



Introduction to K-12 Content Interoperability

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This document is a working paper developed under the direction of the SIIA Education Division's Working Group on Technical and Development Issues and with the guidance of the SIIA staff. Visit www.sii.net/education

It was drafted by Educational Systemics, a service organization offering experience in education, technology and business planning for the K-12 market. Visit www.edusystemics.com.

PREFACE

This document is written to give K-12 stakeholders a context for their understanding and productive participation in the development and adoption of interoperability standards.

Interoperability standards can facilitate the interchange of information between educational applications and as such, has the potential to improve the quality of education and change the business of education.

Interoperability for K-12 education applications is a burgeoning field with a dynamic but often confusing landscape. This paper arose from the awareness that there is much confusion about the definition and goals of interoperability, as well as about the numerous emerging standards contending for industry attention

Standards have improved products for both end users and providers in other markets. The promise of interoperability in K-12 is, for example, that it will enhance the ability of educators to access assessment and other data in real time, use it to inform the instructional process, and address the needs of every learner using the most appropriate content and curriculum. Educational applications that incorporate interoperability standards are necessary enablers, allowing educational institutions to assemble the best blend of applications and content – from a variety of sources and vendors -- needed to directly support their educational aims.

This document aims to arm readers with the information necessary to participate now in adopting, implementing and evolving these standards. The focus is on identification of the drivers, goals, definitions, opportunities and challenges around interoperability, rather than any definitive synthesis of the many specific standards and standards bodies. This introduction is one component of SIIA's ongoing efforts to help inform and lead the industry on these technical and development issues important to the success of educational technologies.

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INTRODUCTION

Elementary and secondary education is looking increasingly to educational software, digital content and related e-learning technologies to meet evolving education needs and goals. Technology-based products, services and resources are having a positive impact on education, and improving efficiency and outcomes in the areas of teaching, learning and classroom/school management. At the same time, as educators grow more sophisticated in their use of technology, there are apparent gaps in the integration and interface among disparate applications, as typical of most evolving technology sectors.

School districts are asking for technical and curricular innovations that include:

- Instructional applications and resources in electronic formats that are device and platform-agnostic.
- Instructional resources that are modular and can be seamlessly integrated with the teacher's curricula in a way that both aligns with state and local standards and can be re-organized to differentiate instruction based on the learning needs of individual students.
- The ability for students and educators to access their applications, resources, projects and assignments from anywhere.
- The ability to access multiple applications from a unified interface (e.g., learning portals with single sign-on access for students, teachers and parents).
- Easy methods for collecting, storing, tracking and analyzing instructional and assessment data from multiple sources broken out by individual students or demographic subgroups.

What each facet of this vision has in common is the tacit requirement of *interoperability*.

To meet these innovative technical and curricular requirements, publishers and developers need to make their products and services interoperable. And to do that, they need to address a number of product development and business challenges that include:

- Providing for the digital rights management of their products and services as necessary to maintain intellectual property rights.
- Ensuring the integrity of their instructional design and content when it is repackaged or repurposed by educators and students.
- Accounting for increased development costs needed to incorporate interoperability and related standards into their educational technologies.

Historically, the case for interoperability in the K-12 educational marketplace has not been compelling. As long as programs were restricted to individual computers or small local area networks, the overhead costs were rarely justified by the benefits. Many vendors have focused on proprietary designs that, while solving the needs of their customers, do not allow for easy integration with systems from other vendors. Likewise, education decision-makers are most often looking first and foremost to meet their immediate teaching and administrative needs and do not include interoperability as a technical requirement.

With the advancement of the Internet and increasing reliance on digital delivery, the usability of isolated K-12 data, content and learning applications is rapidly diminishing. Educational institutions are seeking to strategically leverage their content and data assets across a number of systems that cooperatively provide support for instruction. They seek to assemble best of breed solutions that integrate content and applications from a variety of sources and vendors. For cost efficiencies and teaching and learning effectiveness, interoperability standards are a necessary component of these emerging systems. In today's world, the case for interoperability is increasingly compelling.

In response, K-12 stakeholders have been increasingly collaborating over the last decade to define the underlying technical and architectural *interoperability standards* necessary to deliver the evolving vision of e-learning. Related efforts are ongoing, and in many cases more mature, in other e-learning sectors. These initiatives are producing useful and promising results. Although existing standards have their limitations, the foundation for interoperability exists today.

DEFINING INTEROPERABILITY

Here's a quiz.

