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Data due: 31.05.2016

Keywords: workplace learning, learning analytics, process-based education, state of the art

Abstract:
This deliverable describes the state of the art of learning analytics at the workplace, summarises the activities and events delivered or attended by WP5, and presents how they have led to the achievement of project objectives.
## Contents

- **Introduction** .................................................................................................................. 1
- **Success criteria** ........................................................................................................... 2
- **Events organised by LACE WP5** .................................................................................. 3
  - Policies for Educational Data Mining & Learning Analytics Briefing.......................... 3
  - Social Business Forum 2015 ...................................................................................... 4
  - sedApta Customers & Partners Meeting 2016 ............................................................ 7
- **WP5 participation in external events** ............................................................................ 10
  - ESANN 2015 ............................................................................................................... 10
  - DevLearn 2015 .......................................................................................................... 10
  - Learntec 2016 ............................................................................................................ 12
  - Learning Technologies 2016 ...................................................................................... 13
  - Performance Support Symposium 2016 .................................................................... 14
- **Social networking and virtual sharing activities** ......................................................... 15
- **Other WP5 activities in the reporting period** ............................................................. 17
  - Contribution to the LACE Evidence Hub .................................................................. 17
  - LACE reviews and publications ............................................................................... 18
- **State of the art of learning analytics at the workplace** ............................................... 19
  - State of the art of policy in Europe regarding learning analytics at the workplace .......... 19
  - State of the art of implementation of learning analytics at the workplace .................. 22
- **Opportunities and issues** ............................................................................................ 24
- **Conclusions** ................................................................................................................ 26
- **Table of Figures** .......................................................................................................... 27
- **References** ................................................................................................................... 28
- **About** .......................................................................................................................... 29
## Introduction

Work Package 5 (WP5) of the LACE Project is dedicated to the promotion of analytics related to workplace learning, spreading learning analytics concepts and capturing the new and latest trends in workplace learning.

During project year 2, WP5 activities were mainly concentrated on

- the expansion and enhancement of the community of people interested in learning analytics at the workplace, through participation in and organisation of dedicated events in Europe and the US, together with sharing of activities and results on social networks;
- the capturing of the latest trends and developments in the field, adding contributions to the LACE Evidence Hub and promoting a survey on the use of learning analytics in commercial products for learning at the workplace;
- the development of two publications (LACE reviews) focused on EU policies and interoperability standards.

The present document summarises the physical and virtual events conducted by WP5 during 2015 and the first months of 2016, relating them to the project’s main objective, i.e. to promote knowledge creation and exchange within the ‘disparate communities’ targeted by LACE.

As introduction to this document, a section focused on the “State of the art” of learning analytics at the workplace is presented, depicting current EU policies, evidences of implementations and opportunities and issues of the application of learning analytics tools to workforce.
Success criteria

The LACE description of work (DOW) identifies eight stakeholder groups targeted by LACE:

1. Policy makers.
2. Heads and managers of information systems.
3. Heads of eLearning and TEL development teams.
4. Suppliers of technology-enhanced learning (TEL) software.
5. Software developers.
6. Early adopter practitioners.
7. Learning analytics (LA) and educational data mining (EDM) researchers.
8. Standards and interoperability experts and bodies.

Across all the work packages, and across the life of the project, “success” is defined as

- 600 direct contacts involving most stakeholder groups. A direct contact is defined as “attendance at one of our events or at a sessions where a LACE project member presents”.
- 50% of events involve at least three stakeholder groups or at least two sectors.
- Attendees blog or tweet about the event.

This document estimates direct contacts for all the events co-organised by LACE WP5. When available, specific numbers on engaged participants are provided, while in some case these are necessarily vague, and the number of overall event attendees is indicated. Stakeholder engagement is noted for events run by WP5 and engagement with social media is also noted for events organised or targeted by the work package.
Events organised by LACE WP5

This section describes the events, related to learning at the workplace, which WP5 members have contributed to organize in order to share LACE project activities and results, as well as to capture the latest trends in this field.

For all co-organized events, blog posts on the LACE website have been published, as well as several Twitter, Slideshare and LinkedIn posts entered before, during and after the events, as described in the next chapter.

Policies for Educational Data Mining & Learning Analytics Briefing

A first example of events co-organised by WP5 is the “Policies for Educational Data Mining & Learning Analytics” briefing & workshop, held in Brussels on the 15th April 2015.

This event, organised with other partners of the LACE project and in collaboration with European Schoolnet and the PELARS, WatchMe and Lea’s Box Projects, has been attended by 67 people, including representatives from different institutions/organisations with different interests, skills and backgrounds.

