

Transforming Data to Information in Service of Learning



May 2013

About the State Educational Technology Directors Association

Founded in the fall of 2001, the State Educational Technology Directors Association (SETDA) is the principal association serving, supporting, and representing US state and territorial educational technology leadership. Our mission is to build and increase the capacity of state and national leaders to improve education through technology policy and practice. SETDA's work is supported by state membership dues, private sector partner contributions, charitable foundations, and the federal government. <http://setda.org/>

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Executive Summary

While states, districts, and schools have long collected education data, we still lack the ability to easily transform that data into information that will help guide policy or decisions affecting instruction, school administration, and operations. Education data and information systems need to be in service of learning. We must think systemically about how to make information easily accessible to help guide decision-making in a way that is usable in support of student success. Simply put, we must raise the profile of data interoperability issues if we are serious about increasing learning opportunities for all of the nation's students.

The State Educational Technology Directors Association (SETDA) developed this report to raise awareness about many of the major initiatives currently underway to address data standards and interoperability issues. The widespread implementation of new and emerging interoperability initiatives has the potential to herald the arrival of a new educational technology ecosystem truly responsive to educators and in support of student success.

New leadership will be required from the federal government, state governments, and the technology industry to make needed advances. SETDA offers three recommendations to move the field forward:

- **Recommendation 1:** Develop a consensus-based, long-term vision and roadmap for interoperability to ensure investments in technology and digital learning are cost effective and meet educator and student needs.
- **Recommendation 2:** Establish an ongoing mechanism to address transparency related to the privacy and security of student data.
- **Recommendation 3:** Address data standards and interoperability issues with vendors as part of state and district procurement processes for educational technology and digital learning solutions, including for the adoption of free solutions.

As this report demonstrates, there are many organizations working on these issues now, but we will need many more people engaged if we are to make a difference. It is our hope that this report will become an opening to a much deeper and sustained conversation about how to ensure that we successfully make the transition from data to information in service of learning.

The Emerging Educational Technology Ecosystem

Every day states, districts, and individual schools make policy decisions affecting instruction, school administration, and operations. Often their decisions must be based on anecdotal and incomplete information because that's all that decision-makers can access at the time. In spite of the fact that we are awash in useful digital learning applications and potentially valuable data, the systems we use to collect, manage, analyze, and report on that data are often disconnected and don't work well together. Most data currently being collected isn't captured to inform instruction; it's used for the purposes of state or federal accountability reporting. Some kinds of data that could give teachers and students immediate insight for personalizing instruction are not being captured at all or not in a systematic fashion.

Transforming data into insightful information can be a daunting effort requiring investments in additional staff, training, and technology. End users must too frequently revert to tedious manual processes in order to integrate data from multiple applications. For example, summative assessment results for a district may be delivered several months after the tests were given to students. When it arrives, the data must be integrated with other systems the district is using, including student information and interim assessment applications. Then a district analyst must identify relevant details on each student that can be used by teachers to help with “special education identifications, test results, and other information to create appropriate instructional groupings and interventions.” (1)

Meanwhile, in other aspects of life beyond schools—such as shopping, healthcare, law enforcement, sports, entertainment, and transportation—“smart” systems use data in extraordinarily sophisticated ways. If a company such as Amazon can recommend books and other products that a consumer might enjoy based on previous and pending purchases, education leaders should be able to leverage similar tools in support of the nation's most important resource—our children. Through technology, more aspects of life are “infused by Web 3.0 social data hyperlinked among people, content, groups, ideas, and information that dominate our decision-making.” (2) The same innovations need to be empowering our schools.

The goals for intelligent use of data in the education ecosystem are worthwhile. Aggregate data accumulated over years and from multiple sources can divulge trends and point the way to success for particular groups of students and/or for program evaluation. Likewise, information generated through digital learning, computerized assessments, grade book programs, learning management systems, and other applications can track a specific student's progress over time. Instructors can use formative assessments—even those as brief and frequent as pop quizzes—to redirect instruction on the spot and help students succeed with learning. Information can be made accessible through real-time dashboards and other user-friendly reporting tools. Because the information is used by those “closest to it,” users can catch data errors “on the fly” and make corrections so that it is more accurate overall. (3)

As a recent report from the International Association for K-12 Online Learning (iNACOL) stated, improvements in education require an information technology infrastructure that emphasizes interoperability to enable the sharing of data. “We need to make it easier for teachers and students to access the right content, print and digital, at the right time.” (4)

Yet challenges remain:

- The integration of data between and among the proliferating mix of education-related applications and information systems in the nation's classrooms is difficult, requiring too many time-consuming, manual processes to navigate.

- Digital education resources abound, but it's difficult for teachers and students to sort through them to find the ones that are most valuable and relevant and adhere to defined levels of quality and alignment to standards.
- There are numerous and competing approaches to aligning digital resources to state academic standards, many of which are incompatible and costly.
- Families (and students themselves) have no easy way to access a student's personal data—such as test results or the need for special accommodations—or to share that information securely with other appropriate parties in the event of a school transfer.
- Schools and districts must typically cobble together complex storage solutions (on and offsite, including “in the cloud”) to maintain the data generated by their information systems.
- There is confusion regarding legal provisions and disclosures about student records, where they reside in digital form, and to what uses they can be put.
- When a school or district switches software application providers, there is often no guarantee that it can easily migrate its data to a new provider.
- In order to get a complete profile of a student, teachers and administrators often must pull relevant information out of a number of systems and manipulate it manually through spreadsheets or other means to make it useful.
- Users may have to go through multiple logins and passwords to access classroom resources or compile data since each of those systems has its own authentication process.
- Even once student data is compiled, educators and administrators lack a simple way to display it in real-time, in useful and insightful ways, when it is most relevant.

