The LACE LAW Manifesto

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LACE

Learning Analytics Community Exchange

The LACE LAW manifesto

Promoting Learning Analytics @ the Workplace

July 2015

Contents

Executive summary

The following Manifesto deals with recommendations for EU and national institutions about **future policies that should be adopted on Learning Analytics for the training of workforce**, and it represents the synthesis of a discussion meeting held in Brussels in April 2015 during the Learning Analytics Community Exchange (LACE) Spring event.

Learning at workplace, defined as "formal and informal knowledge or learning experiences that people receive whilst they are acting in working environments and/or ecosystems using systems or information sources managed by their employer or self-managed", will become crucial for the European Industrial Renaissance and its recovery in competitivity, in particular in the manufacturing sector. This because **manufacturing is rapidly changing its characteristics** from tradition (*i.e.* "make to stock" production, standardised products) to Manufacturing of the future ("Produce on demand", "Make to individual", strong customization of products). This change, together with the raising of new technologies and trends (Internet of Things, 3D printing, Digital Disruption), implies the development of **new skills for workforce** and new pedagogical and IT tools with the aim to reduce shortages in the 21st century skills.

The first thing that EU should do is to **identify and cooperate with all the relevant stakeholders**, such as industry leaders, employers, workers, universities, teachers, social partners, trade and teacher unions, with the aim to identify the 21st century skills, to improve the training of existing workforce maintaining the equilibrium between the needing of industries and society.

Moreover, the EU and national educational authorities, together with companies and social partners, could improve the research and development of IT tools that are able to help leverage a mix of formal and informal learning situations during workforce daily operations.

In the final part of the Manifesto, two case studies on the use of Learning Analytics at the workplace are presented, related to the EU project Watch Me and to Skillaware™, an IT platform for electronic performance support.

Preface

On 15th April 2015 the LACE project, a Community Support Action for the promotion of Learning Analytics supported by the European Commission, invited its members, associate partners and people interested in Learning Analytics to Brussels. The workshop event was promoted, with the support of the European Parliament, to discuss and propose possible EU Public Policies guidelines and best practices for fostering Educational Data Mining and Learning Analytics.

More than 60 people, including representatives from different institutions/organisations with different interests, skills and backgrounds, attended the workshop, known as the LACE Spring event. Moreover, several online posts on LACE website and social networks were generated, both during and after the event.

Given the interest and the momentum, it was decided that the participants of the "workplace learning" session would keep in touch creating a sort of living document, code named the **LAW (Learning Analytics at the Workplace) Manifesto**. The present Manifesto is constantly reviewed as soon as other members and/or interested parties join the LACE community with particular interest in Workplace Learning.

The LAW working group was first initiated in the LACE Spring event breakout sessions in a workshop moderated by Fabrizio Cardinali (CEO of Skillaware, *www.skillaware.com*, a new company for workplace learning and performance support analytics solutions of the sedApta Group) and by Marieke van der Schaaf (Watch Me Project Manager, *http://www.project-watchme.eu/*, a Workplace Learning EU Project from Utrecht University).

The LAW SubGroup participants, who eventually reviewed and agreed in the publishing of the present manifesto (shown in the table below), represent a large variety of institutions and organisations, from EU institutions (EU Parliament and DG CNECT) to companies, universities, social partners and associations.

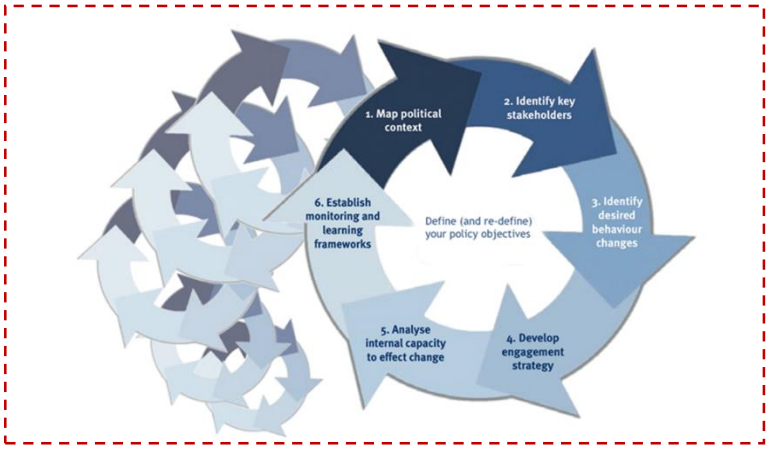
List of participants to the workplace workshop session at the LACE Spring Event 2015 (LAW SubGroup).

Name	Organisation
Fabrizio Cardinali (moderator)	Skillaware – Sedapta Group, LACE Project
Marieke van der Schaaf (rapporteur)	University of Utrecht, WatchMe Project
Maren Scheffel (rapporteur)	Open University of the Netherlands, LACE Project
Marco Paini	Sedapta Group, LACE Project
Melissa Vanarwegen	CVO HBO5 Antwerpen, Belgium
Jasmine Glaser	EU Representation of the Federal Austrian Economic Chamber
Denise Janssen	Mateum
Gabor Kismihok	University of Amsterdam
Patrice Chazerand	DIGITALEUROPE
Susan Flocken	European Trade Union Committee for Education

The Group discussions were based on a brainstorming and analysis methodology named the ROMA model [1] (Rapid Outcome Mapping Approach), presented in the joint session by the new president of the Society for Learning Analytics Dragan Gašević (the presentation is available at *www.slideshare.net/laceproject/spring-event-draganqasevic20150415*).

LAW SubGroup meeting at the 2015 Spring Event.