![Figure 1. Plenary session of “Policies for Educational Data Mining & Learning Analytics” Briefing.](image)

After the plenary session (Figure 1), three separate workshops took place, one for each sector of the LACE project (Schools, Workplace and Higher Education), in which the interested participants had the opportunity to discuss what policy-makers can and should do about learning analytics implementation in the training and educational landscape. The workshop dedicated to workplace learning discussed the role of EU and national policies for the development and implementation of learning analytics in the workplace around the Rapid Outcome Mapping Approach (ROMA) (Macfadyen et al., 2014), which was presented during the plenary session by the President of the Society for Learning Analytics Dragan Gašević and is shown in Figure 2.
The discussion developed to cover several subjects and institutions, such as representatives of EU institutions, universities, trade and commerce institutions and industrial subjects, generating a small and highly focused community of stakeholders. After the discussion, the community agreed to develop, starting from topics and concepts depicted during the meeting, a wider and more complex document on EU policies for learning analytics in the workplace. This document was developed by LACE WP5 leader ITS, and has been published as “The LACE LAW Manifesto - Promoting Learning Analytics @ the Workplace” (LACE Review 4)¹.

Progress towards LACE objectives:

Direct contacts: 67 people attended the event (12 participants to the Learning at workplace workshop).

Stakeholder engagement: MEPs and representatives from the European Parliament, European Commission project officers and advisors (DG CONNECT and DG EAC), representatives from key lobbying and stakeholder organisations including European Schoolnet, the European Trade Union Committee for Education, DIGITALEUROPE, European Publishers Association and organisations with a more general interest in data management in Europe including European Data Protection supervisors and the Big Value Data Association.


Social Business Forum 2015

The LACE WP5 leader participated in the organisation of the Social Business Forum 2015², held in Milan on 7th – 8th July 2015. The event was dedicated to “Next Generation Workplaces” and the use of disruptive learning technologies for user engagement and on-boarding. The Social Business Forum 2015, organised by OpenKnowledge under the slogan “Embracing Digital Disruption”, focused on how Digital Disruption is reshaping the basis of our lives, jobs and societies, dealing with topics such as:

Ubiquitous marketing, communication and business strategies, related to the spread of the Internet of Things (IoT) in the new social-industrial internet.

Reinvention of organisations and company hierarchies, in a world that is becoming more and more “on-demand”.

The use of Big Data to manage better customer relationships and employees’ experiences in the workplace.

Next generation (digital) workplace training and support, moving from traditional e-learning to a more effective and innovative mix of learning technologies and methodologies (learning analytics, performance support, business process improvement).

Business of sharing, which is considered the new way of doing business, such as collaborative consumption, peer-to-peer production and shared practices and cultures among customers, citizens and users.

Social customer relationship management, with the re-definition of the relationships between companies and their customers.

In 2015 the Social Business Forum was attended by more than 1,000 people from more than 20 countries in the two days. During the event, up to 50 speakers and 20 business cases were presented by different providers from the IT Industry (IBM, Microsoft, Adobe, SAP, Acer, sedApta, Expert System), Communication & Media (Sky, Cisco, Telecom Italia), Banking (BNP Paribas, UniCredit, Intesa Sanpaolo, ING Direct) and other fields like Energy, Manufacturing and Healthcare (Philips, Enel, a2a, Sanofi, Damiani International).

Fabrizio Cardinali, CEO of Skillaware[^3], the new company for workplace learning and performance support analytics solutions of the sedApta Group, of which WPS leader ITS is part, presented the LACE project and its activities during his opening keynote to the plenary session (Figure 3), on “The Learning Sputnik Effect. Supporting Digital Disruption @ the Workplace”. He embraced topics such as training and learning needs that technological disruption generates in people and workers, new pedagogical models (e.g. 70:20:10 framework, in which only 10 % of learning occurs in classroom, 20 % occurs by coaching and the largest part occurs as informal learning and experience acquisition), rapid up-skilling and competency development of the next-generation workforce.

[^3]: http://www.skillaware.com/
Moreover, the LACE project was listed on the Social Business Forum website (Figure 4) as one of the main organisations affiliated to the event.

Finally, WP5 organised a thematic lunch on the topic of workplace learning (Figure 5), which was attended by a wide variety of people from both the industrial and the academic field. This thematic lunch provided an opportunity to promote the relevance of learning analytics and Performance Support at the workplace in connection with the digital disruption concepts.
Considering the number of attendees and the relevance of this event, the Social Business Forum 2015 represented a unique possibility to share and foster the ideas and concepts of learning analytics in the workplace, with the aim of raising the awareness of industrial and academic fields on this topic.

**Progress towards LACE objectives:**

**Direct contacts:** more than 1,000 people attended the event during the two days (15 participants to the thematic lunch).

**Stakeholder engagement:** Heads and managers of information systems, heads of eLearning and TEL development teams, software developers, early adopter practitioner, members from diverse industrial fields.