Information for and about students exists in multiple applications and systems. Data from any one of those data sets—even one as extensive as a longitudinal data system—are never as rich or revealing as that which is drawn from multiple sources. But getting the data from one system or application to interoperate with that from another can be a complex process requiring costly database expertise and middleware which few districts can afford or access.

Educators have settled for working with education data in silos for too long. As the delivery of instructional materials and courses, along with student assessment and professional learning systems, become more reliant on technology, and details about aspects of these activities are captured, we need to ensure that schools can take advantage of the resulting data. Those systems need to be in service of learning. That will require us to stop thinking about “data” as the goal and to start thinking about how to make information easily accessible and personalized. That's the only way to help guide educator decision-making in support of student success.

The good news is that help is on the way. Nonprofit and commercial organizations—in collaboration with state and federal governments—are working hard to address data interoperability issues. However, understanding how the numerous efforts relate to and complement each other can be confusing, even to the most informed observer.

The State Educational Technology Directors Association (SETDA) developed this report to raise awareness about many of the major initiatives currently underway to address data standards and interoperability issues. The report's

focus is on helping readers understand the context for the various initiatives, their relationship to teaching and learning, and to lay out a clearer vision for how they might work in combination to increase efficiency, lead to cost savings, support educators, and ultimately benefit students.

Broadly speaking, these initiatives focus on ensuring consistent data definitions, enabling the sharing of information across systems, and facilitating the search and discovery of education resources. With agreement to standardize around a set of approaches and widespread implementation, new and emerging interoperability initiatives have the potential to herald the arrival of a new educational technology ecosystem truly responsive to educators and in support of student success.

A Glossary

Application Programming Interface (API): A set of programming instructions and standards for enabling software applications to interact with each other.

Data dictionary: A compilation of descriptive information about data elements that includes information such as what kinds of values a data element can contain, its relationships to other data elements, its origin, its usage, and its format.

Data element: A separate piece of information that can't be made any more granular than it already is, such as a last name or a birth date.

Data model or logical data model: A conceptual structure that defines both a language and the language rules to collect, compare, and work with a set of data. The data model doesn't collect data.

Data standard: An agreed-upon way to represent certain kinds of information for the purposes of simplifying data exchange. Typically, a data standard is defined through a rigorous process among multiple parties; frequently an organization sifts through and evaluates the merits of contributions and input from numerous organizations and individuals. However, sometimes one organization's way of representing information is so popular, by virtue of "market acceptance," it becomes an ad hoc standard.

Interoperability: The capability for systems to work together with the same data and content. Achieving this requires multiple operations: extracting the data from its source database; manipulating or transforming the data to work with other data, such as mapping one field to another's format; and loading all of the relevant information into the data warehouse or repository from which data analysis will be done.

Metadata: Information about a resource that describes it, such as what form the item takes, who created it, and who it's intended for. The use of metadata tags—details—allows a resource to be found or discovered.

Paradata: Descriptors that capture information about a resource's activities—how it has been used and by whom, including ratings of usefulness, alignment, and quality.

Schema: A diagram or outline for showing the structure of information. Many, but not all of the organizations discussed in this report use an XML schema for their data standards to provide a common way to communicate information. Multiple XML schemas exist. XML is a markup language (like HTML or JSON) for converting information into a form that can be interpreted by software; an XML schema therefore defines how that XML information should be structured or coded for use by software.

Web Service: A software program that performs a discrete amount of work and is designed to perform computer-to-computer interactions on a network, including the internet.

Transforming Data to Information in Service fo Learning: A Vision

Jack, a new student, is struggling to understand the concept of variables, which surfaced in a state math standard aligned to the Common Core State Standards (CCSS) for high school algebra. His math teacher knows from previous quiz results that Jack tends not to do well with word problems. She also knows that his quiz results tend to be better when he's heard explanations rather than just reading them.

The teacher gained this information through a combination of sources. First, because Jack's new and old high schools support the **PESC** standard, the new school was able to accept delivery of a high school transcript that was immediately added to his latest records. Second, because the schools are in separate states that support the **Digital Passport**, they're also able to share student data maintained in their respective longitudinal data systems. And third, Jack's teacher downloaded assessment data from a website the school was granted access to by Jack's parents. Before moving from one state to another, they had used **MyData** functionality on the parent portal maintained by his previous school in order to capture a snapshot of Jack's school records—including assessment results—and then saved it to a secure online data repository.

Both the district that Jack's family has moved from and the one they've moved to participate in the **Common Education Data Standards** effort, which defines how data should be formatted for optimal integration. That means his new district could absorb the data made available to the school and add it without human intervention to the data systems and applications already in use by Jack's new teachers.

Because the district has adopted the **inBloom** user identity directory, which provides a single-sign-on capability, the teacher only has to log in once to access multiple instructional programs.

The teacher searches for a video for Jack on "variables." Along with the key words in the search, she specifies grade level, preferred mode of learning (video), and time requirement (10 minutes or less). This filtering capability is available because the content creators have used the tagging scheme laid out in the **Learning Resource Metadata Initiative**. She does a quick comparison of the various videos, whose paradata has been exposed through the **Learning Registry**, and chooses one with a strong rating as accorded by other educators.