The ROMA approach is constituted by a cyclical process divided in six checkpoints, which allows the definition and re-definition of the policy targets, which EU and national institutions should put into practice for the implementation and the improvement of workplace-based learning.



Rapid Outcome Mapping Approach (ROMA) graphical representation [1].

The present Manifesto is meant as a common working document, regularly summarising the needs, trends and possible action lines discussed by the LAW Group either during the kick off workshop and/or when new associate members join the LACE community with specific interest in workplace learning.

Workplace Learning

For the focus of discussion of this document, we may define Workplace Learning as "**formal and informal knowledge or learning experiences that people receive whilst they are acting in working environments and/or ecosystems using systems or information sources managed by their employer or self-managed**".

The learning and training of employees directly at the workplace is becoming more and more important in the industrial world, from both, the perspectives of employers' or HR departments' and the educational perspective.

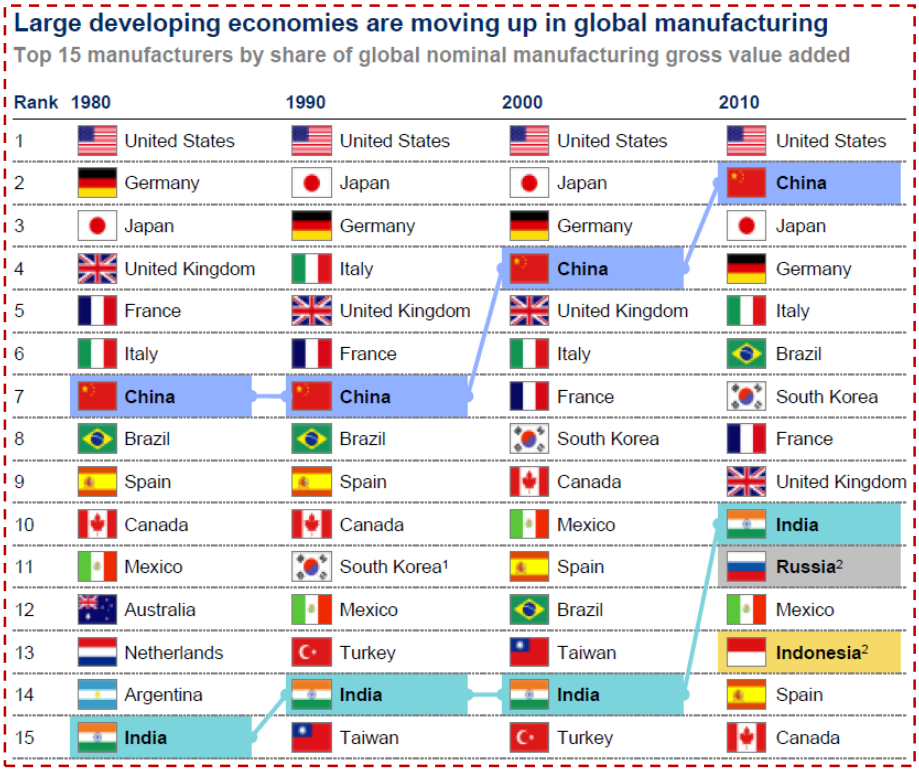
The growth of digitalised tools for training at the workplace in the last years has led to the necessity of Learning Analytics tools that are able to track the experience of users and to evaluate performance and quality of the materials provided. In this context, European and national policies should foster the development and the sharing of Learning Analytics and Educational Data Mining concepts and evidences, with the aim to increase competitiveness of European industry and sustain the economic growth.

Since Workplace Learning may encompass many industries and sectors, with great difference regarding their aims, performance indicators and policies, for the purpose of this document, a focus is given on Manufacturing IT Training. This sector has been selected due to the high value and strategic role that it plays for the continuous improvement of Europe's competitiveness towards 2020 and the need of proper Public Policies in such perspective.

EU manufacturing: what is the "state of the art"?

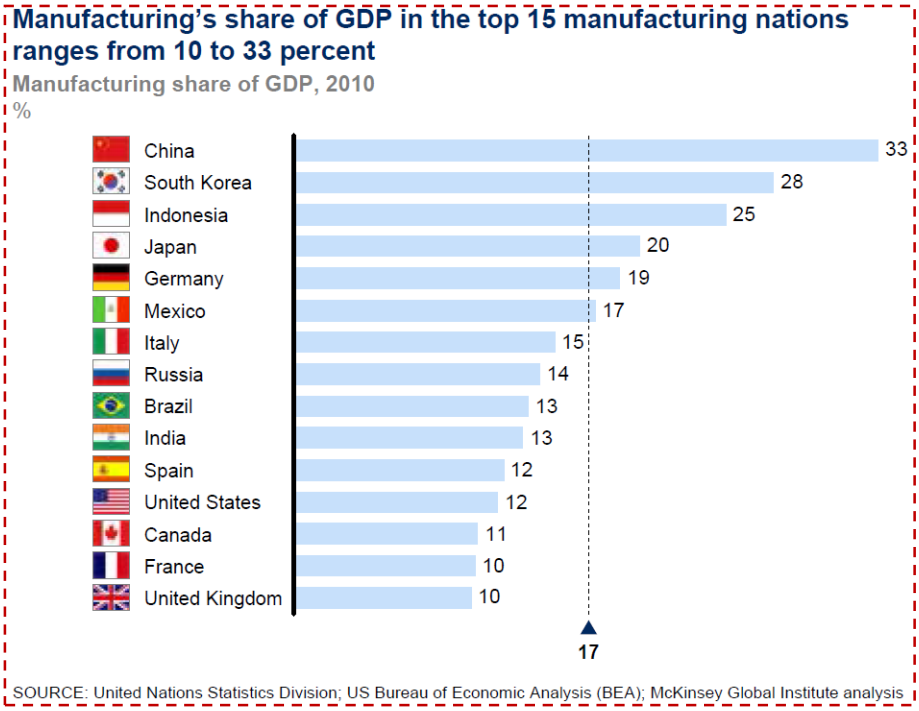
During these years, Europe is trying to emerge from its longest-ever recession period. Due to structural reforms and economic governance, nowadays EU is on the right track, with most of the economic, business sentiment and confidence indicators betting on recovery in the coming years.

