

WHITE PAPER

SYSTEM STANDARDS

for Learning Management
Systems (LMS)



Executive summary

LMS system standards play a pivotal role in ensuring robust integration, scalability, and functionality within modern learning environments. They define protocols and frameworks to guide system interoperability,

security, and data exchange. By adhering to these standards, LMS platforms can better meet the evolving demands of learners and organizations.

Introduction

The following document explores the critical standards that underpin LMS platforms, including their purpose, core features, benefits, and challenges. These standards encompass system integrations, user data security, accessibility compliance, and analytics frameworks.





Overview of major LMS standards categorized by focus area

System integrations

IMS Common Cartridge

OVERVIEW

Set of standards facilitating interoperability of tools and content within e-learning environments.

KEY FEATURES

Facilitates tool and content interoperability; supports secure data exchange.

PROS

Ensures seamless integration of third-party tools; improves consistency across platforms.

CONS

Limited adoption outside educational markets; requires technical expertise for implementation.

LTI (Learning Tools Interoperability)

OVERVIEW

LTI allows learning platforms to integrate remote tools and content.

KEY FEATURES

Facilitates interoperability; advanced tools for grading and linking.

PROS

Simplifies integration between learning tools; improves consistency across platforms.

CONS

Limited adoption outside educational markets; requires technical expertise for implementation.



PENS (Package Exchange Notification Services)

OVERVIEW

Automates the submission of content packages from authoring tools to LMS platforms.

KEY FEATURES

Content upload notifications; workflow automation.

PROS

Streamlines content delivery; compatible with SCORM and xAPI.

CONS

Limited adoption; focused on content deployment.

QTI (Question and Test Interoperability)

OVERVIEW

QTI allows the exchange of test and assessment questions and responses between applications.

KEY FEATURES

Standardized representation of test data; allows authoring and delivery in separate tools.

PROS

Improves consistency between platforms; supports adaptive testing.

CONS

Limited adoption outside educational markets; complex implementation; requires additional tools to support analytics.

REST/GraphQL APIs

OVERVIEW

Standards enabling seamless communication between LMS platforms and external systems.

KEY FEATURES

Programmatic interaction; supports real-time data exchange; flexible customization.

PROS

Highly flexible; enables advanced customizations; suitable for modern LMS ecosystems.

CONS

Requires skilled development resources; ongoing maintenance demands.



User data security

ISO/IEC 23988 (Online Assessment Security)

OVERVIEW

A standard ensuring the integrity and security of online and offline assessments.

KEY FEATURES

Guidelines for secure test administration and result validation.

PROS

Reduces fraud; builds trust in assessment outcomes.

CONS

Requires technical and operational adjustments.

LDAP (Lightweight Directory Access Protocol)

OVERVIEW

Protocol for secure user authentication and sharing of user data.

KEY FEATURES

Secure authentication; user data search.

PROS

Provides more detailed user information.

CONS

Exposes additional user data, so less used than OAuth.

OAuth 2.0 / OpenID Connect

OVERVIEW

Protocols for secure user authentication and authorization across platforms.

KEY FEATURES

Secure authentication; token-based authorization; scalable integration.

PROS

Protects user data; simplifies cross-platform access; widely supported.

CONS

Requires robust backend integration; complex initial setup.

SAML (Security Assertion Markup Languages)

OVERVIEW

Protocol for secure user authentication and authorization.

KEY FEATURES

Secure authentication; scalable integration.

PROS

Protects user data; simplifies cross-platform access.

CONS

Requires robust backend integration; complex initial setup; less used in favor of OAuth.



Accessibility compliance

EN 301 549

OVERVIEW

A European standard defining accessibility requirements for ICT products and services, aligned with WCAG guidelines.

KEY FEATURES

Covers accessibility for software, hardware, and digital content.

PROS

Ensures comprehensive accessibility compliance; widely recognized across Europe.

CONS

Requires in-depth auditing and alignment with other accessibility standards.

ISO/IEC 24751 (Personalized Learning and Accessibility)

OVERVIEW

A standard supporting personalized learning experiences for diverse needs.

KEY FEATURES

Frameworks for adaptive systems and inclusive learning.

PROS

Promotes equity and accessibility; supports diverse learners.

CONS

May require advanced infrastructure and technologies.

Section 508 Compliance

OVERVIEW

U.S. federal accessibility standards for electronic and information technology.

KEY FEATURES

Mandates accessibility for all users; ensures equal access for individuals with disabilities.

PROS

Facilitates access to public sector applications; supports legal compliance.

CONS

Implementation can require significant resources and audits.

WCAG (Web Content Accessibility Guidelines)

OVERVIEW

Guidelines ensuring web content is accessible to users with disabilities.

KEY FEATURES

Compatibility with screen readers; support for keyboard navigation.

PROS

Promotes inclusivity; aligns with global accessibility standards.

CONS

Compliance requires ongoing updates to interfaces and content.



Analytics frameworks

AICC (Aviation Industry Computer-Based Training Committee)

OVERVIEW

The original standard for interoperability between content and LMS platforms.

KEY FEATURES

Progress tracking; offline tracking.

PROS

Simple standard.

CONS

Limited support today as most systems moved to SCORM.

Caliper Analytics

OVERVIEW

A framework for capturing and analyzing learning data to generate insights into learner engagement and progress.