Jack watches the four-minute video that explains variables and works through a similar type of problem as the one he's trying to solve. The instructor who created and posted the video is somebody who lives and teaches in another state. Fifteen minutes into the class, he has finished the first of two story problems and has settled into his work. The assessment results, couched in the common language provided by **IMS and SIF's Assessment Interoperability Framework**, are automatically made available to a number of the applications in use by the school, one of which is an **Ed-Fi Solution dashboard**, which the teacher will use to review the results of that morning's learning efforts.

Meanwhile, elsewhere in the class, the teacher consults her tablet and identifies the next math standard she'd like her more advanced students to work on. She pulls up a formative assessment application from the Smarter Balanced Assessment Consortium that has mapped its assessment content to the CCSS using specifications defined though the **Granular Identifiers and Metadata (GIM-CCSS)** project. She guides those students to work through specific practice problems for which she's already provided instruction in order to see how much they remember from the lesson.

The instructor is experimenting with the **Open Badges** program, which allowed one student to prove her expertise in algebra by earning a digital badge through a free online university course; this student is moving immediately to self-study in a different area suggested through **xAPI**, guidance formulated by an artificial intelligence analysis of her previous learning activities.

Since Jack's schools and districts have implemented crucial data and interoperability initiatives, he has been able to seamlessly transfer schools and re-enter the learning experience with minimal disruption. Likewise, administrators and teachers have been able to customize Jack's instruction quickly and accurately with very little time or costs diverted to re-assessing him or ensuring his paperwork was in order.

Illustrative Videos of Select Data Standards and Interoperability Initiatives

The links below provide visual representation of how some of the initiatives profiled in this paper support teaching and learning:

- **Ed-Fi Alliance Overview**
<http://www.youtube.com/watch?v=bBXvgzKoWPA>
- **How inBloom Works for Teachers: A Use Case**
http://www.youtube.com/watch?v=gHjbdpXohk0&list=PLhphE_WTaP38vn4iipRACqCYdBVBr_8lb&index=1
- **Learning Registry**
http://www.youtube.com/watch?v=Ong_jvDNpR8
- **LRMI: Peek under the hood of Personalized Learning**
<http://www.youtube.com/watch?v=14h253iQRZs>
- **U.S. Department of Education Datapalooza Playlist**
<http://www.youtube.com/OfficeOfEdTech>
- **U.S. Department of Education's Office of Educational Technology: Personal Learning Profile**
http://youtu.be/O46JZB_a8Pk

An Overview of Major Interoperability Initiatives

As schools have increasingly looked to digital tools and resources to support teaching, learning, assessment, professional development, and operations, so have the number of organizations engaged in addressing data standards and interoperability issues. While this is encouraging, the sheer number of initiatives—especially those with seemingly overlapping aims—can be confusing even to those immersed in the work on a day-to-day basis.

In this report, SETDA profiles 14 distinct initiatives. Some are better established and more well known than others, but it should be noted that the initiatives profiled in this report are neither comprehensive of the universe of such efforts or solutions, nor static.

The report provides a detailed view into each of these initiatives in three broad categories, which help define the primary purpose for each:

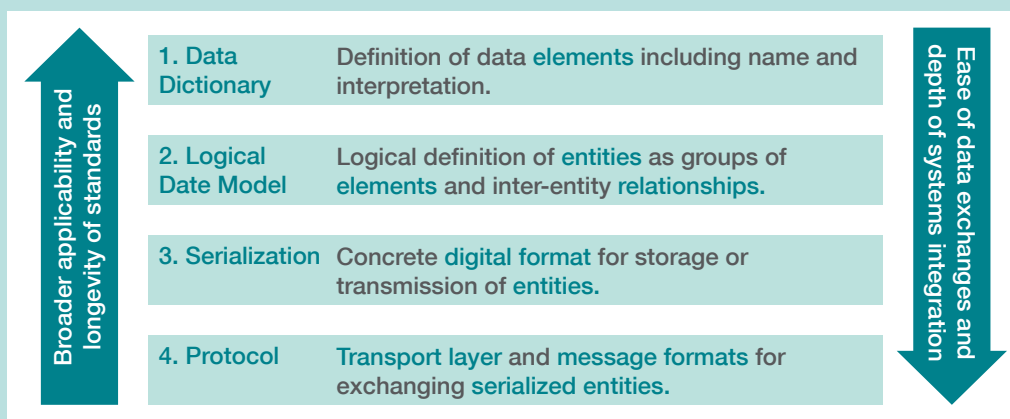
- Ensuring consistent data definitions
- Enabling the sharing of information across systems
- Facilitating the search and discovery of education resources

Where there's overlap or multiple goals for an initiative, we point that out and explain how the various efforts cooperate with or complement each other. In the section below, we provide a brief overview of each of the major interoperability initiatives. More details can be found later in the body of the report.

