21st CENTURY SKILLS FOR THE AEROSPACE INDUSTRY WORKFORCE AND THEIR TRANSLATION TO THE CLASSROOM

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ABSTRACT

Responding to the fast-paced change which is taking place in both the aerospace industry and the education, and given the challenges associated with educating the future aerospace industry workforce, the paper attempts to translate needed future skills to the university classroom for the aerospace industry personnel. A synopsis of the current challenges faced in the educational field is outlined, followed by a mapping of the future of both education and air platforms, in an attempt to set the basis of the needed skills framework. Research undertaken by the Assessment and Teaching Of 21st Century Skills Project [1] is used as a baseline for the definition of the future 'critical' skill-set, which is considered well aligned with the future needs of the aerospace industry. Finally, a translation of this 'critical' skill-set to the classroom is proposed, based in redesigning existing learning approaches and activities, together with expected benefits.

1 INTRODUCTION

The European Union (EU) has now one of the highest unemployment rates all over the world. In 2013, almost a quarter of young people in the EU labour market were unemployed. Furthermore, the youth unemployment rate has been 20 percent or above for 10 of the past 20 years [2], therefore it has been for long time an issue which finally turned into a burning one during the recent economic downturn.

With such high unemployment rate for young people, we might assume this particular kind of unemployment to be just an issue of supply and demand. Obviously, companies would be able to select talent at modest cost. However, according to a recent survey [3], an important reason for young people being held back is a lack of skills relevant to the workplace.

In Greece, the country with the highest unemployment rate in Eurozone, employers still complain they cannot find suitable entry-level hires; the same is true even for countries with lower unemployment rates. Across all countries which took part in this survey, most employers (61%) were not confident they could find enough applicants with the right skills for them. Companies today are challenged with inexperienced workers who lack the skills it takes to create, build and help sustain a business. The private sector needs employees with a plethora of skills, like the ability to respond creatively to complex problems, effective communication, team working and the use of technology to create new knowledge.

The imperative to help young people build skills for employment is unlikely to disappear. The 2012 Programme for International Student Assessment (PISA), which measures student performance at secondary level for mathematics, reading and science, saw the scores of three of the eight countries go down and the remaining rise only minimally [4].

An industrial-age curriculum will not fully equip students for living and working in an information-age society. To succeed in this knowledge-based economy, everyone must learn to collaborate and connect digitally — both in their local communities and around the globe. Translating these 21st-century skills to the classroom will shape the economic and social development of countries and communities for the years to come.

However, one of the most striking findings of the survey is that the education providers are the only ones who, in general, (74%) believe that their graduates are adequately prepared for entry level positions in their chosen field of study, in contrast with what 35% of the employers and 38% of the youth themselves believe.

All the above mentioned facts send alarming signals to both the aerospace industry and the educational establishments. The aerospace industry has always been at the forefront of the excellence and innovation, attracting and retaining highly skilled employees and because of that it is anticipated that this potential skill shortage will adversely influence the capacity of the industry to develop and maintain both existing and future air platforms and systems. New skills have to be identified for the future workforce of the aerospace industry, which have then to be translated to the classroom.

2 EXISTING CHALLENGES IN THE EDUCATIONAL FIELD

Demand for higher education is set to grow in the coming decades [5]. An increase in the number of the secondary school graduates is expected and a rising share will choose to continue their studies at a higher level in pursuit of "good jobs". Unfortunately, it is not guaranteed that their higher education qualifications will actually equip them with the skills they need to fill those jobs. Just because of the fast changing job market, many graduates lack the specific technical and professional skills demanded by the current market.

A response to this problem would be to reform the traditional model of academic universities aimed at the middle classes in advanced economies so that it places more emphasis on professional and vocational education and training. It has been observed for many years that countries which generally score highly on the World Economic Forum's Global Competitiveness Index [6] have such systems.

As the under-funded public sector struggles to meet rising demand for higher education, it is also likely that private (for-profit) institutions will play an increasingly important role. High tuition fees at many institutions may lead them naturally to focus on the preparation of jobs-ready graduates, at the expense of disciplines with less attractive career paths, namely arts and humanities. This can introduce the risk of compromising higher education's role as an environment of social interaction. Societies definitely need graduates who can think creatively and engage themselves in non-job, social issues. In other words, the real challenge is not only to prepare the future workforce, but to develop thought leaders with an ability to be able to see the bigger picture as well.