However, the inheritance of economic crisis is heavy and severe, in particular in manufacturing: in this sector, 3.5 million jobs have been lost, the share of manufacturing in GDP has fallen from 15.4 % to 15.1 % during the period 2008-2013 and EU productivity performance continues to decrease compared to that of worldwide competitors [2].



Top 15 manufacturing nations in the last decades [3].

Despite the crisis and the massive offshoring and de-industrialisation, industry maintains its leading role in the EU economy. And this is not only due to manufacturing, but also to all the other related sectors (raw materials, energy, sales, logistics, funding, after-sales services, etc.), accounting for over 80 % of Europe's exports and 80 % of private research and innovation. It was estimated that one in four private sector jobs is in industry, often **highly skilled**, while each additional job in manufacturing creates 0.5-2 jobs in other economic sectors [2], and each euro of added final demand in EU manufacturing generates around 50 cent of additional final demand in other sectors of the economy. This is why industry, and manufacturing in particular, must be the core of what the EU defines as "**European Industrial Renaissance**".



Manufacturing Share of GDP - Top 15 manufacturing nations by GDP % [2].

How will industry change in the coming years?

New disruptive technologies are appearing that will revolutionise the way people produce, distribute and purchase goods in contemporary markets [4].

All these innovative technologies and trends imply that the workforce should be **properly and continuously trained**, by both educational institutions and employers.

In particular, a wave of new technologies and processes have come in the last decade, such as Advanced Robotics, 3D Printing and Internet of Things. These and other innovations will revolutionise the way in which employees make their job, passing from a role of manual workers to a role of controller/operator of an automated device that makes the product for you. This change implies that not only the industrial world has to change, but also the education. In particular, considering that a quality public education is a public good and a human right, education authorities, education institutions, teachers and their representatives need to face the difficult task of **providing an adequately trained workforce (close to the changing needs of labour market and industry) ensuring a proper development of students and workers also as active and responsible citizens**.

3D Printing & Internet of Things

3D printing is a manufacturing process that builds layers to create a three-dimensional solid object from a digital model. Today consumer and low cost printers are positioned on the market together with the patenting of new high-end polymer layering methods for printing more and more diverse forms and materials. This is giving birth to new production and supply chain models such as "Produce on Demand" or "Engineer to Order" which are about to revolutionise the way we produce, distribute and consume goods in contemporary marketplaces.

Internet of Things (IoT) consists in the network of objects embedded with software, sensors or connectivity features that are able to connect to the Internet and to interoperate with manufacturers, operators or other connected devices. This kind of technology will revolutionise our lives in the next years, with applications in automation for manufacturing, smart medical devices, environmental and infrastructural monitoring systems, energy management (smart grid), home automation and so on. According to ABI Research, more than 30 billion of devices will be wirelessly connected to the Internet of Things by 2020 [5].

All together, these new technologies are creating a new cyber physical workplace where human workforces will need more and more to coexist and perhaps compete with their mechanic counterparts.

This new working environment is due to be heavily affected by digital disruption in its workflows, systems and tools. This also means that an enormous amount of data will be generated, which must be treated/analysed in order to obtain useful information.

Blending analytics and learning innovation to conceive and implement new working environments capable to constantly analyse, diagnose and support the performance of users, and offer them context-aware and intelligent learning experiences directly at the workplace, in their day-by-day workflow, is going to be crucial for the workforce of the future. In this context, it is crucial to respect and allow for workers' privacy and the protection of their personal data, ensuring that Learning Analytics and learning innovations will not be used as a means of workforce surveillance.

Digital Disruption

Despite the fact that the term "Web 2.0" was coined more than a decade ago (it was popularised by Tim O'Reilly and Dale Dougherty during the O'Reilly Media Web 2.0 Conference in San Francisco in 2004, but it was first coined in 1999 by Darcy Di Nucci), it is still very popularly used to generically describe the intent to digitise information and knowledge coming either from an individual and his/her network or from a digital version of an older economic model.

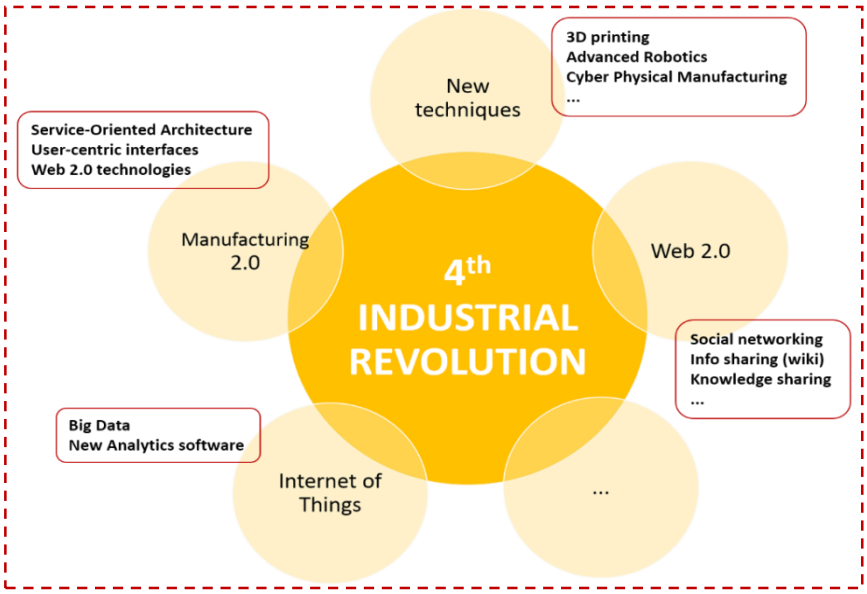
Nevertheless, this usually mainly concerns the front end, information-based, sharing of knowledge via blogs, wikis and /or innovative web sites.

