Abstract:
This project deliverable comprises a compilation of the studies related to data sharing and interoperability that have been produced by LACE in the first two years of the project. These studies range from general introductions to the field through to more technical works dealing with specific kinds of learning activity for which data capture would be useful for learning analytics.
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1. Introduction

This project deliverable (D7.3) comprises a compilation of the studies related to data sharing and interoperability that have been produced by LACE in the two first years of the project. It is an update of deliverable D7.1 arising from the following task in the Description of Work:

We will produce a small number of studies to document the current state of the art in existing standards and systems for interoperability suited to LA & EDM. Each study will address a different set of requirements and map to the top level themes (provosionally, these are as described in Section 1.1.3 as “content and resources”, “support for learning” and “assessment and performance”). An initial study of existing systems, whether or not they attempt to provide or consume data in an interoperable fashion, will lead to a provisional prioritised set of key concepts (data types in concrete terms), which will be validated by consultation with SIG and other stakeholders prior to the production of each study. The results of open data projects such as LinkedUp will also be used. The studies will indicate, with reasoning, where work to develop common models or standards would advance adoption, research, and innovation. Attention will be given to the requirements of the SoLAR Open Learning Analytics proposal to design, implement and evaluate an open platform for LA. These reports are likely to be of a technical nature and may not be suitable for publication in the LACE Review; this will be decided ad hoc. Deliverable D7.1 is a compilation of the studies after they have been initially created in a public space and had a period in which they are open for comment.

Each of the studies exists as an independent document, and several have been subject to change as part of the open and consultative process that LACE is adopting in Workpackage 7, Interoperability and Data Sharing (WP7).

This document summarises the open process we are adopting for some of the studies and provides an overview of the compiled studies. This second compilation, D7.3 includes revised studies being published in D7.1, as well as new studies created during 2015. The studies mentioned in section 3.1, 3.3 and 3.9 have been updated for this deliverable; and the studies mentioned in 3.5, 3.6 and 3.7 are new contributions to this deliverable.

2. The Open Consultative Process

LACE is, as a Support Action, necessarily committed to the open creation and exchange of knowledge about learning analytics and we seek to involve stakeholders with a special interest in interoperability and data sharing through WP7. In addition, the benefits of open process for the development of interoperability standards is well documented (Lundell, 2012), and is a key aspect of the idea of open standards. These benefits include the building of trust and legitimacy in formal standards, but an open process also helps to ensure that the widest possible range of perspectives and requirements can come to bear on the design process. We recognise, therefore, that the quality of those studies that we undertake which analyse requirements and possible solutions stands to be improved by a similar kind of open process. We believe that this benefit is realisable, even though the work we are doing is intended to be supportive of standardisation processes, rather than to establish our own standardisation process. Our aim is to help build consensus and to document it.
This kind of process is not applicable to all of the outputs of the Interoperability and Data Sharing Workpackage (WP7); our intention is to use it for the generally more technical studies that we see as informing the specifications and standards development process. Studies for which we do not see this role are published using the normal LACE procedures.

The cornerstone of our open process is the idea of creating complete but provisional studies and publishing them as Drafts for Public Comment, soliciting comment, and incrementally refining the studies. Our website has a dedicated page for Drafts for Public Comment\(^1\), which provides links to a downloadable PDF file, an online version that can have comments attached, and a Google Group discussion forum. We have kept these studies separate from other publications both because they are likely to be revised during the project, and because the audience is very clearly a sub-set of the overall LACE community. As new revisions are created, as they have been for D7.1, they are posted online. On the initial release, and for significant version changes, we promote the study via social media and directly to relevant communities interested in learning analytics interoperability. We also take advantage of opportunities such as workshop meetings (e.g., the series of six Ethics & Privacy for Learning Analytics workshops October 2014 – March 2015), and our involvement in specifications and standards development organisations to gather feedback in less public settings. In particular, we have through privileged roles of LACE individuals provided input to IMS Caliper Analytics work and ISO/IEC JTC 1/SC36 work.