**sedApta Customers & Partners Meeting 2016**

On the 11th - 12th May 2016, the LACE project supported the sedApta Customers & Partners Meeting, held in Genoa and organised by sedApta, the software company of which ITS is part (Figure 6).
This meeting brought together more than 350 attendees, coming from over 160 companies from different industrial sectors (Figure 7), including Food & Beverage (Bauli, Domori, Ferrero, Lavazza, Illy Caffè, Rana, etc.), Fashion & Luxury (Armani, Bulgari, Etro, Valentino, Versace, Benetton, Aeffe - Alberta Ferretti, etc.) and Manufacturing (ABB, Magneti Marelli, Brembo, Ansaldo Energia, Fiat Chrysler Automobiles, Riello, Piaggio Aerospace, etc.), as well as consulting and market analysts (Accenture, Deloitte, KPMG, Capgemini), relevant IT companies (Microsoft, Rockwell Automation, Siemens, Cegid, Gerber Technologies, Unisys, Engineering, etc.) and companies from other sectors (Verallia - Saint Gobain, Ardagh, Pirelli, Saipem, Gruppo Marcegaglia, etc.).

All the attendees had the opportunity to access the results and ideas of the LACE project at any time during the event by visiting a dedicated corner of the demo room (Figure 8). LACE flyers were distributed with the aim of sharing concepts and raising awareness of learning analytics in relation to the workplace and workforce training for manufacturing companies.
Progress towards LACE objectives:

Direct contacts: more than 350 people attended the overall event.

Stakeholder engagement: Heads and managers of information systems, suppliers of technology-enhanced learning (TEL) software, software developers, early adopter practitioners, attendees from relevant manufacturing companies in different sectors.
WP5 participation in external events

During the reporting period, WP5 partners also attended other events, not directly organised by LACE, in order to capture the latest thinking and trends, as well as to spread the ideas and concepts behind the LACE project to industrial stakeholders and communities and relevant people involved in learning in the workplace. Also in these cases, blog posts on LACE website and several Twitter, Slideshare and LinkedIn posts were entered before, during and after the events.

ESANN 2015

WP5 attended the European Symposium on Artificial Neural Networks, Computational Intelligence and Machine Learning (ESANN) 2015 event, held in Bruges from 22\textsuperscript{nd} to 24\textsuperscript{th} April 2015. During the event, a successful special session on “Advances in Learning Analytics and Educational Data Mining” was held on 23\textsuperscript{rd} of April, which 50 to 60 people attended. In this session, the LACE project, Evidence Hub and activities were introduced to the audience with the aim of fostering the growth of interested communities and awareness of learning analytics and educational data mining (Figure 9).

![Figure 9. Presentation of LACE project and activities during ESANN 2015](image)

Progress towards LACE objectives:

\textbf{Direct contacts:} 50-60 people* attended the special session.

\textbf{Stakeholder engagement:} Heads of eLearning and TEL development teams, software developers, learning analytics (LA) and educational data mining (EDM) researchers.

\textbf{Social Media:} Before, during and after the meeting, social network activities were carried out, and a blog post on LACE website was generated (http://www.laceproject.eu/blog/advances-in-learning-analytics-and-educational-data-mining-at-esann-2015/).

* Considering that a presentation of LACE project, activities and results was carried out during this event, the attendees can be considered as “Direct contacts” according to the definition reported in the Success Criteria chapter.

DevLearn 2015

With the aim of capturing the latest thinking and sharing information and ideas about learning analytics and the related interoperability standards, LACE WP5 attended the DevLearn 2015 event, held in Las Vegas from the 30\textsuperscript{th} September to the 2\textsuperscript{nd} October 2015. This was a great opportunity to involve relevant extra-European stakeholders in LACE project activities, and to measure the maturity of learning commercial products concerning learning analytics topics.
DevLearn is known to attract the leading learning technologies vendors, developers and technical opinion-makers from all around the world to discuss and to show innovations in learning technologies. In 2015, more than 1000 attendees, largely from outside Europe, attended this event, and the main focus of the event was related to xAPI and interoperability standards in learning technologies (Figure 10).

![XAPI graph](https://example.com/xapi-graph.png)

*Figure 10. A xAPI graph displayed during the DevLearn 2015 days to summarise the concept*.4

During the event, a LACE table was set up at the XAPI CAMP on the pre-conference day, while during the entire conference a LACE corner was kindly hosted by the Skillaware booth (Figure 11).

![LACE project table](https://example.com/lace-table.png)

*Figure 11. LACE project table at DevLearn 2015, hosted by Skillaware.*

During the event, an extensive social networking campaign was set up, and a long blog post was published on the LACE website5, generating a good level of discussion on the website.

<table>
<thead>
<tr>
<th>Progress towards LACE objectives:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contacts: more than 1000 people, largely from outside Europe, attended the overall event.</td>
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</tbody>
</table>

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4 [https://tinconapi.com/overview/](https://tinconapi.com/overview/)
Potential stakeholder engagement: Heads and managers of information systems, heads of eLearning and TEL development teams, suppliers of technology-enhanced learning (TEL) software, software developers, standards and interoperability experts and bodies.