KEY FEATURES

Supports real-time data collection and advanced analytics.

PROS

Enables data-driven insights; supports diverse learning environments.

CONS

Requires robust infrastructure and expertise to implement.

cmi5 (Computer-Managed Instruction)

OVERVIEW

Combines benefits of SCORM and xAPI, addressing their limitations while enabling offline tracking.

KEY FEATURES

xAPI-compatible; supports immersive learning and instructor-led training.

PROS

Advanced tracking; supports both online and offline learning.

CONS

Limited adoption; requires support from both LMS and authoring tools.

Ed-Fi

OVERVIEW

A framework enabling interoperability of educational data across systems.

KEY FEATURES

Supports integration of student information and learning management systems.

PROS

Enhances data sharing; supports personalized learning.

CONS

Implementation complexity; limited adoption.



IEEE Learning Object Metadata (LOM)

OVERVIEW

A metadata standard for describing learning resources to enhance reusability and accessibility.

KEY FEATURES

Structured metadata for categorizing and searching educational resources.

PROS

Supports resource sharing; aligns with global practices.

CONS

Can be complex to implement at scale.

ISO/IEC 19788 (Metadata for Learning Resources)

OVERVIEW

An international standard for organizing metadata for educational resources.

KEY FEATURES

Provides a structured approach to metadata organization.

PROS

Enhances resource discoverability; supports global interoperability.

CONS

Requires alignment with existing metadata frameworks.

ISO/IEC 19796 (Quality Standard for Learning, Education, and Training)

OVERVIEW

A framework for ensuring the quality of e-learning systems and processes.

KEY FEATURES

Provides a reference model for quality management in learning systems.

PROS

Encourages continuous improvement; internationally recognized.

CONS

Implementation may require significant organizational resources.

SCORM (Sharable Content Object Reference Model)

OVERVIEW

Defines how e-learning content is packaged and communicated with LMS platforms.

KEY FEATURES

Content reuse; progress tracking; bookmarking.

PROS

Universally supported; simple implementation.

CONS

Limited to static environments; lacks backward compatibility across versions.



xAPI (Experience API)

OVERVIEW

Tracks learning experiences across multiple environments, including simulations and mobile apps. Successor to SCORM.

KEY FEATURES

Real-time tracking; data collection via Learning Record Stores (LRS).

PROS

Flexible; advanced analytics; suitable for modern learning environments.

CONS

Requires additional infrastructure; complex implementation.



Challenges in LMS standard implementation

COMPLEXITY

Diverse stakeholder needs and evolving technologies.

LEGACY SYSTEM COMPATIBILITY

Integration with older standards like SCORM can be challenging.

INFRASTRUCTURE REQUIREMENTS

Advanced standards necessitate robust infrastructure for data storage and processing.



Future trends

ADVANCED DATA ANALYTICS

Standards like Caliper Analytics are becoming more critical for tracking engagement and outcomes.

PERSONALIZED LEARNING

Standards supporting adaptive learning environments (e.g. ISO 24751) will gain traction.

ENHANCED INTEROPERABILITY

Focus on improving cross-platform compatibility and integration.

Conclusion

The adoption of LMS standards provides a foundation for innovation and efficiency in the e-learning landscape. Organizations must evaluate their specific needs and capabilities to implement standards that align with their strategic goals.

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Appendix A

Standard	Category	Description
Caliper Analytics	Analytics Frameworks	Real-time learning data collection and advanced analytics
EN 301 549	Accessibility Compliance	Accessibility for ICT products and services
Ed-Fi	Analytics Frameworks	Enables interoperability of educational data
IEEE LOM	Analytics Frameworks	Metadata for learning resource reusability
IMS Common Cartridge	System Integrations	Assessment and multimedia integration
IMS Global Standards	System Integrations	Facilitates tool/content interoperability; secure data exchange which includes Common Cartridge and LTI.
ISO/IEC 19788	Analytics Frameworks	Metadata organization for enhanced resource discoverability
ISO/IEC 19796	Analytics Frameworks	Ensures quality management in e-learning systems
ISO/IEC 23988	User Data Security	Ensures integrity and security of assessments
ISO/IEC 24751	Accessibility Compliance	Frameworks for adaptive and inclusive learning
OAuth 2.0/ OpenID Connect	User Data Security	Secure authentication and token-based authorization
PENS	System Integrations	Content upload notifications; workflow automation
REST/GraphQL APIs	System Integrations	Programmatic interaction; real-time data exchange
SCORM	Analytics Frameworks	Defines e-learning content packaging and communication
Section 508 Compliance	Accessibility Compliance	Mandates equal access for individuals with disabilities
WCAG	Accessibility Compliance	Global accessibility standards; screen reader support
cmi5	Analytics Frameworks	Combines SCORM and xAPI with offline tracking support
xAPI	Analytics Frameworks	Tracks learning experiences across environments



Appendix B

CYPHER Learning supports the following standards:

1. Caliper Analytics
2. LTI
3. QTI
4. IMS Common Cartridge
5. ISO/IEC 19788
6. LDAP
7. OAuth 2.0/OpenID Connect
8. SAML
9. SCORM - Versions 1.2 and 2004
10. Section 508 Compliance
11. WCAG
12. xAPI Provider only