A Four-Layer Framework for Understanding Education Data Standards

The Bill & Melinda Gates Foundation published a four-layer framework for conceptualizing the composition of an education data standard. Author Brandt Redd notes that all four layers don't have to exist to constitute a data standard; but as more layers are standardized, data interoperability will improve and the cost of systems integration will decrease. The advantage of limiting a standard to the "higher levels" of the stack, he notes, is that it will have "broader applicability." (5)

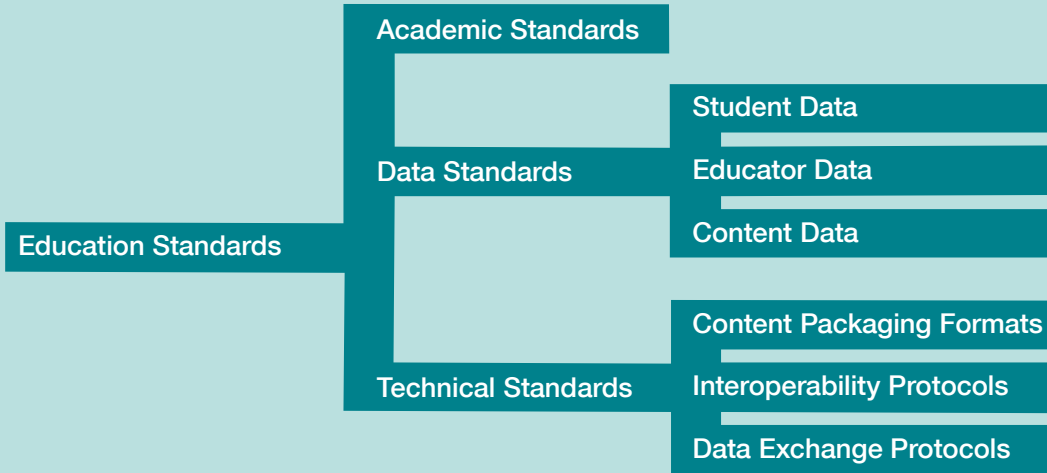
Four-Layer Framework for Data Standards



Source: Redd, Brandt (6)

A Four-Layer Framework for Understanding Education Data Standards (cont'd)

Taxonomy of Education Standards



Source: Redd, Brandt (7)

Consistent Data Definitions: Select Initiative Profiles

These initiatives focus primarily on providing a common language or vocabulary and structure that are a precursor to the seamless sharing of data among different systems and applications. While the organizations we profile for this category address different education needs, many also cooperate with each other by adopting and incorporating each other's work within their own data standards efforts.

Name of Initiative	Description
Assessment Interoperability Framework (AIF)	AIF provides a common structure to allow for the transfer of any data associated with assessment systems; including student and teacher information, learning standards, assessment items, results, and related data across systems.
Common Education Data Standards (CEDS)	CEDS provides a common vocabulary and reference structure through a data dictionary and logical data model for information that needs to be shared across education organizations.
IMS Global Learning Consortium Specifications	IMS content, application, and data standards enable teachers to mix and match educational content and software from different sources into the same learning platforms.
P20W Education Standards Council (PESC)	PESC consists of numerous standards for sharing specific types of education data, such as financial aid, transcript, and admissions information.
SIF Implementation Specification	The SIF Implementation Specification is a technical standard that is used by developers of education software to ease the transfer of data among applications in use by schools, districts and state education agencies.

Additional information about each of these initiatives can be found in the "Select Initiative Profiles" section of this report.

Sharing of Information Across Systems: Select Initiative Profiles

These initiatives provide rules for allowing data to move between and among applications without it first having to be transformed in some way. Two of the organizations whose projects are profiled here—Ed-Fi Solution and inBloom—also provide additional functionality, such as facilitating the reporting of data through dashboards.

Name of Initiative	Description
Digital Passport	Digital Passport is a tool that brokers the exchange of student data between states or districts to enable electronic record transfer as students move from one school to another.
Ed-Fi Solution	Ed-Fi Solution is a data model combined with a tool suite that streamlines the sharing of student data and also provides the elements of dashboards for use by educators to improve the academic outcomes of students.
Experience API (xAPI)	xAPI is a protocol and simple data format for sharing learning activity streams among systems to track student activities and securely expose data to other learning systems.
inBloom (formerly, Shared Learning Collaborative)	inBloom is currently working with districts to bring together secure student data, services and educational applications into a unified solution to help teachers more easily track student progress, pinpoint areas of concern, and identify the best learning resources to help students learn.
MyData	MyData is the functionality within any system containing student data that allows students and their families to export their data in an open format to maintain a copy of their own education records.
Open Badges Infrastructure (OBI)	The Open Badges Infrastructure is a standard and platform for issuing, storing, and sharing “micro-credentials,” recognition for skills and achievements that learners have completed.

Additional information about each of these initiatives can be found in the “Select Initiative Profiles” section of this report.

Search, Alignment, Discovery of Education Resources: Select Initiative Profiles

These initiatives are intended to optimize the process of finding appropriate resources, including standards-aligned resources, whether through an online search engine or across independently-operated, affiliated content repositories.

Name of Initiative	Description
Granular Identifiers and Metadata for the Common Core State Standards (GIM-CCSS)	GIM-CCSS is creating a digital representation of the CCSS to meet the need of assessment for standards alignment to ascertain the breadth and depth of standards coverage for testing purposes.
Learning Registry	The Learning Registry is an open repository of metadata and paradata about digital learning resources across the internet, including location and information about alignment to learning standards.
Learning Resource Metadata Initiative (LRMI)	LRMI provides a common structure for tagging of learning resources that can be used by online search engines and content delivery platforms to deliver more precise results and richer filtering capabilities.

Additional information about each of these initiatives can be found in the “Select Initiative Profiles” section of this report.

Data Standards and Interoperability Initiatives: Purposes and Beneficiaries

To offer an overview of the primary purposes and beneficiaries of the data standards and interoperability initiatives profiled in this report, the chart below organizes them in two important ways. The initial columns indicate both the primary and secondary purposes of each initiative. The remaining columns indicate the primary beneficiaries of these initiatives, presuming their full implementation.