Social Media: This event has not led to a LACE review, but has contributed to the concepts and ideas at the basis of one of the WP5 LACE review (http://www.laceproject.eu/learning-analytics-review/law-interoperability/). Before, during and after the meeting, social network activities were carried out, and a successful blog post on LACE website has been written (http://www.laceproject.eu/blog/dont-worrybe-xapi/).

* Please, consider that event attended by WP5 led to the counting of (potential) contacts and potential stakeholder engagements instead of “Direct contacts” and “Stakeholder engagement”, respectively. This is due to the fact that LACE project was not presented to them in an official way, but only to those people who entered in contact with attending WP5 members.

Learntec 2016
The LACE project was also present at Learntec 2016 (Karlsruhe, 25th - 28th January 2016), an international fair on the latest learning technologies and innovations in eLearning and performance support systems. The LACE project was kindly hosted by the Skillaware booth, as can be seen in the Twitter post below (Figure 12).

![Figure 12. LACE corner at Learntec 2016.](http://www.learntec.de/en/presse_service/presseuebersicht/presseservice_71808.jsp)
Progress towards LACE objectives*:

Contacts: more than 7250 people attended the fair.

Potential stakeholder engagement: Heads and managers of information systems, heads of eLearning and TEL development teams, suppliers of technology-enhanced learning (TEL) software, software developers, early adopter practitioners, standards and interoperability experts and bodies.

Social Media: Before, during and after the meeting, social network activities were carried out.

* Please, consider that event attended by WP5 led to the counting of (potential) contacts and potential stakeholder engagements instead of “Direct contacts” and “Stakeholder engagement”, respectively. This is due to the fact that LACE project was not presented to them in an official way, but only to those people who entered in contact with attending WP5 members.

Learning Technologies 2016

Most recently, WP5 was present at Learning Technologies 2016, with the aim of capturing the latest thinking about learning analytics and educational data mining (Figure 13).

![Figure 13. Capturing the latest thinking in learning analytics at Learning Technologies 2016.](image)

Learning Technologies is an annual summit that, in association with Learning and Skills, “has been Europe’s leading conference for organisational learning and the technology used to support learning at work”\(^7\) for the last 16 years. The event is structured in two parts: the conference, which represents a good opportunity to interact with leading thinkers, visionaries and practitioners in workplace learning, and the free exhibition, which hosts the latest and most innovative technology-supported learning solution providers (most of them specifically dedicated to workplace learning). Moreover, a huge number of free seminars on new solutions and commercial products take place in the free exhibition.

\(^7\) [http://www.learningtechnologies.co.uk/Content/Conference-LT/7/](http://www.learningtechnologies.co.uk/Content/Conference-LT/7/)
**Progress towards LACE objectives**:  
**Contacts**: not available.

**Potential stakeholder engagement**: Policy makers, heads of eLearning and TEL development teams, suppliers of technology-enhanced learning (TEL) software, software developers.

**Social Media**: Before, during and after the meeting, social network activities were carried out.

*Please, consider that event attended by WP5 led to the counting of (potential) contacts and potential stakeholder engagements instead of “Direct contacts” and “Stakeholder engagement”, respectively. This is due to the fact that LACE project was not presented to them in an official way, but only to those people who entered in contact with attending WP5 members.*

**Performance Support Symposium 2016**  
As a final event for WP5, the work package will attend the Performance Support Symposium 2016 in Austin, 8th - 10th June, with the aim of capturing the latest thinking and innovations concerning performance support and learning at workplace technologies.
Social networking and virtual sharing activities

The identification of the latest trends and the raising of discussion about learning analytics, applied in particular to the workplace, have been fostered by the continuous and regular publication of short posts on social networks (Twitter and LinkedIn), as well as on long blog posts on the LACE website, before, during and after the events attended or organised by work package members. Moreover, two relevant publications have been published and shared with the community (see next chapter).

Considering WP5 activities on social networks, more than 30 short posts on LinkedIn thematic groups and Twitter have been produced (as shown in Figure 14), several blog posts have been published on the LACE website and presentations have been shared through Slideshare.

WP5 social network activities before, during and after the events have gained a very wide post-event audience and sharing, for example for the recorded lesson taken from the keynote on “Digital Disruption & Learning Analytics at the workplace”, in which at minute 22 the LACE project was introduced to the +1500 international attendees of the Social Business Forum 2015. During the post-event week, the 30-minute lesson was experienced remotely by more than 50 trainees, online reached by the video and the presentation deck through the Zaption platform (Figure 15).

Figure 14. Some examples of Twitter posts published during attended and organised events.