The term "Interoperability" means that:

- a. Systems or applications can seamlessly share data, content and services in a manner consistent with the information's associated business rules.
- b. Users can more easily and continuously use and share information, software and services from multiple sources on any device or platform.
- c. Applications do not need to know about each other in order to coexist and exchange relevant information as required or desired by the end user.
- d. Users can reduce administrative overhead (and data entry errors).
- e. Users can more easily repurpose content and couple learning systems from best-of-breed offerings from many different vendors.
- f. All of the above.

What's the correct response: It is f. All of the above.

Within the context of this document, *interoperability* refers, at its most simplified level, to the *seamless sharing of data, content and services among systems or applications in a manner consistent with the information's associated business rules*. Stated another way, interoperability is defined, *from the user's perspective, as the ability to more easily and continuously use and share information, software and services from multiple sources on any device or platform*. The goal is for information and services provided by one system or application to be easily shared – *interoperate* – with systems or applications created by other entities.

Interoperability includes the close cousin of portability. Loosely described, interoperability refers to the real time, *continuous* transfer of data (and/or metadata) *between* disparate applications or systems. Portability (narrowly defined) refers to the movement (porting) of content *from* one system or application to another, typically as an infrequent or *non-continuous* transfer. Alternatively, one could think of data as interoperable and instructional content as portable. Please note that this is an over-simplified explanation of these two related concepts, and disagreements and exceptions do exist.

Interoperability can only be achieved through commonly agreed to technical *interoperability standards*. In education, the term "standard" is usually used in the context of curriculum to describe the learning objectives students are expected to attain. In the context of interoperability, standards (and their close cousin, specifications) are rules (e.g., data formats and exchange protocols) stakeholders agree to follow in order to improve the overall interoperability of their products. In

hardware, standards set by the IEEE enable, for example, wireless network cards produced by different vendors to plug into computers produced by different vendors running chip sets produced by still other vendors, and have everything work as expected.

In the absence of interoperability standards, applications wishing to share information and data need to plug directly into each other on a case-by-case basis. Such interoperability strategies have long existed in discrete areas to improve efficiency. But, for the most part, they are neither fast nor seamless, and data and content remains locked within narrowly defined realms. For example, to move administrative data between applications, proprietary ETL (Extract, Transform, Load) utilities have proliferated, and manually managed import/export using flat data files are the rule. In the content and curriculum domains, the lack of standards mean that content created in (or exported into) one IMS/LMS could not be moved to another without significant effort. This undermines the goal of using these systems to seamlessly aggregate and organize digital content, connect it to student learning needs, and connect it all back to state curriculum standards. These first-generation solutions are very brittle – all the hand-entered links between students, content and curriculum standards were easily broken at the slightest change in the system. Maintaining systems as they grew became (and is) a significant challenge for educators since, with so many idiosyncratic and locally constructed solutions, there was no practical way for providers of individual components to address their customer's interoperability needs except with high-touch, costly, custom implementations.

In the standards-based world, applications exchange relevant data, including information on how to exchange the data, as defined by the interoperability standards, knowing that by doing so, other applications will be able to make use of their data. *This is the essential big idea behind interoperability standards: applications should not need to know about each other in order to coexist and exchange relevant information as required or desired by the end user.*

Seen from the end user's perspective, interoperability standards mean they can:

- reduce administrative overhead (and data entry errors),
- avoid application lock-in,
- more easily repurpose content and
- couple learning systems from best-of-breed offerings from many different vendors.

Interoperability standards already play a major role in digital applications for higher education, corporate training, professional development and the military. For example, corporate HR departments purchase online training courses from multiple sources and manage them through a common learning management system (LMS). The Military ensures that the training courses developed by different contractors all follow a common format and feed into a unified assessment system to enable the evaluation of personnel against common performance standards.

In the K-12 market, the foundations appear in place to meet these needs, including XML and Internet protocols, and maturing tools for building standards-compliant content and applications.

Several interoperability standards and specifications have emerged in the last decade. The most notable of these are ADL SCORM, IMS GLC Common Cartridge, SIF, and the recently launched LETSI (Learning-Education-Training Systems Interoperability). Each of these was originally set up to address a specific educational niche, but as the need for interoperability has evolved, there has been some sharing and overlap between these efforts. Some of these interoperability standards specifically address the needs of K-12 educators, others do not, and some K-12 needs are not yet addressed by any existing standards.

Metadata and packaging standards are among the core building blocks of most interoperability standards. XML, or *extensible markup language*, is the technical meta-tagging language of most interoperability standards and is used in a wide variety of applications. For administrative data, metadata would consist of attributes such as student name [firstname_lastname], school name, etc. Content metadata consists of attributes such as the academic subject area, content publisher information and grade appropriateness. Content packaging refers to the protocol for creating and sharing both the content as well as its associated metadata, which includes scope and sequence, author, formatting, etc.