Probably the biggest existing challenge has to do with student debt. Many students in developed economies graduate highly indebted. Unfortunately, the transition to a well paid job is not so easy and many face a lot of difficulties to pay off their debts. According to the International Labour Organization (ILO), under-30s in advanced economies are far more likely than over-30s to be taking up jobs for which they are overqualified [7]. Often they change frequently from one temporary job to another.

If higher education is eventually perceived as a risky investment, increasing numbers of students will embark on university degrees only if their families are able to support them financially. Higher education has traditionally been a way of reducing income disparities, but it may now trigger an income disparity crisis instead.

Highly indebted students who cannot find a satisfying job allowing them to re-pay their debts will not be in a position to make plans for the future. They will also become reluctant to take further financial risk for additional professional development or to invest in any form, something that could stall the potential of any economy. Fortunately, we live in the era where technology plays a disruptive role in widening the access to free or inexpensive online courses. Such courses also promise to help make education and further training a lifelong possibility in developed as well as developing economies, enabling people to update their skills in response to the fast-changing job markets of modern knowledge economies.

Universities and corporations need to collaborate for making the school-to-work transition as smooth as possible. This might imply that many changes need to take place in the professional education systems of many countries. Dual education systems, combining professional education on the job and parallel education at a vocational school, can mitigate most of the risks mentioned above. Worldwide, many models for public-private partnerships to mitigate risks for effective investment in skills and training exist at our disposal [8].

3 THE FUTURE OF EDUCATION

3.1 Online Education

Nowadays, digital innovation is leading a tremendous change across the education sector, illustrating a strong potential both to improve student learning and widen access to high quality education opportunities in ways that would have been unimaginable even a decade ago. This revolution is globally accessible and able to leverage the lower distribution costs afforded by the Internet. All the related innovations will transform both what happens in the classroom ecosystem as well as large scale educational policies for the years to come.

There is no shortage of alarming statistics that reflect the wasted potential of human capital owing to lack of access to quality education: in the United States alone, 41% of college students fail to graduate [9]. Because of high tuition rates, unemployment and a massive student debt burden in the United States– which has now reached more than US$ 1 trillion – there is tremendous momentum to disrupt education as we know it and provide an alternative, or at least a complement, to the traditional 'one size fits all brick and mortar' school system.

3.2 Massive Open Online Courses (MOOCs)

The widespread growth and acceptance of online classes reflect a tectonic shift in the education landscape [10]. However, online courses offered by prestigious universities are not new. The MOOC concept provides free online courses in nearly every higher education subject. Some MOOC providers, like Coursera, are for-profit and venture-funded while others, like EdX and Khan Academy, are not-for-profit, meaning they will be perpetually capital-constrained versus any for-profit players that figure out a successful revenue model.

To date, MOOCs offer only part of what constitutes a course. They offer lectures with top teachers. This is certainly revolutionary, but many more things need to be done. MOOCs offer large and impersonal classes, sometimes supported with additional learning material. Educators contribute notes and suggest free materials to students, but to date the focus of MOOCs has been mainly on lectures. Additional supporting services usually provided by the universities (academic and non academic ones), are missing.

Into this new landscape has come a plethora of new and exciting educational opportunities. Some establishments adapted early, as a means of assembling the best educational experience possible while maintaining their traditional identity. At the same time, some larger institutions have chosen to offer a relatively low cost education in order to serve hundreds of thousands and eventually perhaps millions of students. It is expected that the elite institutions, will begin offering online degrees as well, once it becomes clear that their brand would not be affected.

In general, a very rapid adaptation is observed and even some late entrant institutions are now rapidly following suit. From 2002 to 2012, the fraction of private non-profit institutions with online degree programmes more than doubled from 22.1% to 48.4% [11].

3.3 Digital Native

Coined in 2001 by researcher Marc Prensky, the term 'Digital Native' [12] is used to describe people born after 1980, when social digital technologies such as Usenet and bulletin board systems came online. Digital natives are characterized as having access to networked digital technologies and the skills to use those technologies. Most of their daily activities are taking place and they are also get enhanced with the help of digital technologies: social interaction, friendships, civic activities, and hobbies.