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8 https://www.zaption.com/lessons/5635ee237803d32107f07cbd
A second example is the LACE website blog post about the DevLearn event\(^9\), which gained momentum during Twitter and LinkedIn sharing activity, with more than 300 visualisation and comments on its publication date on the two social networks (Figure 16).

In summary, the Twitter, LinkedIn, Slideshare and Zaption posts related to the LACE workplace learning activities reached a cumulative audience of **more than 3,000 during 2015**.

Other WP5 activities in the reporting period

The activities previously described cover all the WP5 actions related to events organisation, participation and networking. During the reporting period, WP5 members have also been involved in other activities relevant for the LACE project and its results. WP5 has increased its number of contributions to the LACE Evidence Hub (Task 5.4), as suggested by the project reviewers, and it has published two white papers (one of the main results of Task 5.5) which draw on and summarise the latest thinking on learning analytics and educational data mining in the workplace.

Contribution to the LACE Evidence Hub

During the reporting period, the WP5 leader has increased the amount of evidence about workplace learning available in the Evidence Hub, through two different strategies.

Academic publications as “Evidences”

Thanks to other LACE partners, a series of recent academic publications were collected and shared in the Evidence Hub. Currently, 11 pieces of evidence have been identified for the workplace learning sector, together with other two cross-sector evidences, related mainly to informal learning capturing and analytics on workers’ simplified networks.

Survey on learning analytics in current commercial tools

As identified by the project reviewers in their last report, there is a lack of evidence concerning learning analytics applied to workplace learning. This is mostly due to the fact that corporate and industrial stakeholders are far less interested in exposing their achievements to the public. Often workforce performance data are highly restricted and are not circulated unless strict non-disclosure agreements are in place.

Due to such constraints, it was decided to include commercial IT products and solutions for workplace learning as “projects” in the Evidence Hub. To do so, taking into account the decision to add commercial IT products as evidence of how learning analytics and interoperability standards are applied, a dedicated questionnaire was developed and shared with some 20 important international learning IT solution vendors during the last weeks of 2015. This first group of vendors was selected among WP5 leader contacts and contacted directly by e-mail. This way has been chosen considering that often software vendors are not prone to provide information about software to anyone who is not a (potential) customer, and that “intimacy” between a LACE project member and the vendor can increase the percentage of a successful entry in the Evidence Hub.

Anyway, during events attended by WP5, more potentially interesting contacts can be generated, increasing the number of vendors to be contacted by LACE project.

The questionnaire has three main sections:

- **Description of the product**, indicating the sector to which the tool is dedicated (school, HE, workplace), what kind of product it is (e.g. e-learning platform, performance support system, SaaS platform), the use of interoperability standards (if applicable), how the product deals with privacy issues. In this section, the relevance of learning analytics and/or educational data mining had to be clearly expressed.

- **Unique Selling Propositions** of the product, presented as bullet points.
• Brief description of the company profile.

Six questionnaires have been returned to WP5, highlighting the relationship between software solutions and interoperability standards and learning analytics, and they have been added to the Evidence Hub as “Projects”.

Considering the overall WP5 activities on the Evidence Hub, currently 18 entries are present. The WP5 plan is to raise the number of entries at least to 25 by the end of the project, including both academic papers and commercial products.

**LACE reviews and publications**

During year 2, WP5 members have developed two white papers, with the aim of collecting, summarising and sharing the latest trends in learning analytics and interoperability standards for workplace learning.

The first one, named “The LACE LAW manifesto - Promoting Learning Analytics @ the Workplace”\(^ {10} \), concerns the actions that EU and national policymakers should promote for the development of learning analytics as an important part of workplace learning. This document makes use of contributions to the discussions at the “Policies for Educational Data Mining & Learning Analytics” workshop (Brussels, 15\(^ {th} \) April 2015). During the review phases, the manifesto was strengthened by the integration of subsequent comments and suggestions from the workshop participants, as well as learning, technological and social trends from sector studies, market analysis and literature. This white paper was published as LACE Review 4.

The second manifesto, named “Towards Learning Analytics Interoperability at the Workplace (LAW Profile)”\(^ {11} \), concerns the development and usage of interoperability standards in workplace learning. In particular, the paper introduces the needs and possible options for interoperating learning analytics within industrial and corporate scenarios, directly at the workplace. It first introduces general concepts of standardisation roadmaps, abstract reference frameworks, application profiles and so on as key steps towards a shared approach to interoperability. It then proposes a scenario-based method to drill down to interoperability needs and options for workplace learning. This document has been published as LACE Review 5, and has been used within the LACE project as one of the action points for the activities of LACE WP7.

A third publication is currently under development, with the aim of depicting the state of the art of learning analytics and educational data mining concepts at the workplace, highlighting their implementations, opportunities, issues and current policies in Europe.