What is really happening today is much more represented by what Forrester Research has started to call **Digital Disruption** [6], defined as the rapid change that occurs when new digital technologies and business models affect the value proposition of existing goods and services. The impressive increase in the use of mobile devices, social communities and cloud computing, a shift sometimes referred to as the "**consumerization of IT"**, has increased the potential for digital disruption across many industries.

The development of innovative digital platforms based on *Digital Disruption* will rapidly change the way we produce, purchase and consume goods and services. IT services and solution providers, together with new workplace learning paradigms, could support industry to meet the *Digital Disruption* paradigm, helping to train the workforce adequately and prepare workers for lifelong learning.

Industry 4.0

If you combine 3D printing, IoT and digital disruption, it is clear that we are at the dawn of what many call the **4th Industrial Revolution**, that coming after that originated by the invention of the steam engine, electricity and Information society, will happen much faster and deeply, fully reshaping our economies and workforces in the next decade.



4th industrial revolution concept map.

In particular, Industry 4.0 will leapfrog the way we produce, distribute and retail goods using new Cyber Physical Industrial Ecosystems, generating what is sometimes named "**Manufacturing of the future"**. Microsoft has suggested that the future of manufacturing will be "an information environment that supports multiple manufacturing operating modes [...] and global operations based largely on a service-oriented architecture (SOA) with a user-centric interface along with the introduction of new Web 2.0 technologies" [7].

This definition stresses in particular three features of these ecosystems:

1. Service-Oriented Architecture: SOA is a software architecture adapted to ensure integration and interoperability between different systems to allow the use of individual applications as components of the business process. This approach implies a radical change in the way the production process takes place, passing from a "Data-centric" manufacturing to a "Process-centric" manufacturing [8].
2. User-centric interface: Manufacturing of the future enable IT staffs to "right-size" the interface of company software to the time, role and skill sets of the available workforce. These user-centric interfaces can also incorporate analytic and decision support tools.
3. Web 2.0 technologies: as part of the future of manufacturing, Web 2.0 technologies can help the creation of a collaborative

environment between employers, technicians, employees, consultants, suppliers and clients, with a faster share of information and knowledge.

Traditional manufacturing will change dramatically in the next years. This will be due to a change in production planning philosophy, from the actual one, known as "Make to stock", in which production is planned considering the maintenance of a certain amount of product stored in warehouses or distribution centres, to a "**Produce on demand**" approach, in which production is planned according to the amount of product requested by the market. Together with this concept, Manufacturing of the future is characterised by a "**Make to individual**" philosophy, which means that in the future more and more goods will be strongly personalised/customised, as highlighted also by EU institutions in the document "Advancing Manufacturing - Advancing Europe" [9].

This change in pace, and the related revolution of how we will make, distribute and retail goods, implies that employers have to be fast and innovative in the way they train and support new employees and the existing ones, directly at the workplace. For these reasons, new means and methods to cross the chasm of digital disruption without falling into it, should be developed and shared.

What are the industrial skills needed to cross the digital disruption chasm?

One of the most important driver of manufacturing competitiveness, according to the 2013 Global Manufacturing Competitiveness Index, is represented by the **quality and availability of a skilled workforce**, including researchers, scientists, and engineers, and the resulting ability to create innovation [10].

The rise of Manufacturing of the future with its feature of enhanced automation will need highly skilled employees, capable to face new market opportunities, new products and new production processes in a more flexible way, with a consequent decrease in low-skilled job request. But the question is: what are these **21st century skills**?

A recent study of the UK Commission for Employment and Skills describes in which fields skills supply and development will be necessary [11]:

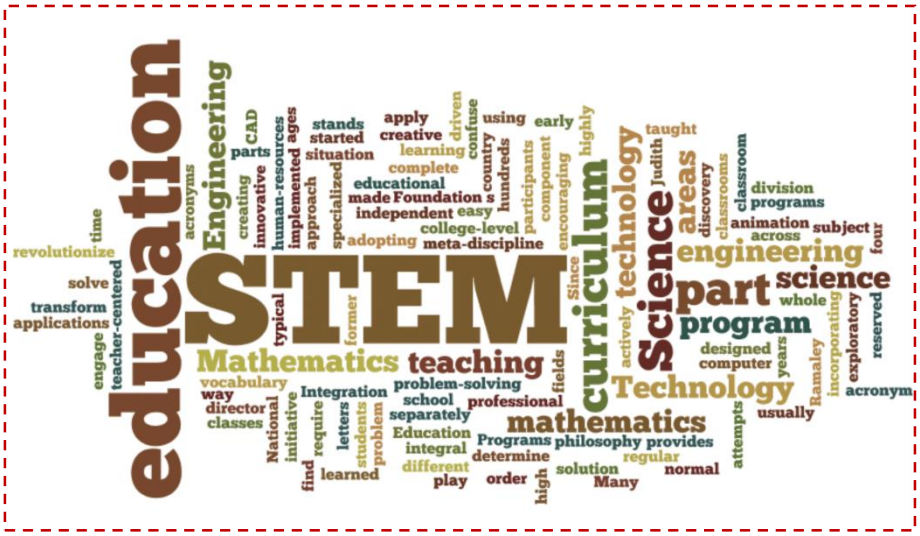
- Technically competent workforce at operative levels.
- Leadership and management.
- Market assessment of senior managers.
- Supply chain management.
- R&D and design.