Education, as Prensky states, is the single largest problem facing the digital world as our 'Digital Immigrant' instructors, who speak an outdated language (that of the pre-digital age), are facing a lot of difficulty in teaching a student body which communicates in an entirely new language. 'Digital Natives' have had an increased exposure to technology, which has changed the way they interact and respond to digital devices. In order to meet the unique learning needs of 'Digital Natives', teachers need to move away from traditional teaching methods that are disconnected with the way students learn today. For the last 20 years, technology preparation for educators has been at the forefront of policy in many places all over the world. However, 'Digital Immigrants' suffer complications in teaching 'Natives' how to understand an environment which is "native" to them and foreign to 'Immigrants'. Probably the most alarming issue with today's educators is not their ability to integrate technology into the classroom, but probably the fact that in most cases they refuse to use the digital tools provided.

To meet the unique learning needs of 'Digital Natives', Leu et al [13] suggest that digital tools are able to respond immediately to the natural, exploratory, and interactive learning style of students today. Learning how to use these digital tools not only provides unique learning opportunities for 'Digital Natives', but they also provide necessary skills that will define their future success in the digital age.

3.4 Collaborative Augmented Reality

Conceptual learning in immersive virtual environments is a relatively young field but with an immense potential [14]. As suggested by Roussos et al [15], Virtual Reality (VR) can contribute to raise interest and motivation in students with a high potential to enhance the learning experience. However, the practical potential of VR is still being explored and understanding how to use VR technology to support learning activities has been a substantial challenge for the designers and evaluators of this learning technology [16].

VR technology completely immerses a user inside a synthetic environment. While immersed, the user cannot see the real world around him. In contrast, Augmented Reality (AR) allows the user to see the real world, with virtual objects superimposed upon or synthesized with the real world. Therefore, AR supplements reality, rather than completely replacing it. Ideally, it would appear to the user that the virtual and real objects coexist in the same space.

One of the most important purposes of an educational environment is to promote social interaction among users located in the same physical space. In collaborative AR multiple users may access a shared space populated by virtual objects, while remaining grounded in the real world. This technique is particularly powerful for educational purposes when users are collocated and can use natural means of communication (speech, gestures etc.), but can also be mixed successfully with immersive VR or remote collaboration.

Another psychological factor of importance is that some users feel unsafe if their view is "locked" in an immersive virtual world whereas AR allows them to "keep control", to see the real world around them. Safety issues are important in collaborative mobile systems where AR is obviously used to give mobile users the freedom of sight needed to move around. There is interplay between emotions and learning, but how feelings such as insecurity and emotions in general influence learning is a matter of ongoing research. AR cannot be the ideal solution for all educational application needs but it is an option to consider. The technology used has to depend always on the pedagogical goals and needs of the educational application and the target audience.

4 THE FUTURE AIR PLATFORMS

4.1 Aircraft Design and Manufacturing

It is seen that there is a consensus among the leading aircraft manufacturers [17][18] concerning the evolution of the technology which is going to affect the design and production of the future air platforms. The aircraft of the future are expected to have longer and slimmer wings which will better glide through the skies, as the flow of air over the wing surface reduces the drag and in turn, improves fuel efficiency. The fuselage is no longer a simple tube but is curved and shaped to provide more internal space for various cabin configurations, with better aerodynamics in its outside skin.

New manufacturing methods will reduce the cost and environmental impact of building the aircraft despite the new advanced materials and complex shapes. Engines will be more reliable, quiet and fuel efficient. The electrical system will continuously monitor its own state of health, anticipating any need for maintenance and automatically scheduling this well in advance. Electronics and other systems on board will be entirely self-sufficient, requiring minimum to zero maintenance.

Future aircraft could be built using a bionic structure mimicking the bone structure of birds. By using bionic structures, the fuselage has the strength it needs, but can also make the most of extra space where required. This not only reduces the aircraft's weight and fuel burn, but also makes it possible to add features like oversized doors for easier boarding and panoramic windows.

