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Information technology for learning, education and training — Learning analytics interoperability —

Part 1: Reference model

Technologies pour l'éducation, la formation et l'apprentissage — Interopérabilité de l'analytique de l'apprentissage —

Partie 1: Modèle de référence

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

The committee responsible for this document is ISO/IEC JTC 1, *Information technology*, SC 36, *Information technology for learning, education and training*.

A list of all parts in the ISO/IEC 20748 series, published under the general title *Information technology for learning, education and training — Learning analytics interoperability*, can be found on the ISO website.

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Introduction

The increasing amount of data being generated from learning environments provides new opportunities to support learning, education and training (LET) in a number of new ways through learning analytics. Learning analytics is a composite concept built around the use of diverse sub-technologies, workflows and practices and applied to a wide range of different purposes. For instance, learning analytics is being used to collect, explore and analyse diverse types and interrelationships of data, such as: learner interaction data related to usage of digital resources; teaching and learning activity logs; learning outcomes and structured data about programmes; curriculum and associated competencies.

Learning analytics is an emerging technology addressing a diverse group of stakeholders and covering a wide range of applications. Learning analytics raises new interoperability challenges related to data sharing; privacy, trust and control of data; quality of service, etc. Through use case collection in the ad-hoc group on learning analytics interoperability, established under JTC1/SC36 in 2014, the following issues were identified and captured as general requirements for learning analytics applications:

For the learner:

— tracking learning activities and progression;

— tracking emotion, motivation and learning-readiness;

— early detection of learner's personal needs and preferences;

— improved feedback from analysing activities and assessments;

— early detection of learner non-performance (mobilizing remediation);

— personalized learning path and/or resources (recommendation).

For the teacher:

— tracking learners/group activities and progression;

— adaptive teacher response to observed learner's needs and behaviour;

— early detection of learner disengagement (mobilizing relevant support actions);

— increasing the range of activities that can be used for assessing performance;

— visualization of learning outcomes and activities for individuals and groups;

— providing evidence to help teacher improve the design of the learning experience and resources.

For the institution:

— tracking class/group activities and results;

— quality assurance monitoring;

— providing evidence to support the design of the learning environment;

— providing evidence to support improved retention strategies;

— support for course planning.

In addition, learning analytics practice can build upon prior work in LET standardization and innovation but there are several factors that require special attention. These factors include:

— requirements arising from the analytical process;

— data items required to drive operational LET systems are not always the same as desired for learning analytics;

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— volume, velocity and variety of the data collected for analytics indicate different IT architectures, which imply different interoperability requirements;

— use of learner data for analytics introduces a range of ethical and other socio-cultural issues beyond those which arise from exchanging data between operational systems.

Therefore, this document gives a conceptual description of the behaviour of components related to learning analytics interoperability. In particular, this document specifies terms as well as proposes a reference model for the learning analytics process and interoperability.

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Information technology for learning, education and training — Learning analytics interoperability —

Part 1: Reference model

1 Scope

This document specifies a reference model that identifies the diverse IT system requirements of learning analytics interoperability. The reference model identifies relevant terminology, user requirements, workflow and a reference architecture for learning analytics.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
accessibility
usability of a product, service, environment or facility by individuals with the widest range of capabilities

Note 1 to entry: Note 1 to entry: Although “accessibility” typically addresses users who have a disability, the concept is not limited to disability issues.

[SOURCE: ISO/IEC 24751-1:2008, 2.2]

3.2
assessment
means of measuring or evaluating learner understanding or competency

3.3
dashboard
user interface based on predetermined reports, indicators and data fields, upon which the end user can apply filters and graphical display methods to answer predetermined business questions and which is suited to regular use with minimal training

[SOURCE: ISO/TS 29585:2010, 3.3]

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3.4
data analysis
systematic investigation of the data and their flow in a real or planned system

[SOURCE: ISO/IEC 2382:2015, 2122686]

3.5
data collection
process of bringing data together from one or more points for use in a computer

EXAMPLE EXAMPLE To collect transactions generated at branch offices by a data network for use at a computer centre.

[SOURCE: ISO/IEC 2382:2015, 2122166]

3.6
data exchange
storing, accessing, transferring, and archiving of data

[SOURCE: ISO 10303-1:1994, 3.2.15]

3.7
data flow
movement of data through the active parts of a data processing system in the course of the performance of specific work

[SOURCE: ISO/IEC 2382:2015, 2121825]

3.8
data format
arrangement of data in a file or stream

[SOURCE: ISO/IEEE 11073-10201:2004, 3.14]

3.9
data source
functional unit that provides data for transmission

[SOURCE: ISO/IEC 2382:2015, 2124348]

3.10
individual
human being, i.e. a natural person, who acts as a distinct indivisible entity or is considered as such

[SOURCE: ISO/IEC 24751-1:2008, 3.21]

3.11
learning analytics
measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs

3.12
learning platform
integrated set of (online) services that provide learner, teacher and/or others involved in learning, education and training with information, tools and resources to support and enhance educational delivery and management

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3.13
learning outcome
what a person is expected to know, understand or be able to do at the end of a training programme, course or module

[SOURCE: ISO/IEC 17027:2014, 2.57]

3.14
usability
extent to which a product can be used by specified users to achieve specified goals, with effectiveness, efficiency and satisfaction, in a specified context of use

[SOURCE: ISO 9241-11:1998, 3.1]

3.15
workflow
depiction of the actual sequence of the operations or actions taken in a process

Note 1 to entry: Note 1 to entry: A workflow reflects the successive decisions and activities in the performance of a process.

[SOURCE: ISO 18308:2011, 3.52]

4 Abbreviated terms

ADL	advanced distributed learning
AFA	access-for-all
API	application programming interface
ICT	information and communication technologies
LET	learning, education and training
LMS	learning management system
LOD	linked and open data
PLE	personal learning environment
VLE	virtual learning environment
xAPI	experience API

5 Use cases and practices

5.1 General

Use cases were collected from national bodies and liaison organizations of ISO/IEC JTC1/SC36. The use cases illustrate key functionalities related to learning analytics by focusing on particular requirements that stakeholders may have and then outlining how such requirements can be reflected in workflows for learning analytics. A total of fifteen use cases were received in 2014.

Use cases considered four main areas:

— learning analytics;

— assessments;

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