CHALLENGES TO K-12 INTEROPERABILITY

While significant progress has been made in the *development* of interoperability standards, the *adoption* of those standards to provide functional interoperability remains limited. K-12 education's slow maturity in the area of interoperability has left proprietary models, one-off customized integration efforts, manually-managed exchange protocols and ultimately untapped technology use and impact as the norm.

The key challenge: to provide a unified and simple model with one-stop shopping for these standards, even if they come from different organizations.

Other challenges (all c's) not yet noted or requiring elaboration are the following:

Content Rights

For publishers and developers, and in some cases for educators and educational agencies, digital rights management (DRM) must be addressed to ensure comfort with interoperability. DRM involves tracking and managing the use of learning objects within a third party application or system in order to ensure the creator receives credit for their use as needed to enable a viable commerce model. Related to this intellectual property concern is the need to ensure the integrity of content when it is repackaged or repurposed outside of that explicit to its original instructional design and intent. The ability to preserve digital rights in a fully open world is not perfected, but it is slowly becoming a reality.

Cost vs Benefits

Building to interoperability standards adds initial development overhead for the publisher/developer of educational products and services. Development costs are typically less when built into a new product than if the publisher is trying to

incorporate into a previously-existing product. Most importantly, the development costs can be beneficial if the publisher can:

- then more easily reuse or repurpose content internally in other products,
- promote interoperability as a market advantage to increase sales, and
- address educator integration requirements and functionalities without unique customization costs.

Completeness

Perhaps the biggest barrier to more widespread adoption is the perception that the standards have not yet matured enough to be widely useable. For example, if a standard defines the interchange of some administrative data objects, but not enough to build a master schedule, what use is it? If the vendor will still need to use traditional ETL utilities to get the rest of the data, why bother with the standard? Similarly, if the sequencing standards for curriculum are not specific to K-12 or expressive enough to capture the adaptive nature of a vendor's curriculum, why bother with them? Or, perhaps a publisher's application can be built to be compliant, but what if other applications at the customer site aren't?

Closed versus Open Standards

Open-ness is a key concept when it comes to standards in any field. Open standards imply:

- Developed jointly by multiple entities
- Available for scrutiny by the community that they affect
- Free of license fees for either the developer or the end user.

Open standards also have the attribute of being "malleable". This is the ability to change and evolve to meet the developing needs of the market and to address the relentless march of technology.

Connections to other markets

There is increasing interest by publishers to leverage products and services from one educational market to another. Instructional materials developed for high schools, for example, may be sold into community colleges and universities, where they are using a different LMS. Digital content developed for teaching English via online courses in the US may be localized for markets in other countries, where they require adherence to other technical standards.

It is the case that many of the interoperability standards we have today originated in higher education and corporate or military training where delivery of complete, online, user-directed courses through a common LMS was of key concern. In K-12, customers are more likely to be interested in middleware applications and portals for managing resources and providing common access points for users. For them, some of the more established education standards from outside K-12 may simply miss the mark. Nonetheless, for many everyday purposes, the existing standards are more than adequate for exchanging roster information, uniformly tagging content objects and creating interchangeable lesson plans. While some more complicated activities such as building a master schedule for a large high school or describing the relationship among learning objects in a adaptive curriculum product fall outside the capabilities of the today's specifications as currently constituted, this is not reason alone to avoid using other mature standards and working to fill the remaining gaps.

ABOUT SIIA

The Software & Information Industry Association (SIIA) is the principal trade association for the software and digital content industry. SIIA provides global services in government relations, business development, corporate education and intellectual property protection to more than 550 leading software and information companies.

SIIA's Education Division serves and represents over 150 member companies that provide software, digital content and other technologies that address educational needs. The Division shapes and supports the industry by providing leadership, advocacy, business development opportunities and critical market information.

SIIA's Education Division provides a neutral business forum for its members to understand business models, technological advancements, market trends and best practices. With the leadership of the Division Board and collaborative efforts with educators and other stakeholders, the Division undertakes initiatives to enhance the use of educational technology and the success of SIIA members.

About the Authors:

This Introduction was drafted by Educational Systemics, a service organization offering experience in education, technology, and business planning for the K-12 market. Educational Systemics works closely with K-12 businesses to conceptualize, design, develop, position, and identify sales opportunities for products that address the education community. Educational Systemics was founded on the idea that lasting educational change requires a systems approach to how and why we educate our children. Visit www.edusystemics.com.

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