The future cabin electrical system can be compared to the human brain, with a network of intelligence pulsating through the cabin. This network will be absorbed into the structural materials, making the hundreds of kilometres of cables and wires found in today's aircraft a thing of the past. Known as 'smart' materials they can perform numerous functions, recognizing the passenger, so that you too are 'connected' to the plane.

4.2 New Materials

New lightweight 'smart' materials will sense the load they are under, making for a lighter aircraft that draws less fuel and curbs emissions. Materials that change shape and return to their initial form, growing like the leaves of a plant, are a very real possibility. Morphing materials might be metals or polymers that have a 'memory'; or are covered with a 'skin' that will instigate a shape change. A memory is created using sensor and activator systems that give materials a certain level of artificial intelligence, allowing them to adapt to the passengers' needs.

Some of the elements in the cabin could be created using additive layer manufacturing, which is a bit like printing in 3D. The process repeatedly prints very thin layers of material on top of each other until the layers form a solid object in materials ranging from high-grade titanium alloys to glass and concrete. As well as making it simpler to produce very complex shapes, this form of production wastes a lot less material than cutting shapes out of bigger blocks. While this technique is already being tested for small aircraft parts today, in the future, its use could be widespread - not only in industry but in people's homes.

4.3 A New Flying Experience

Apart from the revolutionary advances of the related technology, there is an increasing demand by the passengers concerning the overall flight experience. It is evident that they will increasingly want the flight itself to feel like a holiday experience and to be able to access all the technological advances which fill their daily lives during the flight. In the future, technology and virtual reality will be seamlessly integrated with our normal lives, services will be individually tailored and environmental needs will be addressed in everything that we do. All of which will be just as true in the air as it is on the ground and this seamless relationship between people and technology will be evident from the moment passengers' board via this zone.

4.4 Ai Taxi Operations With Small Aircraft

Small aircraft are expected to play an increasingly important role in the future transportation system as very light jets (VLJ's) make air-taxi operations cost competitive with automobiles for regional travel. The crew-cost per seat-mile is higher on small aircraft than larger transport aircraft and while initially planning to operate with two-pilot crews, it is likely that increased use of single-pilot operations will be desired in the future if safety and airspace integration concerns can be addressed. At the same time, widespread air-taxi operations are likely to generate increased interest in self-flown operations as people would experience self-operation also as a means to lower costs and increase flexibility.

A significant concern is addressing safety and airspace integration issues stemming from increased, single-pilot operations, in this case for private pilots potentially having lower rates of exposure, a minimum of training and less formal oversight when compared to airline pilots. To address this concern, technological developments are anticipated, leading to integrated flight system concepts designed to increase the safety, reliability, and performance. Furthermore, human-centered automations will structure the relationship between the human operator and the aircraft as independent, collaborative agents having complimentary capabilities.

4.5 Increase in The Number Of UAVs And Their Applications

In recent years, the use of Unmanned Aerial Vehicles (UAVs) has snowballed with a huge increase in the number of UAVs and their applications. Recent media attention has focused on the increased use of UAVs in military applications and also on the rise of small commercial and privately operated UAVs. However, one area not so much talked about but still under development is the introduction of larger unmanned aircraft.

Over the past 50 years, increased automation of aircraft systems has resulted in the steady decrease in the number of flight crew with the removal of the navigator, flight engineer and the radio operator. Most large commercial aircraft are now down to a flight crew of two and, as mentioned in the previous section, there is now talk of single-pilot commercial jets. If this trend continues, then the next logical step will be to complete the 'depopulating of the flight deck' and have commercial aircraft with no pilots at all. As yet, there are no proposals to introduce unmanned passenger aircraft but there is research currently under way in developing unmanned cargo aircraft designs [19], together with the technology and regulations required to ensure that such aircraft could be operated safely in commercial airspace. Such aircraft could offer considerable economic advantages in certain markets and could also test technology and operations which could potentially be applicable to future unmanned passenger aircraft.

5 21ST CENTURY SKILLS

Cisco Systems Inc., Intel and Microsoft unveiled plans in January 2008 to sponsor a research collaboration to accelerate global education reform by mobilizing the international educational, political and business communities to help transform the teaching, learning and measurement of 21st century skills. The Assessment and Teaching of 21st Century Skills Project [1], focusing on defining those skills and developing ways to measure them, assembled 250 researchers from around the world and established five working groups:

- ✓ Defining 21st century skills.
- ✓ Methodological issues.
- ✓ Technological issues.
- ✓ Classrooms and formative evaluation.
- ✓ Policy frameworks and new assessments.