Initiatives	Purposes			Beneficiaries				
	Consistent data definitions	Sharing of information across systems	Search, alignment and discovery of resources	Content and assessment providers/Creators	Teachers/Administrators	Students and families	State Standards and assessment administrators	Curriculum and instructional technology personnel
AIF	■	□		✓			✓	✓
CEDS	■			✓			✓	✓
Digital Passport		■						
Ed-Fi Solution	□	■			✓		✓	✓
Experience API (xAPI)	□	■		✓			✓	
GIM-CCSS			■	✓			✓	
IMS Specifications	■	□		✓	✓		✓	✓
inBloom		■			✓	✓	✓	✓
Learning Registry		□	■	✓	✓	✓		✓
LRMI	■		■	✓	✓	✓		✓
MyData		■		✓		✓	✓	✓
Open Badges Infrastructure	□	■	□	✓	✓	✓		
PESC	■	□			✓	✓	✓	✓
SIF Implementation Specification	■	□		✓	✓	✓	✓	✓

Student Privacy and Security

The Data Quality Campaign (DQC) in partnership with the Education Counsel and the Information Management Practice of Nelson Mullins Riley & Scarborough provides a comprehensive resource for federal, state and district education leaders, *Using Data to Improve Education: A Legal Reference Guide to Protecting Student Privacy and Data Security* (<http://dataqualitycampaign.org/action-issues/privacy-security-confidentiality/>). This resource includes summaries of multiple federal laws and organizes the state laws access both by issue and by state. (8)

On the federal level, two critical federal laws, Family Educational Rights and Privacy Act (FERPA) and the Children's Online Privacy Protection Act (COPPA) can impact the implementation of some data initiatives however, these laws grant wide latitude to schools and districts in order to tend to the business of educating students.

The Family Educational Rights and Privacy Act (FERPA) is a federal law that protects the privacy of student education records. (9) In 2011, the U.S. Department of Education announced three initiatives to safeguard student privacy while also clarifying what flexibility states have in sharing school data. (10)

First, it undertook a review of FERPA to clarify how and when student information could be disclosed. New regulatory changes for FERPA became effective on January 3, 2012. Second, within the National Center for Education Statistics, the Department established a Privacy Technical Assistance Center (PTAC), which serves as a "one-stop resource" for the P-20 education community on privacy, confidentiality, and data security. Since its launch the center has developed a PTAC Toolkit that provides resources on data sharing, security best practices, and other relevant topics. The site also includes training materials, FAQs, case studies, and other guidance documents and makes experts available to answer specific privacy questions for education organizations. Third, the Department hired its first chief privacy officer, Kathleen Styles, who previously had managed a portfolio for the US Census Bureau that included confidentiality and data management among other privacy areas. Among other things the 2012 changes to FERPA expanded the requirements for written agreements and enforcement mechanisms to help ensure program effectiveness, promote effectiveness research, and increase accountability.

Congress enacted the COPPA in 1998. Most recently, it was amended in December 2012 to take effect on July 1, 2013. The goal of COPPA is to put parents in charge of what information may be collected online about their children under the age of 13. The rule applies to operators of commercial websites and online services (including mobile apps). (11)

COPPA allows schools to act as "intermediaries" between website operators and parents in providing consent for the collection of personal information in the school context. For example, when a district contracts with a vendor for homework help, individualized education modules, online research and organizational tools, or web-based testing services, the vendor doesn't have to obtain consent directly from the parent; the school is authorized to speak on behalf of the student.

However, the Bureau of Consumer Protection Business Center also advises schools to inform parents of its practices in their acceptable use policy. When student use of a web service extends beyond school activities, the center adds, the school "should carefully consider whether it has effectively notified parents of its intent to allow children to participate in such online activities."

Recommendations

The federal government, state governments, school districts, and the technology industry all must accelerate efforts to proactively cooperate to ensure we have an interoperable educational technology ecosystem that works for students and teachers. While the initiatives and organizations profiled in this report are a strong base to build from, new leadership will be required to make needed advances. SETDA therefore recommends:

Recommendation 1: Develop a consensus-based long-term vision and roadmap for interoperability to ensure investments in technology and digital learning are cost-effective and meet educator and student needs.

State and district leaders need to come together with government and industry to develop a consensus vision and roadmap for what data may be made available to them now and in the future and how that data can inform their work across the education ecosystem and in support of student learning. This vision will be important as states and districts adopt new academic standards and curricular materials; implement new assessments and accountability systems; procure products and services; and provide professional development to educators and administrators. While every state and district is likely leveraging the work of at least some of the initiatives profiled in this report (or other solutions not profiled herein), this is a case where increased standardization in the sector can unleash innovation. In so doing, state and district leaders must assess the urgency of varying interoperability needs, the degree to which current solutions might meet evolving state and district needs, roles for informal institutions and the student and his or her family directly, and whether there are gaps that need to be filled to address these needs. Moreover, most states and districts would benefit from a bias toward openly licensed interoperability solutions, which are less susceptible to vendor lock-in and should be more cost-effective over time.

Recommendation 2: Establish an ongoing mechanism to address transparency related to the privacy and security of student data.

While existing laws and regulations provide strong protection for privacy of student data and information, awareness and implementation varies from district to district and across states. The entire K-12 community – including parents and students themselves – would benefit from an ongoing mechanism to determine and certify best practices related to issues of the privacy, security and transparency of the handling of student data. Coupled with training and technical assistance support, such a certification process would reduce the burden on individual districts and states navigating a rapidly changing technology landscape. Moreover, it also would give parents the tools to engage in a broader conversation about the appropriate safeguards that ought to be in place as educational technology and digital learning initiatives are launched to advance education and support student learning.