Other important cross-sector skills are considered critical and analytical thinking, problem solving, digital techniques, communication, collaboration, flexibility, adaptability, risk analysis, initiative and self-direction [12, 13], because nowadays for a company and its employees the capability to respond in a flexible and agile way to market opportunities is seen as essential.

Moreover, in the next decades the 4th Industrial Revolution will demand those joining the workforce to have a much stronger education and skills in scientific fields, known as **STEM** (**S**cience, **T**echnology, **E**ngineering and **M**athematics), and this is where the educational institutions and the EU policies should invest.

> ***"We need to do a much, much better job of ensuring that education programs are well-informed by and aligned with the needs of the modern workforce. The term "STEM education" cannot just mean the four S-T-E-M subjects, but must in fact represent the myriad of different fields and skills that are required by the best jobs in the global technological economy. If we want to keep up with our global competitors, we must set up our engagement in questions of STEM education policy. Roll up those sleeves, Congress. Our future depends on it."***
>
> *James Brown, Executive Director of the STEM Education Coalition, USA*

For example, in 2012, European data shows that engineering is among the Top 3 bottleneck occupations on the European labour market [13], and according to Manufacturing Institute and Deloitte in US the manufacturing sector cannot find people with the necessary skills to take nearly 600,000 unfilled jobs, despite the presence of more than 13 million Americans unemployed. Many STEM-related jobs are going unfilled simply for **lack of people with the adequate skill sets**.



Shortages in skills and competence deficits are considered by industry as one of the barriers to reach a wider uptake of advanced manufacturing technologies in Europe [14]. And this is particularly true for ICT skills, considering that in Europe the demand for ICT practitioners is growing at a rate of 3 % per year, while at the same time there is a decrease in the number of ICT graduates [15].

But what can Europe do about that?

Reduce skill shortages in the industrial field should be one of the priority of EU and national policies for ensure a strong and solid upturn from economic crisis maintaining the competitiveness against other global competitors. The European Industrial Renaissance should pass through the awareness that the 4th industrial revolution will change the way we produce goods and services, and that Europe cannot be a passive spectator of these changes.

EU policies should foster the creation of a well-trained high-skilled workforce, focussing in particular on some points:

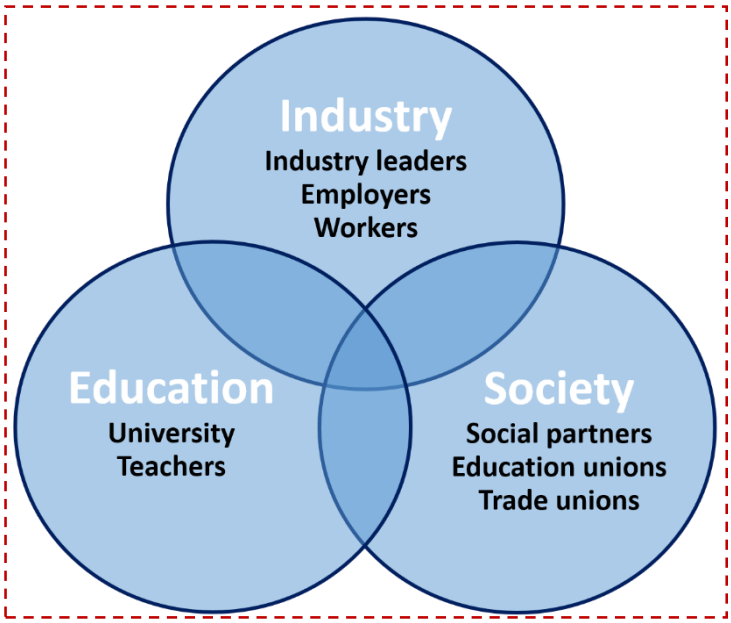
- To foster the **identification of 21st century skills** and relative **skill shortages**, such as collaboration & networking, problem solving, leadership, entrepreneurship, analytical and data analysis, privacy and security skills.
- To enhance the **digitisation of industry**, with the aim to drive the change from traditional manufacturing to Manufacturing of the future.

- To foster the development of workplace learning tools related to 21st century skills, such as **Learning Analytics**, Technology Enhanced Learning or Electronic Performance Support tools.
- To encompass all contexts of **lifelong learning** from K12 to further education, higher education, vocational & individual informal learning, considering that the workforce of the future should continuously update its skills following job market flexibility.
- To enhance the development of more powerful analytics tools able to monitor the changes in workforce performances and the effects of the undertaken actions in general.

The EU institutions are not able to do all this on their own. The first thing that European member states should do to effectively act towards these goals is to identify the relevant stakeholders involved in workplace learning and to drive the cooperation with them.

Who can be a stakeholder for promoting workplace learning?

The action that EU public policies have to take to reduce skill shortages, enhance STEM education, and push the workplace learning towards the digitisation and 21st century skills is to **identify and cooperate with all relevant stakeholders**.



Stakeholders involved in workplace learning.

Subjects that EU should consider for the development of the future policies on Learning Analytics belong to three different spheres: industry, society and education.

Industry

Industry should be involved at all levels, from employers to employees, because all of them play an important role as a driving force for transformation in the EU scenario.