Based on their analysis [20], ten skills have been identified in four groupings:

Ways of Thinking

1. Creativity and innovation.
2. Critical thinking, problem solving, decision making.
3. Learning to learn, Metacognition.

Ways of Working

4. Communication.
5. Collaboration (teamwork).

Tools for Working

6. Information literacy.
7. ICT literacy.

Living in the World

8. Citizenship – local and global.
9. Life and career.
10. Personal and social responsibility – including cultural awareness and competence.

The above identified skill set aligns also well with the future needs of the aerospace industry. Today, we are witnessing a rapid shift in the way people work in the aviation world. Outsourcing services across national and continental borders are just one example. Another is having team members telecommute while working on the same project. For instance, the design of the Airbus A380, the world's largest passenger aircraft, has been divided across design offices and engineering centers located throughout Europe and North America and its large main components have been produced in France, Germany, Spain and the United Kingdom, with a final assembly line in Toulouse, France. The design offices used state of the art interactive software packages, enabling designers to work collaboratively on common designs from different locations. To support these examples of moving toward globalization, communication and collaboration skills must be more finely tuned. Communication must be rapid, concise, and cognizant of cultural differences.

Future aerospace industry workforce will be called to work in much more diversified environments in all accounts (multi-disciplinary, multi-site, and multi-cultural). Although analytical skills will continue to play an important role as entry level qualities, soft skills like leadership, team spirit, three dimensional thinking, risk definition and risk management are expected to be the critical success factors of their long careers.

6 EXISTING SKILLS FRAMEWORK OF THE USW AERONAUTICAL/AIRCRAFT MAINTENANCE ENGINEERING CURRICULUM

The following table is the existing '*Matrix of Intended Learning Outcomes'* followed by the School of Engineering of the University of South Wales, for course design purposes:

A (KNOWLEDGE AND UNDERSTANDING OF)	**B (INTELLECTUAL SKILLS – able to)**	**C (PROFESSIONAL/VOCATIONAL SKILLS - able to use)**	**D (KEY SKILLS)**
A1 Appropriate mathematical methods	B1 Select and apply appropriate mathematical and/or computer based methods for modelling and analyzing engineering problems	C1 Appropriate mathematical methods for modelling and analyzing engineering problems	D1 Communication
A2 Appropriate engineering science	B2 Apply scientific principles to the development and analysis of engineering solutions	C2 Relevant test and measurement equipment including experimental laboratory work	D2 Enquiry and Analysis
A3 Appropriate engineering technology	B3 Apply engineering technology to the development of solutions for engineering problems	C3 Engineering IT Tools	D3 Problem solving
A4 General principles of design	B4 Evaluate the design of new processes or products through synthesis of ideas from a wide range of sources	C4 Practical tools for the testing of synthesised engineering systems	D4 IT skills
A5 Management and business practices	B5 Produce engineering solutions which encompass technical risk evaluation	C5 Information retrieval systems	D5 Working with others
A6 Professional and ethical responsibilities	B6 Evaluate Business Risk	C6 Apply engineering techniques taking account of industrial and commercial constraints	D6 Critical reflection

Table 1: Matrix of Intended Learning Outcomes (School of Engineering, University of South Wales)

Many of those skills and intended learning outcomes reflect the concerted effort of the University to get accreditation of relevant professional bodies, thus enhancing the employability potential of the prospective students. In other words, the skills and learning outcomes align well with the UK Standard for Professional Engineering Competence [21], as a basis for a successful Chartered Engineer (CEng) application.

When comparing the identified 21st Century Skills and the Intended Learning Outcomes of **Table 1**, it is observed that there is an adequate overlap. In general, it can be said that common ground exists, even to some limited extent, between the two frameworks for:

1. Creativity and innovation.
2. Critical thinking, problem solving, decision making.
4. Communication.
5. Collaboration (working with others).
6. Information literacy.
7. ICT literacy

It is also important to notice that although there is an overlap, the main difference of the 21st Century Skills is that they are going to be developed in a very different educational environment which will be greatly influenced by the technological advances analyzed in the precious sections, mainly by the enhanced digital collaborative and distant learning capabilities.