Recommendation 3: Address data standards and interoperability issues with vendors as part of state and district procurement processes for educational technology and digital learning solutions, including for the adoption of free solutions.

State and district RFPs for technology and digital learning systems should include assurances and certifications that new technologies will meet widely accepted data and interoperability standards or have a plan in place to do so. States and districts should evaluate every technology investment based on the ability for those new systems to interoperate seamlessly with the data and devices for which they already have access, consistent with their own vision and roadmap, including the ability to export data to future solutions that might better meet evolving needs and requirements. Cost-benefit analysis of procurements must include a consideration of the costs to ensure interoperability and may look quite different with this variable included. Given the rise of free or so-called “freemium” services, it is important that the large-scale adoption of any no-cost solution undergoes this same evaluation process.

This is an exciting time for education. Technology is allowing us to meet our longstanding challenges for public education in ways that were not possible a few short years ago. If we are serious about leveraging the data from these technology investments to shape school reform and improvement efforts and ultimately to improve learning and student success, we will need to be much more serious about the issue of interoperability. There are many organizations working on this issue now, but we will need many more engaged if we are to make a difference. It is our hope that this report will become an opening to a deeper and sustained conversation about how to make this happen.

Select Initiative Profiles

Consistent Data Definitions

Assessment Interoperability Framework (AIF)

Website: <https://ceds.ed.gov/aif.aspx>

Lead Organizations: SIF Association, IMS Global **Secondary Organization:** Institute of Education Sciences' National Center for Education Statistics

Funding: SIF Association and IMS Global provided initial funding; work on Common Education Data Standards Race to the Top Assessment (CEDS-RTTA) was funded by the U.S. Department of Education and Institute of Education Sciences.

Purpose: Both the SIF Association and IMS Global create technical standards for interoperability in assessment systems. The two organizations began collaborating on work through the Assessment Interoperability Framework (AIF) to help the education sector determine which technical standards to use when, and to identify additional areas of development. The U.S. Department of Education (ED) and the Race to the Top Assessment program is leveraging the AIF work within CEDS and to support the consortia.

AIF offers common data terms to allow for the transfer of assessment-related data across applications within a district, between a district and state agency, and across states. CEDS used existing data standards and the IMS/SIF framework to create new assessment elements for the data model.

Although this work was undertaken specifically to support the needs of the federal Race to the Top program, the framework design results are expected to be applicable for other assessment programs (both formative and summative) and applications.

The assessment platform framework addresses:

- Creation of a test item
- Creation of a test
- Alignment to learning standards
- Delivery of a test or item to a student
- Reporting on data in both ad hoc and pre-defined formats
- Delivery of relevant data to the registration system from the student information system or some other data source, such as a learning management system or something else in use by the district
- Scoring to deliver student results back to the reporting system and eventually into the student information, or similar, system
- Accessibility and accommodation information to deliver assessments based on individual student needs (12)

Potential Impact on Teaching and Learning: The use of AIF will speed up the transfer of data for the entire assessment enterprise, including test questions, results, and related data among the various assessment entities—schools, districts, and state agencies. This will enable teachers in the classroom to make quicker comparisons and analysis for identifying and addressing learning gaps among their students. In addition, with the use of learning standards in assessment data, targeted resources can be provided to students for learning.

Status: The framework developed by the AIF working group is still fairly new; its details were officially released in December 2012. The next phase includes implementation of the specifications within the assessment systems being used by states and districts. (13)

Future Plans: The SIF Association and IMS Global working group continue to push ahead with further development of components for formatting and transporting data, providing additional documentation for technical development, creating additional reporting capabilities, and conducting additional pilots and testing.

Common Education Data Standards (CEDs)

Website: <http://ceds.ed.gov>

Lead Organization: Institute of Education Sciences' National Center for Education Statistics

Funding: U.S. Department of Education and Institute of Education Sciences

Purpose: Multiple forms of data exist in schools to maintain information about students and other aspects of education operations, all with different labels or fields and in various formats. Yet there are certain kinds of data that need to be shared across organizations, such as between state and local education agencies. For example, as a student moves from pre-kindergarten to grade school, high school, and possibly college, or moves from one district to another, it would be useful for the agencies, districts, schools, and other entities involved in that child's education to be able to share, compare, and exchange data in an "accurate, timely, and consistent manner." (14)

Doing that exchange, however, requires a shared data "vocabulary," so that the meaning and structure of the data provided by one organization is understood by the other receiving it. (15) Without a common vocabulary, transfer of data can be "slow, laborious, and fraught with errors," increasing the workload for staff that have to figure out how to decipher it. (16)

The Link between CEDs and EDFacts

Introduced in 2003-2004, EDFacts is a U.S. Department of Education initiative that compiles aggregated K-12 education data. Previously, states and local education agencies had to submit data from different sources—enrollment and graduation rates, individuals with disabilities, participation and compliance with Title programs, and so on—to separate federal agencies; EDFacts provides a format for reporting the data that consolidated those separate submission processes. (17)

For version 2.0 of CEDs, the CEDs team worked with the EDFacts team to ensure alignment of data structures and coverage of the various EDFacts data groupings. The goal was to ensure that all elements required for federal reporting were part of the CEDs version 2.0 standard. CEDs defines data elements and data structures that meet EDFacts reporting requirements. Unlike EDFacts, however, CEDs does not store data; nor does it provide standards for the aggregation or transmission of data from local education agencies to state systems or from state systems to Department of Education systems. The states must still create and build files of aggregated data to provide to EDFacts. (18)

CEDs is a national collaborative effort among states to develop common data for a key set of education data elements. Districts that participate in the standard, for example, can have confidence "that their data will be accurately interpreted by recipients, and that they, in turn, will understand data received from others." (19)

For example, in address data, any field that specifies the city is standardized as “Address City”; a field designating the name given to a course of study offered in a school or some other organization is “Course Title.”