### 3. The Learning Analytics Interoperability Studies

In planning and writing the studies, we have considered a range of audiences with at least some interest in, or awareness of, the topic of interoperability. This has led us to produce different kinds of document, for which we use the word “studies”, following the Description of Work. Some of them are broad-and-shallow and generally descriptive, while others are narrow-but-deep and are generally more analytical. Those of a broad-and-shallow character are intended to be read by an audience for whom interoperability is not a daily concern. These studies are published through the normal LACE channels: as blog-style web-site articles, or in the Learning Analytics Review. The narrow-but-deep studies are intended for an audience with a special interest in interoperability.

The following summary of the studies is in approximate order of detail. The studies are provided as logically separate documents, separate from this current document.

#### 3.1 Standards to Support Learning Analytics – an Overview of Current Activity 2015

Many people in the learning analytics community recognise the significance of the idea of interoperability but are, for various reasons, not well informed about what is going on in the standardisation bodies and pre-standardisation communities. To address this knowledge-gap, LACE produced an overview of current activity in these bodies and communities. This has been published as an article on the LACE website and as a PDF version, included in D7.3.

The report was first published end of 2014 and has been updated at the end of 2015, capturing recent development and newly published specifications.

\(^1\) [http://www.laceproject.eu/dpc/](http://www.laceproject.eu/dpc/)
3.2 Learning Analytics Interoperability – The Big Picture in Brief

This white paper, which is described as an “introductory briefing”, is published as part of the Learning Analytics Review and is intended to outline some of the potential benefits of interoperability in the context of learning analytics. It is aimed at people who may be considering adopting or developing learning analytics solutions in their organisation, and the term “Big Picture” is used to capture the idea that learning analytics systems may be usefully supported by existing or emerging interoperability specifications that are not directly associated with learning, education, or training, in addition to specifications intended for this domain of application.

Online location: http://www.laceproject.eu/learning-analytics-review/learning-analytics-interoperability-big-picture-brief/

3.3 Specifications and Standards Quick Reference Guide

This document, which has been published as a Draft for Public Comment continues where the Big Picture white paper left off. It is intended to be a quick reference for people building systems or making decisions about what to specify in procurement. It identifies 34 relevant specifications and standards and indicates both where the technical documentation may be found, and what evidence is available for its usefulness. The document also draws attention to some of the complexity inherent in evaluating specifications and standards.

All of the evidence and technical documentation referred to in the Quick Reference Guide are also stored in the popular online citation management system, Mendeley. New resources are added as we discover them so that Mendeley serves as living repository of information. We have made this a public group to allow other people to make contributions.

The Guide has been updated with recent 2015 developments.


3.4 Learning Analytics Interoperability – Looking for Low-Hanging Fruits

Whereas the Big Picture in Brief was aimed primarily at potential adopters of interoperability specifications, the paper described in this section considers the process of prioritising attention to interoperability barriers and possible solutions. The paper (Hoel & Chen 2014) itself was created for the 1st Workshop on Learning Analytics at the International Conference on Computers in Education, held in Japan from 30 November to 4 December, 2014.

This paper emphasises the idea that the problem space for learning analytics interoperability, and hence the solution space, must account for a wide spectrum of stakeholder concerns that go well beyond the overt benefit of interoperability: moving data around and using it. These concerns include what are often termed “organisational” facets of interoperability, which include the issues of privacy, trust, and control. These are factors that can, and do, nullify even the most elegant of technical solutions.

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2 http://www.laceproject.eu/learning-analytics-review/
3 https://sites.google.com/site/la2014ws/. The workshop proceedings are yet to be published.
Although the conclusions based on stakeholder interviews used in this paper need to be validated through further field work, the conceptual aspects of the paper have been used in debates within the International Organization for Standardization Ad-Hoc group on Learning Analytics Interoperability (see “Standards to Support Learning Analytics – an Overview of Current Activity”).


3.5 Is Privacy a Show-stopper for Learning Analytics? A review of Current Issues and their Solutions to develop Trusted Learning Analytics

This LACE Review report gives an introduction to the issues surrounding ethics, privacy, data protection, data ownership and sharing and other concerns in the context of learning analytics. The issues are complex, and since learning analytics is a new field of interest to most professions this review is not aiming at promoting solutions, but more to framing the discussion and give ideas how to develop an agenda for a more sound development strategy of learning analytics where these issues are thought through. The paper introduces the scope of the issues, describes some LACE activities in the area, and discusses some relevant current initiatives.

The paper is published as a LACE Learning Analytics Review Paper.

Online location: http://www.laceproject.eu/learning-analytics-review/is-privacy-a-show-stopper/

3.6 Privacy in Learning Analytics – Implications for System Architecture

Privacy is identified by the LACE project as one of the most pressing issues to be addressed both in terms of best practices for learning analytics as well as for technical design. However, it is not clear what this means for system architectures.

This paper explores some of the implications for system architecture. Based on requirements of open architecture, transparency and trust, and ownership and consent the paper proposes a search architecture for learning analytics based on open and linked data. The proposed middle layer highlights dynamic usage agreements and student agency and represents an alternative approach to the LA architectures now being developed in international standardisation fora.

The paper (Hoel & Chen 2015) was presented at the 11th International Conference on Knowledge Management, ICKM 15, in Osaka, Japan, 4 - 6 November 2015.


3.7 Towards Learning Analytics Interoperability at the Workplace (LAW Profile)

This paper introduces the LAW profile developed by the LACE Workplace Learning work package. It 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 standardization roadmaps, abstract reference frameworks, application profiles and reference implementations 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, using a top-down approach. The paper suggests how the community could take action to develop specific profiles and recipes from existing and emerging specifications, with the aim of producing, managing, sharing and
distributing standards-based and actionable analytics for improving workplace learning within industrial verticals.

*Online location: http://www.laceproject.eu/learning-analytics-review/law-interoperability/

### 3.8 Interoperability Study – Audio/Video Player Events

This was the first study produced that considers technical detail within a narrow area of application. Among the various kinds of educational content resource that could be considered in a learning analytics context, video (in particular) was identified as a priority for attention for two reasons. First, there is likely to be some useful information that can be gathered from in-video activity tracking. Second, there is growing use of video from lecture capture, through MOOCs, and the Khan Academy, yet there is no clear common approach to expressing video watching activity data.

The approach taken in the study is to inspect a selection of existing media players through the lens of learning analytics enquiry and to speculate on a common model to capture run-time events.

This study is available as a Draft for Public Comment, and has been taken as input into the ADL Experience API Video Community of Practice (Video CoP). The current version of the Audio/Video study has benefitted from material and feedback provided by members of the Experience API community. We intend to participate in the Video CoP and expect to revise the LACE study according to new information, critique, etc. An early draft was also made available to the IMS Caliper project team.

*Online location: http://www.laceproject.eu/dpc/audio_video-playback-learning-analytics-interoperability-study/

### 3.9 Interoperability Study – Assessment and Allied Activities

This is the second study to address activity data in depth. Assessment is an essential part of almost all realisations of education and training, and concepts such as formative assessment and “assessment for learning”, which offer good potential for learning analytics, are becoming widely practiced. Because of the way assessment and feedback is so embedded in education and training practice, it is a good starting-point for engaging practitioners with learning analytics. Assessment analytics also stands to benefit all learners across the spectrum of age, ability, and motivation.

The approach taken in this study is to consider a range of assessment practices that could be described as mainstream, including the use of eAssessment (even though eAssessment may not be very widely practiced, it is generally equivalent to paper-based testing instruments in terms of what is assessed). The widely implemented IMS Question and Test Interoperability specification is taken as a conceptual starting-point; it defines concepts from the point of view of exchanging assessment content and associated response processing rules.

An early draft has previously been made available to the IMS Caliper project team as input to discussion on the Assessment Metric Profile.


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4. Conclusions

The studies compiled in this deliverable have contributed to the on-going discourse on learning analytics interoperability by giving an overview of current actors and activities, a guide to specifications that need to be taken into consideration, as well as giving input to new issues that need to be reflected in requirements for interoperability, e.g., issues related to ethics and privacy. Together with D7.3 LACE will publish D7.4, which is an extensive and ground breaking report on requirement, specifications, adoption and practice related to interoperability and data sharing. Both reports will form background material for workshop and webinar activities, as well as new LACE Review papers to be published at laceproject.eu in 2016.

5. References


6. About

Version History

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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.

Objective 1 – Promote knowledge creation and exchange
Objective 2 – Increase the evidence base
Objective 3 – Contribute to the definition of future directions
Objective 4 – Build consensus on interoperability and data sharing

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