From the comparison, it is noticed that there are still some 21st Century skills which do not seem to have been addressed so far, especially:

3. Learning to learn, Metacognition.
8. Citizenship – local and global.
9. Life and career.
10. Personal and social responsibility – including cultural awareness and competence.

7 TRANSLATING THE 'MISSING' SKILL SET TO THE CLASSROOM BY REDESIGNING EXISTING LEARNING APPROACHES AND ACTIVITIES

7.1 Shift to Competency Based Training (CBT) Programs

In a traditional educational system, the training is centered on subject contents and the delivery is time-based and instructor-centered. The course contents are based on defined training objectives and an assumed homogenous level of knowledge from the participants, whose entry competencies are seldom evaluated before attending the training program. This kind of training program gives little chance to address individual's needs. In a CBT program, the delivery is based on training needs to perform defined tasks and it is learner-centered.

The first step in a CBT program is the analysis of the training needs (namely Training Needs Analysis-TNA), which is based in identifying the gap between existing and required competencies to fulfil defined tasks to a defined standard (quality and performance standards). The training process requires an entry assessment of the individuals who will participate in the program and the minimum requirements that have to be met. The next step will be the development of the training method needed to fill the competency gaps in terms of knowledge, skills and attitude.

Expected benefits:

More focused training: Training needs for each individual are identified and the training focuses on filing the specific knowledge, skill and attitude gaps of the individual.

Addressing particular job requirements: Due to the wide variation of the tasks involved throughout the life cycle support of a modern air platform, no single training program can satisfy the training requirements of the aerospace workforce. A variety of training programs that reflect the different job requirements in the various fields of the air platform's life cycle have to be established. CBT moves away from content and instructor-centered training to student and competency-centered programs.

7.2 Shift to Enhanced Team Work

Team work and the skill of collaborating effectively gains increasing momentum as teams become more virtual, remote and diverse. The university has to prepare students for the challenges they are going to face in their professional field and if possible to 'simulate' and integrate important features of the future working environments in the curriculum. Based on my educational experience so far, both as a student and as a lecturer, I think that the overall acceptance of team work-based module design and assessment is strongly influenced by each individual's (students and educators) culture, in a way which correlates with the 'Individualism' index on Hofstede's Cultural Dimension [22] (also illustrated at http://geert-hofstede.com/countries.html). In other words, there exist cultures in which team work is highly respected and appropriate (which eventually score low in the 'Individualism' index) and cultures where team work is seen as not so effective (which eventually score high in the 'Individualism' index), especially for educational purposes. A simple look at United Kingdom's score on the 'Individualism' index (*89*), can be seen as a warning that action needs to be taken for UK universities towards the enhancement of the curricula provisions with more team-based delivery and assessment.

7.3 Off Airplane Devices

Improved reliability in aircraft components and materials result in fewer discrepancies, leading to less hands-on experience and troubleshooting skills acquired by the maintenance staff. Training time on the real airplane is becoming more difficult and more expensive. The optimum fleet management focuses in keeping the fleet grounded for maintenance to the lesser extent possible, minimizing at the same time the turnaround time for the scheduled maintenance inspections. Historically, a solution to this limitation was the training taking place in retired aircraft, something which adds new limitations (high costs, obsolescence of systems and their technology, systems in not perfect working order, etc.). Today, the technology is mature enough that new synthetic training devices can be designed to complement the CBT programs, in the form of Virtual Collaborative Environments for aircraft maintenance training. Such systems can play a crucial role in educating aircraft maintenance engineers in trivial and non-trivial troubleshooting cases.

7.4 Gamification

Following the success of the location based service Foursquare, the idea of using game design elements in non-game contexts to motivate and increase user activity and retention has rapidly gained traction in interaction design and digital marketing. Under the term "Gamification", this idea is spawning an intense public debate as well as numerous applications, ranging across productivity, finance, health, news and entertainment media, sustainability as well as education [23].