On the one hand, industrial leaders and employers, in particular, should **drive the rise of Manufacturing of the future digital ecosystems** in their companies and implement new IT systems and skills both in every-day work and in training their workforce. Moreover, they can influence EU institutions in order to **promote the development of standardisation** of digital manufacturing systems and processes.

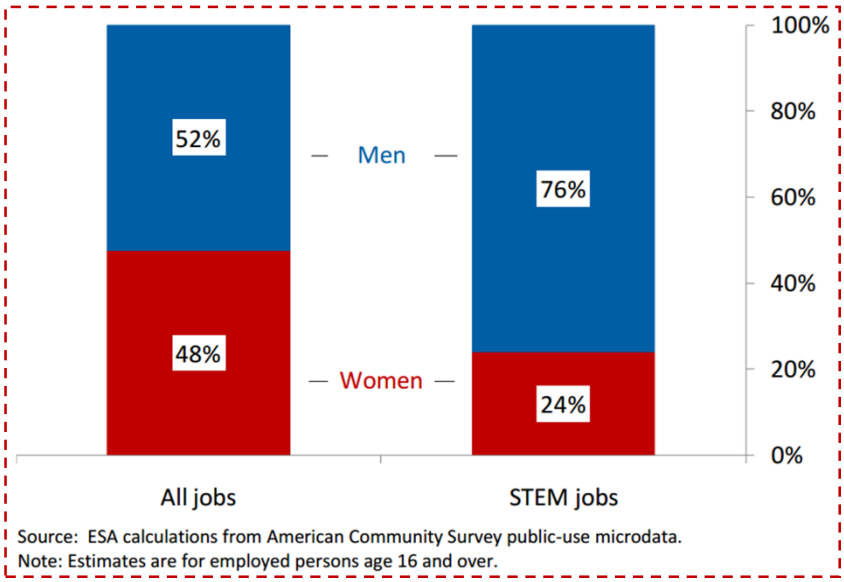
Industrial leaders should also interact and cooperate with the institutional and the educational world for the **identification of the "skills of the future"**, and then through these determine the **Key Performance Indicators** (KPIs) that should be evaluated by Learning Analytics to support the learning performances of employees.

On the other side, employers need to make the provisions to allow workers together with their representatives to be part and contribute to the implementation of the IT systems in their company with the aim to develop an adequate and agreed training scheme for a continuous workforce upskilling. It is important to understand that **a continuous improvement of workers' capacities and knowledge (lifelong learning) is crucial for their own professional development**.

By **giving feedback** and **utilising the sharing opportunities offered by Web 2.0**, workers, as end-users in workplace learning, can provide valuable information. This feedback, combined with Learning Analytics, is extremely beneficial for the development of more and better customised learning environments that are able to track the learning needs and provide adequate materials to end users.

Education

Of course, to develop new strategies and tools for learning at the workplace, educational institutions must be involved. In particular, all levels of education (from K12 to universities) should enhance a more pervasive **presence of STEM** in educational programmes and approaches. This can be obtained introducing new national and regional educational policies, promoted and sustained by EU institutions. Moreover, EU and national policies should foster the **elimination of the gender gap in STEM subjects**, considering that there is still a huge lack of women specialised in STEM, as reported by studies of the U.S. Department of Commerce [15] (shown in the figure below) and of the UK Department for Employment and Learning [16].



Gender Shares of Total and STEM Jobs (2009) [15].

Moreover, all education actors (universities, teachers and their representatives, vocational education and training institutions should work together with industrial leaders to identify and **implement the 21st century skills** in the learning framework of the future workforce. Partnership between industry and education can represent a unique opportunity to develop skills agendas in a targeted, innovative and sustainable way, including the subjects directly involved in the provision, application and updating of specific skills [17].

To do so, not only should the contents of educational programmes be modified, but the educational approach should be changed as well, shifting from traditional classroom systems to integrated systems, in which case studies, e-learning, simulations and **Technology Enhanced**

Learning (TEL) are parts of the learning process. This approach was well explained in a publication of the European Internet Foundation, which holds that the key to train adequate-skilled learners is to "redesign education itself around participative, digitally-enabled collaboration within and beyond the individual educational institution" [18].

The introduction of TEL in educational environment can potentially revolutionise the way learners acquire knowledge, both during school or university and at the workplace. However, to obtain strong and positive results, also **teachers need a continuous quality training to learn how to pedagogically use IT solutions in their teaching**, together with the proper equipments and IT tools. And this can be reached only with the support of national governments, national education authorities and employers.

Society

Other stakeholders should be involved in the development of EU policies on Learning Analytics and in workplace learning in general as well. For example, social partners and EU institutions can play an important role in the transition from traditional manufacturing, characterised by low automation to Industry 4.0, characterised by a higher level of automation and consequently by an adequate skilled workforce. This transition should take place ensuring the **integration between the "cyber workforce" and the human workforce**, and not as a mere replacement.

Workforce and trade unions must also exert a significant influence on EU policies for future learning, granting the **equilibrium between "market-driven" learning targets and the ones related to the correct development of the human being** (quality education is a human right and a public good). Social and societal values should be maintained as learning objectives, because users should become both well-trained learners and active and responsible citizens [19].