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\(^{10}\) http://www.laceproject.eu/learning-analytics-review/law-manifesto/

\(^{11}\) http://www.laceproject.eu/learning-analytics-review/law-interoperability/
State of the art of learning analytics at the workplace

This section describes the state of the art of the diffusion of learning analytics and its topics and innovations in workplace learning.

Unlike school or higher education fields, in which a large quantity of academic studies are present, data and studies concerning workplace learning are not so common and easy to obtain. This is probably due to two main factors:

1. Companies are not so prone to share data of performances of their workforce with the outside world, in which competitors are present.

2. Learning analytics tools providers are not so prone to share in a deep and useful way how their products really works. This means that it may be difficult to extract reliable and useful information on these tools, eliminating the “marketing” layer.

Despite the lack of information and data on commercial products, several academic papers can be found, related in particular to informal learning (García-Peñalvo et al. 2014, Li et al. 2014, Ruiz-Calleja et al. 2015), which is an extremely relevant aspect of workforce learning and it is currently difficult to track, quantify and evaluate.

State of the art of policy in Europe regarding learning analytics at the workplace

Considering that learning analytics is a relatively new branch of research, European institutions have still to be proactive in the definition of policies for learning analytics application.

This is particularly true for workplace learning, in which the development of innovative learning analytics tools able to catch more and more information on learners is coupled with a strong innovation of the workplace itself. This is particularly evident for manufacturing, where new technologies such as Internet of Things (Figure 17), 3D printing, advanced robotics or Internet of Services are rapidly reshaping factories, workplaces and the skill set required to employees. Moreover, technologies like Internet of Things can represent innovative ways to obtain information on the correct usage of instruments, equipment and software, which is strictly related to the training provided by the company on procedures and processes.
HOW IoT WILL CHANGE YOUR WORKPLACE

The Internet of Things (IoT) isn’t limited to kitchen appliances, like coffee pots that turn on automatically when you wake up and brew you a fresh pot. Rather, IoT is transforming the workplace, reducing operating costs, saving electricity and possibly even building new revenue streams.

Here’s what the future looks like.

1. **Energy**
   - Lights and thermostats operate autonomously to save on energy costs, turning off automatically when everyone leaves for the day.

2. **Security**
   - Smart doorbells, locks and surveillance systems will tell you who’s in front of the building anytime for your peace of mind.

3. **Smarter analytics**
   - More IoT devices mass more data and analytics on all aspects of the business to improve strategy and the customer experience. Intel IoT Platforms solutions generate actionable information by running analytics software and services on data for industrial, retail, automotive, energy, and healthcare industries.

4. **New revenue streams**
   - With more automated processes that allow for better business strategy, businesses will be able to focus more on researching and developing new products.

5. **Productivity**
   - When the printer is running low on ink, it will order more on its own, saving the secretary time. For industrial companies, machinery will be able to operate autonomously. And when a smart machine isn’t working properly, you’ll be notified.

6. **Travel**
   - Today’s Internet-connected cars give drivers a better sense of real-time traffic conditions and vehicle diagnostics to make business trips more efficient. Eventually, when self-driving cars go mainstream, accidents and travel time will be reduced.

7. **Inventory**
   - Businesses will be able to trace goods in the supply chain with Internet-connected inventory that can display exact locations at all times.

Figure 17. An infographic describing how Internet of Things will change the workplaces\(^\text{12}\).

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The increased digitisation of industries and workplaces in the recent years has led to the development and growth of digitalised tools for training at the workplace integrated with learning analytics functionalities, which are able to track the experience of users and to evaluate performance and quality of the materials provided. In this context, European 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.

The development of European policies on learning analytics at the workplace have of course to consider data privacy, which is why several actors should be present to the discussion tables on these topics. This topic was extensively studied and explored by LACE project, leading to the publication of a LACE review13 and a related paper14. The main stakeholders that should contribute to the creation of clear, useful and equal EU policies have been widely described in another LACE review15 published by WPS members (Figure 18).

![Figure 18. Stakeholders involved in workplace learning policies definition.](image)

Summarising, each stakeholder can contribute to develop, together with EU institutions, equal and clear policies for learning analytics at the workplace:

- **Industry leaders** can promote the development of standardisation of digital processes at the workplace, for instance through interoperability standards. They can also interact and cooperate with the institutional and the educational world for the identification of the “skills of the future” at the related Key Performance Indicators (KPIs) to be measured by learning analytics tools.

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- **Employers** can foster the application of continuous improvement policies for workers’ skills and knowledge, in compliance with the concept of lifelong learning.

- **Workers** can contribute, together with employers, to develop more and better customised learning environments, by giving feedback and utilising the sharing opportunities offered by social networks. This activity is particular valuable because it allows to raise the larger part of the issues related to learning data and privacy policies.

