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Information technology — Learning, education and training — Virtual experiment framework

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ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

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Foreword

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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 WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

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

Introduction

New and emerging technologies are allowing learners to test and develop new knowledge for the creation of virtual experiments. By employing a collection of different technologies, virtual experiments are widely used within K-12 and higher education institutions (e.g. scientific laboratory experiments, technical training in medicine and biomedicine) and also within corporate training (e.g. flight simulators, manufacturing process control). Virtual experiments allow access to a wide range of different experiments, decrease the timeframe to complete experiments, eliminate hazardous situations, and reduce the costs of materials.

To facilitate the development of virtual experiment technology and specification integration, this Technical Report defines a virtual experiment framework that indicates how various standards and specifications can be combined to support the design, implementation, analysis and evaluation of virtual experiment systems. This Technical Report denotes the components and categories of related standards and specifications that can be used to support virtual experiment systems and learners. It illustrates how the components and categories can be structured to support implementations to improve reusability, reduce costs, and broaden applicability. It defines the framework of related virtual experiment standards and determines the mutual relations between different standards for designing, analysing and comparing different virtual experiment systems in order to promote the design and application of the virtual experimental components and systems. The framework of virtual experiment standards also helps to illustrate the categories of related virtual experiment systems and their relations in order to guide the development of other standard-setting work and normatively describe virtual experiment system.

Virtual experiments are typically accessed from an IT system, such as a learning management system (LMS), which provides the environment for learning. In addition to tools specifically tailored for learning, IT systems (such as LMSs) can also provide access to external tools. In a common scenario, an identity federation mechanism will automatically log into the external service but it is up to the learner whether to provide data inputs to the external tool. At the end of the activity, a score is returned to the IT system (e.g. LMS). This type of approach can be used to support activities, such as those involved in the scientific experimental approach, where there are requirements to repeat an experiment with a variety of parameters in order to assess their individual role in a process. There is a need to bridge the switch from the IT system (e.g. LMS) to an external virtual experiment tool, providing data inputs and recording outputs for further analysis. This Technical Report can be used to support these types of activities. In addition, this Technical Report provides specific considerations for the development of ITLET supportive technology and specification integration.

Information technology — Learning, education and training — Virtual experiment framework

1 Scope

This Technical Report defines the framework for IT standards and specifications on virtual experiments supporting IT-enhanced learning, education and training. It is based on implementations of standards and specifications that are used to support virtual experiment, development, evaluation and management that rely on ITLET.

This Technical Report

— provides a framework that can be used for virtual experiment systems that rely on ITLET,

— determines the categories of different virtual experiment standards and specifications and their relationships to facilitate their integration,

— promotes the appropriate design and application of virtual experiment components so that IT systems that are being used are reusable, low cost, and more broadly applicable,

— indicates considerations to be taken into account when developing ITLET systems that are being developed or used to support virtual experiment systems,

— provides sample architecture of a virtual experiment system framework that can be used to support further development of virtual experiments,

— illustrates various roles that different actors can have at various points within the virtual experiment system,

— demonstrates how standards and specifications that support virtual experiments can be combined to form the basis for future work and implementations.

The following aspects are not addressed in this Technical Report:

— specifications of the implementation details of virtual experiment systems;

— accessibility;

— privacy;

— security.