Games provide complex systems of rules for players to explore through active experimentation and discovery. More broadly stated, games guide players through the mastery process and keep them engaged with potentially difficult tasks. One critical game design technique is to deliver concrete challenges that are perfectly tailored to the player's skill level, increasing the difficulty as the player's skill expands. Specific, moderately difficult, immediate goals are motivating for learners and these are precisely the sort that games provide [24]. Games also provide multiple routes to success, allowing students to choose their own sub-goals within the larger task. This, too, supports motivation and engagement.

Expected benefits:

Games can increase student's motivation and engagement levels and they can also provide teaching staff with enhanced tools to guide, assess and reward students. They can also transform the learning experience from traditional and rigid to enjoyable and even joyful.

Apart from the expected benefits gamification can yield in terms of enhancing the classroom experience, a web based game (with 'players' from everywhere in the world) designed for aviation professionals can also become a platform of developing the 21st Century 'Living in the World' skills mentioned above.

8 DISCUSSION

From all the different initiatives researched, the Assessment and Teaching Of 21st Century Skills Project [1] showed a competitive edge when compared with other similar efforts. It has a good mix of contributing countries, representing educational systems from all over the world (Australia, Finland, Singapore, United States, Costa Rica and Netherlands) with researchers, executive and advisory panel members representing most of the stakeholders; industry (mainly IT: Cisco, Intel and Microsoft), academia, national and international organizations.

Another important fact that came out of the literature was that most of the research has been undertaken and published by institutions and organizations based in the United States. It has been clear that the issue of defining a skill set framework for the 21st century learners has attracted more attention in United States than everywhere else in the modern times.

The EU has launched the 'New Skills for New Jobs' initiative with a threefold focus; to promote better anticipation of future skills needs, to develop better matching between skills and labour market needs and to bridge the gap between the worlds of education and work. As stated in the EU's 'Agenda For New Skills and Jobs' [25], the European Commission supports the development of European Sector Skills Councils designed to anticipate the need for skills in specific sectors more effectively and achieve a better match between skills and labour market needs. Skills Councils have already been set up in two sectors, (textile, clothing and leather and commerce (retail and wholesale)) and fourteen more, not including the aerospace sector, have benefited from Commission funding for feasibility studies on setting up European Skills Councils. Moreover, the European Commission maintains the EU Skills Panorama and the identification of skill needs in sectors is one of the priorities of the European Center for the Development of Vocational Training (CEDEFOP), which, among other initiatives, has recently launched the Sector Based Anticipatory System (SBAS) for anticipating short term labour market trends and skill needs at European level.

Up to date, the only initiative addressing skill needs with a clear aviation focus is ICAO's 'Next Generation of Aviation Professionals (NGAP)', which has been launched with the wider objective to ensure that enough qualified and competent professionals are available to operate, manage and maintain the future international air transport system. The initiative is supported by many aviation stakeholders throughout the world, including regulatory authorities, international organizations, education providers and aircraft manufacturers.

9 RECOMMENDATIONS

Given:

- The complex and dynamic nature of anticipating future skills needs for the aerospace industry.
- The lack of concrete and reliable data.
-The need for a continuous monitoring of the emerging trends.

-The need to avoid duplication of effort in a European-wide level,

it is recommended that a Skills Council is launched for the aerospace sector in Europe. Upon launching, the Skills Council should collaborate with the existing initiatives in both European and global level. A valuable contribution would also be the SBAS tool to be populated with aerospace industry data sets and produce results tailored to the aerospace industry needs.

10 CONCLUSION

We are living in an era of unprecedented change. Capital, including human capital, and information are moving with unconceivable speed while technology and innovation are promising to change dramatically the world and to bring us into the next era of our civilization. In this volatile and fast changing world, educational establishments will continue to be the intellectual beacons of our society. At the same time though, they need to realize that the new challenges require new and novel approaches and be aware that the new generation constitutes a very different, in all accounts, student body. On the other hand, the aerospace industry needs to attract and retain highly skilled workforce, creative, life-long learning individuals comfortable with the fast pace of change, being able to work in an interactive and collaborative mode to design and maintain highly complex systems. Only wide collaboration can set up a bridge between the educational institutes and the aerospace industry in this ongoing battle for talent and skills.

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