- **Universities** should work together with industry for the identification, implementation and monitoring through learning analytics of 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. The identification of 21st century skills will guide the development of learning analytics tools to trace and measure these skills, which are generally difficult to quantify.

- **Company teachers** can be involved during the development of trusted learning analytics tools, considering that they can give important feedbacks on students’ data management. Moreover, they need a continuous quality training to learn how to pedagogically use IT solutions in their teaching.

- **Social partners** and **other unions** can work together with employers and learning analytics developers with the aim to jointly address challenges and opportunities of new technologies in the labour market. In particular, they have to work together on data privacy of single trainees and the usage of learning data by the company, with the aim to allow the company obtaining useful information for continuous improvement of workforce without affecting workers’ rights.

Finally, EU policies should foster the research and development of IT tools that are able to help to leverage a mix of formal and informal learning situations during workforce daily operations.

**State of the art of implementation of learning analytics at the workplace**

Concerning the implementation of learning analytics tools and functionalities at the workplace, only a small quantity of information is available. As mentioned before, this is due in particular to a lack of willingness to share data (even if anonymously) by both software providers and industrial customers.

In general, considering the evidences collected during the project (see for instance the Evidence Hub), it seems that workplace learning is less mature than other sectors on learning analytics topics. During the project, two main categories of “implementations” have been found, very different one to the other:

1. Commercial software that declares the usage of learning analytics functionalities or concepts.

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16 Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions - “Rethinking Education: Investing in skills for better socio-economic outcomes”, (2012).
2. Academic papers, dedicated in particular on informal learning and social network analysis and community analysis on well restricted and defined groups of workers.

During a small and non-exhaustive market survey on learning analytics commercial tools, performed by WP5 with the aim to insert commercial products as evidences in the Hub\textsuperscript{17}, most of the participants have declared that they have some functionality attributable to the learning analytics sphere, but without declaring it explicitly. This seems to indicate that software vendors are mature enough to implement and improve learning analytics in their current portfolios, but that they are waiting for the reaction of markets and institutions to this topic and its issues, such as the management and the control of sensible learning data.

On the other side, academic research groups are starting to develop, test and share results on the first models of IT tools for learning analytics in relation to the workplace. A large part of these papers is strictly connected to informal learning, which for workplace learning constitutes the majority of the learning experience of employees. However, many of these papers are based on small test groups, involving employees of specific sectors such as teachers or health professionals (Li \textit{et al.} 2014), without considering, at the moment and to the best of our knowledge, jobs that requires high manual skills or workers that are not used to deal with computers and social networks.

\textsuperscript{17} http://evidence.laceproject.eu/projects/
Opportunities and issues

Despite the lack of evidences and successful implementations at the workplace, there is still an enormous potential in the application of learning analytics at the workplace. In this section, the main opportunities and issues of the application of learning analytics at the workplace are presented.

Opportunities

The application of learning analytics at the workplace presents several opportunities that can improve how training is provided and how learning is measured. In general, as for the other educational fields, learning analytics allows monitoring the learning performances of each trainer, providing information on additional learning materials to be provided to specific employees, as well as on the overall quality of training courses and materials.

Another great opportunity of learning analytics implementations at the workplace is related to capturing the informal learning of employees. Indeed, at the workplace the largest part of the learning of a new worker is related to informal learning, by first-person experience or talking and exchanging ideas with colleagues. This essential part of workers’ learning is currently not measurable by the company, and the introduction of a learning analytics tool, associated for instance to internal social networks, can give the company the possibility to have a clearer idea of the knowledge portfolio of its workforce.

Strictly related to the previous topic, there is also the possibility to find and evaluate the levels of 21st century and soft skills inside the workforce. According to a recent study of the UK Commission for Employment and Skills, the company areas in which skills supply and development will be necessary are: technically competent workforce at operative levels, leadership and management, market assessment of senior managers, supply chain management, R&D and design. Moreover, additional soft skills are nowadays required in next-gen workforce, such as critical and analytical thinking, problem solving, digital techniques, communication, collaboration, flexibility, adaptability, risk analysis, initiative and self-direction. Considering that large parts of these soft skills are cross-sector, and not related to specific competencies or work experiences, learning analytics can be a solution for the tracking of presence and progresses of these skills inside the company workforce.

Finally, the development of learning analytics at the workplace will lead to the development of interoperability standards, which can significantly help to validate in a harmonised way the different aspects (for instance, measured on different tools) of lifelong learning of employees.

Issues

Some of the issues concerning the application of learning analytics at the workplace are not so different from the ones of higher education or school sectors. The biggest issue is related to workers’ privacy and management of workers’ data, considering that an incorrect use of learning analytics data from the company can lead to severe consequences for the worker’s life at the workplace. A possible solution to this issue can be the development and application of learning data management policies, fostered by the company together with social partners. Moreover, it can be useful, where possible, to aggregate and to anonymise data during reporting activities.