The data standards are not required to be used by any organization because adoption of the data standards is strictly voluntary; nor do they act as some kind of national student record system since CEDS does not collect any data. However, CEDS is “among the most important” efforts currently underway; many states are aligning their longitudinal data systems to CEDS. (20)

Why the Need for CEDS?

Here's a new student:

Jonatha
Tsumura II

Race = Japanese
Gender = M

Hmm...
Did you mean:

Jonathan ?
Tsumura?
Suffix = II ?
Race = Asian ?
Sex = M ?

High School in state A

IHE in state B

Source: CEDS (21)

These data standards form a shared vocabulary within and across pre-kindergarten through college and the workforce institutions and sectors. The vocabulary for CEDS version 3.0 includes 1,147 elements along with their definitions, usage notes, use cases, and other technical specifications to streamline sharing and comparing. (22)

CEDS stakeholder groups representing educational organizations spanning early learning, K-12 (state and local education agencies), post-secondary, adult education, and workforce programs guide the development along with representatives from other key educational data initiatives. There are numerous standard data formats already in use, including: the SIF Implementation Specifications (sifassociation.org); the P20W Education Standards (pesc.org/); EDFacts (ed.gov/edfacts); and others. The CEDS effort relied on those formats where they existed for its data definitions; only when an element didn't already exist in those sources did the collaborative team develop a new definition.

Along with the data standards, the CEDS team has developed multiple tools to allow stakeholders to use and integrate the data standards into various parts of their work. CEDS Align is a web-based tool that allows users to import or input their data dictionaries, align their data elements to CEDS definitions, compare their data definitions with that of other groups, and analyze their data in relation to various other CEDS-aligned efforts. CEDS Connect allows stakeholders from educational organizations to use the tool to answer policy questions, calculate metrics and indicators, address reporting requirements, and suggest additions to the data standards.

Potential Impact on Teaching and Learning: When a child transfers from one district or state to another, from one program or institution to another, certain information should follow the student, whether it's about bus service needed, special educational needs, a high school transcript, or something else. Use of CEDS can ensure that the data being provided about that student is understood by the recipient, minimizing the risk of data errors and optimizing the exchange of data in order to prevent gaps in the "continuity and appropriateness of services provided." (23)

Status: CEDS version 3.0, released in January 2013, covers all additional content areas, with an emphasis on workforce, career and technical education, adult education, and Race to the Top assessments. It also includes data definitions supporting teaching and learning, including learning resources and the formative assessment process. (24)

Future Plans: A growing number of stakeholder organizations are using the CEDS Align and Connect tools. Data from the CEDS tools, along with stakeholder feedback and participation, informs future areas for expansion. The National Center for Education Statistics (NCES) announced in April 2013 that version 4.0 of CEDS will be released in January 2014. Version 4.0 will build on the work of the previous versions and continue development in the P-20 domains and expansion into adult education and workforce. A special effort will be made in the upcoming development work to meet the needs of states developing integrated P-20W systems designed to get useable information in the hands of stakeholders at all levels.

Promising Practice

State of Washington Uses CEDS to Identify Data Alignment

In 2012 the Washington Office of Superintendent of Public Instruction (OSPI) brought together federal, state, and district education stakeholders to lay out a plan for feeding data from all source systems into the statewide longitudinal data system. CEDS is being used as the starting point to identify the universe of available data in state education systems and to identify the degree of alignment among the systems for data elements collected by more than one agency. The applications for inclusion in the initiative run from early learning through K-12 and into post-secondary source systems. (25)

IMS Specifications

Website: imglobal.org

Lead Organization: IMS Global Learning Consortium

Funding: Member fees, compliance testing, sponsorship

Purpose: The IMS standards are:

- Common Cartridge
- Learning Tools Interoperability
- Learning Information Services
- Accessible Portable Item Protocol and Question and Test Interoperability
- Interactive Whiteboard Common File Format

These technical standards aspire to enable education content and software to be mixed and matched by the instructor. For example, a teacher could blend curriculum from multiple sources and share that “package” of content with another instructor to use in a different course management system. Or a teacher that uses a course management system from one company in her classroom can “plug in” a utility that allows her students to run videos from another company within the course system, as long as both programs comply with the Learning Tools Interoperability standards. Students only need to log in once in order to access multiple programs. Content creators and software developers benefit because they don’t have to figure out how to integrate their materials or programs with every other program for their users; they simply need to adhere to the relevant IMS specifications. (26)

- The Common Cartridge specification addresses the challenge of enabling digital class materials to be used in multiple learning management systems and with other course content.
- The Learning Tools Interoperability specification tackles the problem of allowing differing education programs to work together. This is especially important to teachers who may want their students to stay inside of the learning management system and not have to leave that application in order to run another program. The specification also allows outcome data—such as grades—from those other programs to be shared with the learning management system.
- The Learning Information Services specification addresses interoperability between learning systems and student information systems. In particular, this specification provides web services that allow student enrollments and student grades to be synchronized in real time. (27)
- Accessible Portable Item Protocol and Question and Test Interoperability allow teachers to move digital tests and test items from one test item bank to another; it also provides access features for building an interface that lets educators make a test or an item accessible for students with special needs. These specifications are consistent with IMS Common Cartridge, and a subset of these is available in the Common Cartridge to support assessment. (28)
- The Interactive Whiteboard Common File Format provides interoperability of interactive whiteboard content. (29)

IMS is focused on helping suppliers, districts, and states achieve plug-and-play interoperability, leading to greater innovation and personalized learning. To that end, IMS has granted over 140 conformance certifications and is expecting another 70 or so in 2013.

