: The long-run economic impact of improving PISA outcomes, Paris: OECD Publishing.

Hanushek, E. A. & Wößmann, L., 2007. The role of education quality for economic growth, s.l.: The World Bank.

Helve, H. et al., 2014. Matching skills and labour market needs: building social partnerships for better skills and better jobs, s.l.: World Economic Forum.

Horn, Michael B., and Staker, Heather, (2011). The Rise of K–12 Blended Learning. Mountain View, CA: Innosight Institute. Retrieved from: www.innosightinstitute.org

Hwang, G., Wu, P., & Chen, C. (2012). An online game approach for improving students' learning performance in web-based problem-solving activities. Computers & Education, 59, 1246–1256.

Hwang, W., & Hu, S. (2013). Analysis of peer learning behaviors using multiple representations in virtual reality and their impacts on geometry problem solving. Computers & Education, 62, 308–319.

Khanlari, A. (2013). Effects of Robotics on 21st Century Skills. European Scientific Journal, 9(27), 26-36.

Koh, T. S., 2014. Policy: Setting the Framework for Success. In: Transforming Education for the Next Generation: A practical Guide to Learning and Teaching with Technology. s.l.:Intel Corporation, pp. 32-40.

Light, D. & Pierson, E. (2012) Highlighting Changes in the Classrooms of a Successful 1-to-1 Program in Rural Argentina: Case Studies of Todos Los Chicos En La Red in San Luis. Intel Education. Retrieved from: http://www.intel.com/content/www/us/en/education/evaluations/other-programs.html

Mirkin, B., 2013. Arab Spring: Demographics in a region in transition, s.l.: United Nations Development Programme, Regional Bureau for Arab States.

Morales, T. M., Bang, E., & Andre, T. (2013). A One-year Case Study: Understanding the Rich Potential of Project-based Learning in a Virtual Reality Class for High School Students. Journal of Science Education and Technology, 22, 791–806.

OECD (Organisation for Economic Co-operation and Development). (2010a). Inspired by Technology, Driven by Pedagogy: A Systemic Approach to Technology-Based School Innovations, OECD Publishing. www.oecd.org/publishing/corrigenda

Pantelidis, V. S. (2010). Reasons to Use Virtual Reality in Education and Training Courses and a Model to Determine When to Use Virtual Reality. Themes in Science and Technology Education, 2(1-2), 59-70.

Patrick, S., Kennedy, K. & Powell, A., 2013. Mean What You Say: Defining and Integrating Personalized, Blended and Competency Education, Vienna, VA: iNACOL.

Prensky, M. (2001). Digital natives, digital immigrants. On the Horizon, 9(5), 1-6.

Project Tomorrow, (2011). The New 3 E's of Education: Enabled, Engaged, Empowered: How Today's Educators are Advancing a New Vision for Teaching and Learning. Retrieved from: www.tomorrow.org/speakup/pdfs/SU10_3EofEducation_Educators.pdf

Sánchez, J., & Olivares, R. (2011). Problem solving and collaboration using mobile serious games. Computers & Education 57, 1943–1952.

Severin, E. & Capota, C. (2011). One-to-One Laptop Programs in Latin America and the Caribbean: Panorama and Perspectives. Inter-American Development Bank. Retrieved from: http://www.iadb.org

SRI International. (2010). ITL Research: Executive Summary of Pilot Year Findings. Commissioned by Microsoft, Partners in Learning. Retrieved from: www.itlresearch.com

Squire, K. D. (2006). From content to context: Video games and designed experiences.

Educational Researcher, 35(8), 19–29.

The Economist, 2013. E-ducation A long-overdue technological revolution is at last under way. The Economist, 29 June.

Trespalacios, J., Chamberlin, B., & Gallagher, R. R. (2011). Collaboration, Engagement & Fun: How Youth Preferences in Video Gaming can inform 21st Century Education. TechTrends, 55(6), 49-54.

Universidad Autónoma of Barcelona, (2010). Evaluation Programme "Pizarra Digital" In Aragon: Executive Report.

U.S. Department of Education, Office of Educational Technology, (2011). International Experiences with Educational Technology: Final Report, Washington, D.C. Retrieved from: www.ed.gov/about/offices/list/opepd/ppss/reports.html

Wagner, T., 2008. The Global Achievement Gap. New York: Basic Books.

Waxman, H. C., Michko, G. M. & Lin, M.-F., 2003. A Meta-Analysis of the Effectivenesss of Teaching and Learning With Technology on Student Outcomes, Houston: Learning Point Associates.