A second issue, also described by García-Peñalvo et al (2014) during the analysis of informal learning tracking tools, is related to the **lack of interest in using learning tools** for informal learning evaluation, such as company social networks for Social Network Analysis. This is probably due, according to authors, to the introduction of a new tool at the workplace, different from the ones usually present. The suggestion of García-Peñalvo et al. (2014) to solve this issue is to integrate “…[informal learning tracking] systems with the applications which already formed part of the users working environment”. This is why in recent years some of the most innovative learning tools for companies are electronic performance support systems (EPSS), which allow providing information and learning materials to the employees directly when they need them.
Conclusions

During the reporting period, WP5 has focused its efforts on crucial activities related to fostering learning analytics and educational data mining ideas in the workplace, as well as capturing what the commercial world has to offer in terms of learning analytics IT tools for workforce training.

In particular, WP5 has concentrated its efforts on:

- Developing and **stimulating the communities of stakeholders** interested in workplace learning, through participation in events, social networking and blog posts on the LACE website. Moreover, a manifesto (LACE Review 4) has been published based on contributions of participants at a LACE-organised event.

- **Spreading topics and ideas of learning analytics** and educational data mining to the industrial world, by co-organising dedicated events (Social Business Forum 2015, sedApta Customers & Partners Meeting 2016), and publishing two white papers (LACE Review 4 and 5).

- **Contributing to the Evidence Hub**, through the addition of several pieces of academic evidence and commercial IT tool descriptions as “projects”.

By the end of the project, WPS activities will be focused on consolidating the results that have been obtained, through participation in more extra-EU events and continuous monitoring and reporting of evidence to the Evidence Hub.
Table of Figures

Figure 1. Plenary session of “Policies for Educational Data Mining & Learning Analytics” Briefing. 3
Figure 2. ROMA approach, as described by Macfadyen et al. (2014). 4
Figure 3. LACE project presentation at the Social Business Forum 2015. 6
Figure 4. Social Business Forum 2015 website - Sponsor page. 6
Figure 5. Thematic Lunch promoted by WPS at the Social Business Forum 2015. 7
Figure 6. Contributions to the organisation of the sedApta Customers & Partners Meeting 2016. 8
Figure 7. Attendees during the plenary session of the sedApta Customers & Partners Meeting. 8
Figure 8. LACE corner at the sedApta Customers & Partners Meeting. 9
Figure 9. Presentation of LACE project and activities during ESANN 2015. 10
Figure 10. A xAPI graph displayed during the DevLearn 2015 days to summarise the concept. 11
Figure 11. LACE project table at DevLearn 2015, hosted by Skillaware. 11
Figure 12. LACE corner at Learntec 2016. 12
Figure 13. Capturing the latest thinking in learning analytics at Learning Technologies 2016. 13
Figure 14. Some examples of Twitter posts published during attended and organised events. 15
Figure 15. Zaption platform analytics on Fabrizio Cardinali’s speech at Social Business Forum 2015. 16
Figure 16. LinkedIn analytics about “Don’t worry...be xAPI!” post. 16
Figure 17. An infographic describing how Internet of Things will change the workplaces. 20
Figure 18. Stakeholders involved in workplace learning policies definition. 21
References


Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, (2012). “Rethinking Education: Investing in skills for better socio-economic outcomes”.


About

Version History

<table>
<thead>
<tr>
<th>Date</th>
<th>Notes</th>
<th>Person</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016-05-17</td>
<td>First Draft</td>
<td>Fabrizio Cardinali, Marco Paini</td>
</tr>
<tr>
<td>2016-05-25</td>
<td>Internal Review</td>
<td>Rebecca Ferguson, Wietse Van Bruggen</td>
</tr>
<tr>
<td>2016-05-27</td>
<td>Integration of reviewer suggestions</td>
<td>Fabrizio Cardinali, Marco Paini</td>
</tr>
<tr>
<td>2016-05-31</td>
<td>Final version</td>
<td>Marco Paini</td>
</tr>
<tr>
<td>2016-05-31</td>
<td>Cleared for submission to the EC</td>
<td>Hendrik Drachsler, Maren Scheffel</td>
</tr>
</tbody>
</table>

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About LACE

The LACE project brings together existing key European players in the fields of learning analytics & educational data mining who are committed to building communities of practice and sharing emerging best practice in order to make progress towards four objectives.

<table>
<thead>
<tr>
<th>Objective 1 – Promote knowledge creation and exchange</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective 2 – Increase the evidence base</td>
</tr>
<tr>
<td>Objective 3 – Contribute to the definition of future directions</td>
</tr>
<tr>
<td>Objective 4 – Build consensus on interoperability and data sharing</td>
</tr>
</tbody>
</table>

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This document was produced with funding from the European Commission Seventh Framework Programme as part of the LACE Project, grant number 619424.