Although it may appear that some of the work being done by IMS duplicates work done elsewhere, these initiatives actually solve different problems. For example, both IMS and inBloom provide specifications to be used in achieving single sign-on, enabling a user to sign in with a user name and password once and access multiple applications. But in the case of inBloom, its application programming interface (API) is focused on building infrastructure to collect data that will improve personalized learning. IMS' LTI provides a method for accessing multiple tools and content that will generate outcomes in the classroom. A developer may choose to use the inBloom model for part of the workflow in delivering results back into school systems but LTI would be used in allowing the teacher to combine various programs for student use that are accessible with a single log-in. (30)

In another example, IMS has been developing a specification to help with sharing assessment items across data stores. That work has evolved into the AIF, a joint initiative with the SIF Association to allow for the transfer of assessment-related data across systems for supporting the needs of the federal Race to the Top Assessment program.

Potential Impact on Teaching and Learning: With all of these specifications, a major goal is to allow educators to use the digital learning content they've already created without having to recreate it anew when moving from one application to another or having to re-enter information manually when it already exists in digital form. Reducing those types of burdens leaves more time for planning, preparation, and instruction.

Status: The latest specification release from IMS is Learning Tools Interoperability 2.0, which was made publicly available in November 2012.

Future Plans: The data specifications covered here have active workgroups that are continuing to be enhanced as digital content and application alternatives evolve.

Promising Practice

IMS Specs Help Virtual School Keep Up with Growth

During the 2011-2012 school year the Florida Virtual School (flvs.net) served 148,000 students as well as schools and districts in 49 states and 57 countries with 120 online courses. (31) A major challenge in its dramatic growth has been delivering its course content to a myriad of learning management systems—at least seven at one point. (32) When done manually, the conversion process could take up to eight hours for a single course on just one of those systems. Several years ago the school became a member of the IMS Global Learning Consortium and participated in several of the specification committees. Now Florida Virtual School asks its third-party vendors whether their products “meet IMS standards in order to determine their potential for interoperability.” The senior manager of curriculum research and design reports, “Having standards that allow disparate systems to integrate seamlessly with one another potentially cuts down on the expense of developing interoperability for each individual system.” (33).

P20W Education Standards Council (PESC)

Website: pesc.org

Lead Organization: P20W Education Standards Council (PESC)

Funding: Member fees, meeting registration and sponsorships

Purpose: The PESC community brings together colleges and universities, local education agencies, state and federal agencies, software providers, and others to ensure interoperability among data systems in use by K-12 and higher education across state lines. (34) PESC-approved data standards address admissions applications, college transcripts, global PDF attachments, and graduation rates. Several PESC student aid standards have been mandated by the U.S. Department of Education and therefore are used in every college and university in the country that processes federal student aid.

The organizing body, also named PESC, was established by 29 education organizations at the National Center for Higher Education. The PESC work envisions national and international interoperability within the education domain, supported by a trustworthy, inter-connected network built by and between communities of interest in which data flows between systems without compatibility barriers safely, securely, reliably, and efficiently.

PESC “Approved Standards” support a specific business process or transaction that organizations, institutions, and agencies need to perform. When the applications used by schools—including K-12 and higher education—conform to PESC standards, the transfer of data between systems is greatly simplified. For example, in requesting a transcript, there are numerous activities that must occur in order for the transaction to be successful and the students and administrators to be satisfied. The organization that needs the transcript (A) submits a “request file” to the organization that has the transcript (B). B issues a “response file” that the request was received and then delivers the “transcript file” to A. A “acknowledges” successful receipt of the transcript, and the process is terminated.

PESC takes the banking industry as its model, which worked to build the infrastructure and data standards that created the automated teller machine (ATM) network. The ATM process, including user experience, cost of transaction, liability, recourse, and the transfer of data, is handled seamlessly for the customer. Behind the scenes, banks and banking stakeholders collaborated and agreed on data forms, transaction fees, performance expectations, security, and dispute resolution.

The PESC work includes the development of XML schemas that outline how files should be designed and populated, and implementation guides that explain how to put the standard to work. So far, PESC consists of 15 data standards and a data transport standard, available free of charge. (35)

Potential Impact on Teaching and Learning: While PESC does not interact directly with students, students are its primary beneficiaries. Service providers, agencies, and institutions implement PESC standards within their applications to simplify access to the data those programs contain for use by students, parents, and administrators performing different types of transactions. With stronger interoperability comes increased data portability, improved data quality, and reduced costs.

Status: A National Center for Educational Statistics (NCES) survey conducted at the end of 2009 reported that 29 states use and support PESC’s XML High School Transcript. PESC’s EDI Standards are used by hundreds of colleges and universities throughout the United States and Canada to process tens of millions of transactions each year.

With work now firmly rooted in both pre-K-12 and labor/workforce, in 2012 the PESC board of directors renamed the organization P20W Education Standards Council (using the same acronym, PESC).

Future Plans: PESC expects to release an *Academic e-Portfolio* data standard and a *Recruitment and Enrollment* data standard in 2013. