Standards to Support Learning Analytics, 2015

An Overview of Current Activities, December 2015

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This is a version of an online report[1] formatted for printing

1. Introduction

The development of IT standards and other kinds of technical specifications to support interoperability in educational technology has been underway for more than 15 years, but the focus of attention has usually been on system integration or portability of educational content. The growth of interest in learning analytics has led to an increase in the number and diversity of the people who identify specifications and standards as being important because analytics frequently requires the use of data from multiple sources. It is not simply that learning analytics has widened interest in the products of interoperability and standards specialists; the practice of learning analytics introduces a new set of requirements for technical specifications.

In spite of the interest in interoperability and standards from learning analytics innovators and researchers, standardisation activity remains as something that goes on "elsewhere" and is often not tracked due to difficulty of access or lack of time. This report should help to bridge this gap between interest and knowledge; it provides a brief summary of activities related to learning analytics that are underway in different kinds of standards-related bodies as at the end of 2015.

We find standardisation activities in three types of fora: 1) industry or stakeholder consortia, 2) national or regional standardisation organisations, and 3) international standardisation bodies. In addition, there may be more informal, and often open-access, collaborations working on pre-standardisation tasks. The output of pre-standardisation activity may look like a standard, and some stakeholders have a preference for these specifications because the time and effort to evolve them is substantially less than in more formal settings. Pre-standardisation work is useful when the requirements and design decisions are emerging, and it provides a basis of evidence required for effective standardisation. Learning analytics, being a new and "hot" phenomenon, has stimulated activity in formal standardisation fora as well as a variety of pre-standardisation studies and experimentation, with different levels of stakeholder engagement and with varying degrees of competition and collaboration between these organisations and informal initiatives.

[1] http://www.laceproject.eu/blog/standards-to-support-learning-analytics-an-overview-of-current-activity-2015

The LACE publication, "Learning Analytics Interoperability - the Big Picture in Brief"[2] outlines a view that the scope of learning analytics interoperability includes aspects that are generally applicable to any kind of analytics as well as aspects that are specific to learning, education and training. Standards bodies and groups have addressed all of these categories, resulting in a number of specifications and standards that could be adopted or adapted for learning analytics. The LACE publication "Standards and Specifications - Quick Reference Guide"[3] provides a technical-level summary of the range of existing work that may be relevant to learning analytics system developers.

At present, the general situation is that "work in progress" describes the level of maturity in standardisation work specifically intended to be used for learning analytics. A similar point may be made about the process of gathering evidence for the suitability of existing specifications and standards for learning analytics. In order to properly evaluate the impact and benefits of different approaches, we would need to see more evidence of mature work and software implementations in realistic usage situations. There are, however, examples of reference architectures being developed (the UK Jisc Open Learning Analytics Architecture[4] and the South Korean Open Source Reference Architecture[5] being two cases in point). As of now, no outcomes of these implementations are published. Hence, this report avoids such evaluations and focuses on background and activity. Furthermore, rather than consider the full "big picture" scope, we consider only initiatives with a defined objective of solving issues related to *learning* analytics.

2. Consortia and Specification Development Fora

Advanced Distributed Learning (ADL) and Experience API

The Advanced Distributed Learning[6] (ADL) Initiative of the US Department of Defence is concerned particularly with flexible training for workplace and lifelong learning through the use of technology. ADL is best known for SCORM (Sharable Content Object Reference Model), the standard with the strongest brand name in the short history of learning technologies. To further develop SCORM to fit into the future "Training and Learning Architecture", ADL sponsored the development of what became known as the Experience API (xAPI) through a research and development project called Tin Can (hence the alternative name for xAPI is Tin Can API[7]). The xAPI specification is now in version 1.0.2 2 (with a version 1.0.3 in pipeline) and is published under the Apache Licence (version 2.0), which means that the specification is free to download and use.

xAPI is designed to address a learning landscape with increasing use of mobile devices, games, augmented reality, social media, etc. It enables the reporting of a range of experiences, not just completions of actions using a Learning Management System, although most current uses of xAPI still rely on a similar kind of system. The central concept in xAPI is Activity Streams, which are