EU policies for learning @ workplace: who are the stakeholders?		
		On what can be involved?
Industry	***Industry leaders***	▪ Drive the rising of Manufacturing of the future. Implement Web 2.0 in employees' training. ▪ Promote the development of standardisation of digital manufacturing systems and processes for the development of adequate learning contents. ▪ Identification of "skills of the future" and relative KPIs. ▪ Cooperate actively with the educational institutions. ▪ Actively promote and encourage the upskilling of their workforce with continuous training programmes.
	Employers	▪ Drive the rising of Manufacturing of the future. ▪ Implement Web 2.0 in employees' training. ▪ Promote the development of standardisation of digital manufacturing systems and processes for the development of adequate learning contents. ▪ Actively engage in a meaningful social dialogue with trade unions and worker representatives with a view to provide high-quality initial training and continuous professional training for workers. ▪ Engage with worker representatives and trade unions to jointly address challenges and opportunities of new technologies in the labour market and develop a concept on the use of new technologies for the benefit of the workers and society as a whole ▪ Support and encourage a purposeful and appropriate use of new technologies at the workplace, ensuring decent working conditions (fair pay and pensions, adequate times for training, etc.) avoiding the misuse of these technologies to control workers (*e.g.* data protection of workers). ▪ Invest in a modern workforce by providing meaningful training, tailor-made for each individual worker.
	Workers	▪ Continuous improvement of their capacities and knowledge as crucial point for their own professional development, supported by employers and social partners. ▪ Feedbacks from learning environments and contents (in an anonymous, privacy-safe way), with the aim to improve the learning and training opportunities to each worker's needs. ▪ Actively engage in a meaningful social dialogue with employers with a view to provide high-quality

		initial training and continuous professional training for workers.
Education	***University***	▪ Strengthen STEM in educational programmes and eliminate the gender gap in STEM subjects. To do so, also teachers and professors need to be well-trained in STEM and in innovative pedagogical tools based on IT solutions. ▪ Identification of "skills of the future" and relative KPIs. ▪ Cooperate actively with industry. ▪ Integrate the traditional classroom-based educational approach with innovative TEL tools.
	Teachers	▪ Encourage female students to take up STEM subjects to eliminate the gender gap in these subjects ▪ Address school leaders, parents and kids for a school concept based on blended learning with new technologies (TEL), to gain the necessary support from them and from education authorities ▪ Change in educational approach from tradition to TEL with the appropriate support from government and education authorities; huge investments are needed in teachers' training and education institution's equipment. ▪ Identification of "skills of the future" and relative KPIs. Teachers are well placed to identify the skills needed by students and themselves as well.
Society	***Social partners***	▪ Avoid the mere replacement of human workforce with "cyber workforce". ▪ Equilibrium between "market-driven" learning targets and traditional educational targets, considering that education is a human right and a public good and that it has to prepare students not only for labour market needs, but also for life as responsible active citizens (lifelong learning). ▪ Jointly address challenges and opportunities of new technologies in the labour market and to develop a concept on the use of new technologies for the benefit of the workers and society as a whole.
	Teacher unions	▪ Avoid the mere replacement of human workforce with "cyber workforce". ▪ Equilibrium between "market-driven" learning targets and traditional educational targets, considering that education is a human right and a public good and that it has to prepare students not only for labour market needs, but also for life as responsible active citizens (lifelong learning). ▪ Engage with employers to jointly address challenges and opportunities of new technologies in the labour market and to develop a concept on

		the use of new technologies for the benefit of the workers and society as a whole. ▪ Support teacher training on blended use of IT tools in education. ▪ Support the appropriate use of new technologies at the workplace, ensuring decent working conditions, avoiding the misuse of these technologies to control workers (*e.g.* data protection of workers, fair pay and pensions, etc.).
	Trade unions	▪ Avoid the mere replacement of human workforce with "cyber workforce". ▪ Equilibrium between "market-driven" learning targets and traditional educational targets, considering that education is a human right and a public good and that it has to prepare students not only for labour market needs, but also for life as responsible active citizens (lifelong learning). ▪ Engage with employers to jointly address challenges and opportunities of new technologies in the labour market and to develop a concept on the use of new technologies for the benefit of the workers and society as a whole. ▪ Support the appropriate use of new technologies at the workplace, ensuring decent working conditions, avoiding the misuse of these technologies to control workers (*e.g.* data protection of workers, fair pay and pensions, etc.).

What future for workplace learning?

The challenges that EU have to face are wide and significant, and the future of European industry, and in particular manufacturing, strongly depends on the policies adopted by EU and State members.

Europe has to find a way to enhance the skills of the existing and future workforce during the school/university period, and even more importantly during the work experience itself. A well-trained workforce cannot be possible without quality education: everybody should have access to high quality public education before they enter the labour market and continuously throughout people's career, keeping in touch with subjects, contents and problems that can be present at the workplace. Moreover, also the knowledge of human sciences and other non-scientific subjects are important for the development of some of the 21st century skills, such as leadership, communication and collaboration with colleagues and customers.

At the workplace, nowadays a consistent part of formal learning is constituted by e-learning. However, traditional e-learning shows at

least one important drawback: the **lack in motivation** of end-users to learn [20].

A smart way to try to alleviate this drawback is to change the current e-learning environments. This change should involve the switch from a system in which the end user can only passively find presentations or contents to an interactive environment, in which socialisation with other end users, game-based knowledge, pervasive contact with learning supports (and teachers) and especially the possibility to personalise contents and learning methods can lead to an improved motivation and participation of the workforce to the learning process.

In this perspective, **Learning Analytics** can play an important role, tracking the way in which each user learns and proposing a tailor-made set of contents suited to preferences.

But can e-learning and TEL be the only answers to the challenges of workplace learning?

Of course not. This is because learning at the workplace does not only take place in classrooms or during e-learning sessions, but can take place accidentally **during daily work and in informal scenarios** [21] such as a break with colleagues near to the vending machine. One of the emerging pedagogical theory that considers the great importance of informal learning is named **70:20:10 framework**, in which:

- **10 %** is represented by traditional learning (in classrooms or with e-learning).
- **20 %** is represented by coaching (working or simulating a working situation with the help of an expert user).
- **70 %** is represented by self-learning during daily work.

The EU and national educational authorities, together with companies and social partners, could improve the research and development of IT tools that are able to help leverage a mix of formal and informal learning situations during workforce daily operations. This action is particularly important because it may be complementary to the existing EU policies about workplace learning, which tend to avoid that companies cut their training budgets and that less qualifications/certificates are issued to employees on which career advancement steps are traditionally based.

The LACE Evidence Hub and cases of Workplace Learning Analytics

The LACE Project is studying and promoting Learning Analytics at the workplace with the aim to identify good learning experiences on workplace through a new study methodology named MAN.TR.A™ (MANufacturing TRaining Analytics) maturity level model, based on an online survey. The Man.Tr.A. questionnaire was designed to help LACE understand the current adoption of technology-based learning within the industrial setting and its openness to consider embracing new trainee tracking and reporting analytics working within and beyond the training room into online and workplace scenarios. If you desire to access and contribute to the survey, please visit *http://tinyurl.com/o7jtuyk*.

Moreover, the LACE Project has opened a web portal to collect evidences of the effective use of Performance Support and Learning Analytics in its three target areas of Schools, Universities and Workplace Learning. All those willing to add evidences may do so by accessing the form available at *http://evidence.laceproject.eu/*.

Evidences may include Projects and/or Commercial Platforms and Systems, such as the two sample Workplace Learning entries reported here below:

The Watch Me (*www.project-watchme.eu/*) project aims to improve workplace-based feedback and assessment and professional development by means of learning analytics. It solves the efficiency and quality problems of workplace-based feedback and assessment by means of an electronic portfolio system, which is enhanced with: a) student models that monitor the learners' competency development, b) a Just-in-Time feedback module, c) visualisation tools that inform learners, teachers and institutes just in time as well as on an analytical level. Impact: Quality and efficiency of workplace-based feedback and assessment will increase, as well as the development of professional expertise throughout the domains.

The Skillaware™ Platform (*www.skillaware.com*) is an innovative software platform that combines the benefits of Electronic Performance Support, Business Process Improvement and Guidance and Online Learning & Knowledge Management, in order to help IT Departments to better engage, support and train their workforce and customers during the rollout and uptake of new business processes and software tools within their organisations. Skillaware™ uses new emerging interoperability standards in the area of Learning Analytics (e.g. Tin Can [22] and Experience API [23] from ADL), Business Process Management (e.g. BPMN 2.0 from OMG [24]), Technical Documentation (e.g. DITA from OASIS [25]) to support end user learning experiences during the on boarding of new procedures and platforms. Its benefits and ROI have been showcased effectively during its adoption for the roll out of new Warehouse and Supply Chain Management Systems within large Automotive Groups, new CRM and ERP platforms for Sales and Administration staff and for the support of call centre operators during decision tacking and new product and services rollouts.

Conclusions

Europe is facing one of the worst economic downturns in recent centuries. In particular, the manufacturing sector has reduced its share in GDP from 15.4 % to 15.1 % during the period 2008-2013 and a loss of 3.5 million jobs was registered.

However, the EU can still play a leading role in globalised manufacturing, if it commits to rapidly uptaking the content and perspectives of the 4th Industrial Revolution, betting on the creation of a high-skilled workforce for the production of goods characterised by high added-value, high quality and excellence.

To achieve this, the EU should direct its political efforts towards the identification of and the collaboration with all stakeholders involved in workplace learning, such as industrial leaders, social partners, employers, workers, vocational education and training institutions and universities. The aims of this cooperation should be the identification the 21st century skills that employees of the future need to have, the reduction of skill shortages and the management of the transition

from traditional manufacturing to Industry 4.0 without affecting the employment levels of companies.

A help to achieve these ambitious targets may be given by Technology Enhanced Learning, with its new advancements in Performance Support and Learning Analytics (able to customise the learning contents based on each learner's preferences) capable to deliver the right information at the moment of need, just in time, when the user needs it most.

What is LACE project?

The Learning Analytics Community Exchange (LACE) is an EU funded project in the 7th Framework Programme which aims at increasing benefit with the help of Learning Analytics (LA) and Educational Data Mining (EDM) to stimulate creativity and accelerate the identification of viable and effective solutions to real problems, through more agile training, performance support and just-in-time models of intervention.

LACE project (*www.laceproject.eu*) is divided in four areas of interests for the application of Learning Analytics and EDM, including Schools, Workplace, Higher Education and Interoperability.

LACE project brings together existing key European players in the field of Learning Analytics & EDM from across Europe (nine Core Partners, indicated in the table below, and more than 30 Associate Partners), with the aim to build communities of practice and share emerging best practice in order to make progress towards four objectives:

- Promote knowledge creation and exchange.
- Increase the evidence base.
- Contribute to the definition of future directions.
- Build consensus on interoperability and data sharing.

LACE project Core Partners		
Partner	**Country**	**Info**
Open Universiteit Nederland	NL	*OUNL*
Cetis Centre for Educational Technology and Interoperability Standards, University of Bolton	UK	*Cetis*
Institute for Educational Technology at the Open University	UK	*IET*
Infinity Technology Solutions **Skillaware S.r.l.**	IT	*ITS* *Skillaware*
Skolverket, Swedish National Agency for Education	SE	*Skolverket*
Kennisnet	NL	*Kennisnet*

Høgskolen i Oslo og Akershus	NO	*HiOA*
ATiT Audiovisual Technologies, Informatics and Telecommunications	BE	*ATiT*
EDEN European Distance Education Network	UK	*EDEN*

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About

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