[2] http://www.laceproject.eu/learning-analytics-review/learning-analytics-interoperability-big-picture-brief/
[3] http://www.laceproject.eu/dpc/standards-specifications-quick-reference-guide/
[4] http://analytics.jiscinvolve.org/wp/
[5] http://www.laceproject.eu/blog/korean-perspective-learning-analytics-development-test-bed-based-open-source/
[6] http://www.adlnet.org/
[7] http://tincanapi.com/

statements about what someone has done using a generic format, <Actor>, <Verb>, <Object>, e.g., John Connor ***answered*** "Question 1" with "True".

xAPI also specifies the properties of a Learning Record Store (LRS), which is where the activity records are stored.

In addition to supporting adoption and maintaining the version 1, current activity on the Experience API in ADL is focussed on two areas:

- There is currently vigorous debate on requirements for, and scope of, xAPI v2, and the extent to which xAPI v2 should be backwards compatible with xAPI v1.
- Communities of Practice[8] (CoP) working groups are being established to consider the use of xAPI in various settings, or for particular applications. CoPs are intended to create best practices and to define controlled vocabularies for use with the xAPI core language.

Plans have been announced[9] to set up a Data Interoperability Standards Consortium (DISC) as a new, not-for-profit organization in the State of Pennsylvania, USA, to be the steward of xAPI.

IMS Global Learning Consortium

IMS Global Learning Consortium, often just referred to as IMS, is a membership organisation that issues consortium standards.

Caliper Analytics

IMS Global's learning analytics initiative is called Caliper Analytics and was outlined in a white paper[10] published in September 2013. Version 1.0 of the Caliper specification was published in October 2015, and promoted as "the world's first interoperability standard for educational click stream data". It aims "to provide Learning Metric Profiles as standardised descriptions of actions and related contexts; creating Learning Sensor APIs and Learning Events drive to be able to aggregate metrics; and leverage of existing IMS specifications, like Learning Tool Interoperability (LTI) specification, Learning Information Service specification , and Question & Test Interoperability specification".

Caliper's principal contributions are, according to the IMS website[11],

- IMS Learning Metric Profiles to establish a basic, and extensible, common format for presenting learning activity data gathered from learner activity across multiple learning environments. Metric Profiles provide a common language for describing student activity. By establishing a set of common labels for learning activity data, the metric profiles greatly simplify exchange of this data across multiple platforms. While Metric Profiles provide a standard, they do not in and of themselves provide a product or specify how to provide a product. Many different products can be created using the same labels established by the standard.

[8] http://www.adlnet.gov/tla/experience-api/xapi-cop-directory/
[9] http://xapiquarterly.com/2015/09/the-way-of-xapis-consortium/
[10] http://www.imsglobal.org/IMSLearningAnalyticsWP.pdf
[11] https://www.imsglobal.org/activity/caliperram

- IMS Learning Sensor API™ to define basic learning events and to standardize and simplify the gathering of learning metrics across learning environments.
- Leveraging and extensions of the IMS LTI™/LIS/QTI™ standards thus enhancing and integrating granular, standardized learning measurement with tools interoperability and the underlying learning information models, inclusive of course, learner, outcomes and other critical associated context.

The Caliper specification is composed of three documents[12], Caliper Analytics v1 Best Practice Guide, Caliper Analytics v1 Implementation Guide, and Caliper Analytics v1 Conformance Guide. In addition there is an online repository of Caliper Sensor API Code libraries, a Caliper Java Sample App, and Caliper Additional Repositories (contexts, common fixtures, and Event Store).

Privacy

The development of Caliper, coupled with the recent high profile forced closure of InBloom[13] and legislation in several US states, has led to increased interest in privacy among IMS members and within the IMS Board. A Privacy Group is established, and is, according to the IMS website, working to "create a privacy nutrition label that identifies what information is collected, how information is used, and how and with whom your information is shared." It should be noted that IMS Learning Tools Interoperability specification already includes some useful features to protect the privacy of learners.

Apereo Learning Analytics Initiative

Apereo is an open-source foundation formed through the merger of Sakai and Jasig in 2012 (www.apereo.org). Apereo gives great importance to the incubation process, both in terms of the formal structures of projects and also the development of communities.

Currently, Apereo has three projects in incubation as part of the Apereo Learning Analytics Initiative, which "aims to accelerate the operationalization of Learning Analytics software and frameworks, support the validation of analytics pilots across institutions, and work together so as to avoid duplication where possible." The projects14 are

Learning Analytics Processor
The Learning Analytics Processor project is aimed at accelerating the future of predictive learning analytics through the development of a flexible and highly scalable tool that will facilitate everything from academic early alert systems to data visualizations.

OpenLRS
OpenLRS is an source Java based Learning Record Store which is compatible with TinCan API and Experience API.

[12] https://www.imsglobal.org/activity/caliperram
[13] http://www.businesscloudnews.com/2014/04/25/inblooms-closure-highlights-dark-side-of-privacy-in-sectors-driven-by-data/
[14] https://www.apereo.org/content/projects-currently-incubation

OpenDashboard
OpenDashboard is a web application that provides a framework for displaying visualizations and data views called "cards". Cards represent a single discrete visualization or data view but share an API and data model.

Apereo works closely with UK Jisc to develop the Jisc Open Learning Analytics Architecture.

HR Open Standards Consortium

HR Open Standards Consortium[15] (earlier HR-XML) is concerned with data exchange standards for the human resource community. Currently, there is no activity directly related to learning analytics. However, HR Open Standards have work groups and specifications on Assessment, Competencies, Performance Management, etc. These specifications may be relevant for learning analytics projects centred in the workplace, although they are not of immediate relevance to data collection for analysis.

3. National and Regional Standards Bodies

CEN is the official standardisation body for the European Union/European Economic Area countries and the formal standards it produces - European Norms - apply in all member states by default, and member states are bound not to develop competing standards.

In 2015 CEN put the activities in the Technical Committee 353[16], ICT for Learning, Education and Training, on hold due to lack of new projects. TC353 has discussed learning analytics, but no work item has been proposed by any of the National Standards Body “mirror committees” that also vote on proposals and draft standards. In 2014 CEN disbanded pre-standardisation work in CEN Workshop on Learning Technologies (see below), which used to be a source of new projects for TC353.

National standards activities have been discussed (e.g., in Norway); however, so far no projects have been established within formal standardisation in Europe.

4. International standardisation bodies

International Organization for Standardization

The International Organization for Standardization (ISO) is the standards body recognised by the UN. Information technology standards are developed by ISO/IEC JTC1, a Joint Technical Committee (JTC) with the International Electrotechnical Commission (IEC). Participation in ISO committees occurs through National Standards Bodies.

In June 2014 the ISO/IEC subcommittee on ICT for Learning, Education and Training (SC36) established an Ad Hoc Group on Learning Analytics[17] to prepare scope and terms of reference for a

[15] http://www.hropenstandards.org/
[16] http://www.learning-standards.eu/
[17] http://www.laceproject.eu/blog/la-agenda-international-standardisation/

new Working Group on Learning Analytics Interoperability. Working Group 8 on Learning Analytics Interoperability was established in June 2015 with the first project to develop a multipart standard on "Learning Analytics Interoperability". The first part of the standard will be a "Reference Model", with a "System Requirements" as the next part.

Working Group 8 has also initiated a study group to explore two items, "Systems governance for learning analytics" and "Data framework for learning analytics interoperability".

Within this ISO/IEC subcommittee there is also work on e-Textbook standards. Requirements describe e-Textbooks as adaptive and able to communicate with learning analytics engines, either embedded or through communication with external services. However, SC36/WG6, the working group specifying e-Textbooks, has yet to create a specification to meet these requirements.

The Institute of Electrical and Electronics Engineers

Within The Institute of Electrical and Electronics Engineers (IEEE), the IEEE-SA is the organisation that develops global IT standards within a broad range of industries.

IEEE standardisation of xAPI

During 2014, ADL submitted xAPI for standardisation with IEEE-SA. The proposal was rejected for two reasons: IEEE requested a more modular structure of the specification and European IEEE members in particular requested a more clear discussion of issues of privacy.

By established an independent stewardess body for xAPI (see above), the plans to go forward with IEEE for standardisation of the specification seem to be abandoned.

IEEE ADBook

In 2013, Arenas et al.[18] proposed the IEEE ADBook (Actionable Data Book), which is a specialised eBook, combining data exchange across multiple platforms (including Internet of Things) with specific support for STEM education and accessibility preferences. Industry Connections, an IEEE Standards Association program that facilitates the early exploration of potential interoperability solutions, has established an ADBook project[19]. Although the website has not been updated recently, the project seems to be alive[20] working on a "Pedagogy and Architecture report", defining a xAPI eBook profile, and developing a prototype of bi-diretional ePub3 data communication.

[18] Arenas, E., Richards, T., & Barr, A. (2013). The IEEE Actionable Data Book: A platform for inclusive education (pp. 63–67). Presented at the Global Humanitarian Technology Conference (GHTC), 2013 IEEE, IEEE. doi:10.1109/GHTC.2013.6713655

[19] https://ieee-sa.centraldesktop.com/adb/

[20] http://www.slideshare.net/JohnBCosta/ieee-adb-update-x-api-camp-mar-2015

5. Informal and Pre-standardisation Initiatives

Open Learning Analytics Initiative

The idea of an Open Learning Analytics (OLA) platform was first advanced by a group of leading thinkers on Learning Analytics from Europe, Australia, and North America in a 2011 visioning paper[21] published by the Society for Learning Analytics Research (SoLAR). Since then, a summit meeting[22] was held in Indianapolis (USA) in March 2014 to promote networking, to develop thinking, and to explore possibilities for collaborative research and innovation. This meeting made progress towards the idea of Open Learning Analytics as a technical and conceptual framework around which multiple stakeholders could coordinate their activity around areas of common interest. It also emphasised the idea of an Open Learning Analytics Network as an informal community of collaboration. A European summit meeting[23] was organised on December 1st, 2014, by LACE in collaboration with Apereo Learning Analytics Initiative[24], and the University of Amsterdam.

Throughout the development of the concept of Open Learning Analytics, from the initial visioning paper, through to the recent European Summit, interoperability, standards and open APIs (application programming interfaces, the means by which data may be exchanged and instructions sent) have been a recurrent theme. As yet, however, there is no organised attempt to undertake pre-standardisation work in the Open Learning Analytics Network. Indeed, the focus of activity in the OLA Network is likely to be sharing experiences in using various candidate interoperability specifications, and tentatively moving towards a set of preferred specifications in an emerging Open Learning Analytics Architecture. In doing so, it is expected that useful evidence will be gathered, both for the benefit of potential adopters of these specifications, but also to inform the ongoing standardisation processes.

CEN (The European Committee for Standardization) WSLT

CEN Workshops are a less formal component of European standardisation than the Technical Committees. They produce Workshop Agreements, which are pre-standardisation documents arising by consensus in an expert-based forum which any interested parties are able to apply to join.

The Workshop on Learning Technologies (WSLT) members had plans to put learning analytics on the agenda and LACE project partners had intended to use the WSLT as a forum to identify European requirements, and as a focal point for knowledge exchange. Unfortunately, during 2014, CEN disbanded the WSLT due to an unresolved disagreement with its members about process; its members wished to continue operating the WSLT as an open access and open process pre-standardisation initiative, as it had been accustomed to operate for many years, although not consistent with standard CEN policies.

[21] http://solaresearch.org/core/open-learning-analytics-an-integrated-modularized-platform/
[22] http://solaresearch.org/initiatives/ola/
[23] http://bit.ly/OLANetEU14
[24] https://www.apereo.org/content/learning-analytics-initiative

6. About ...

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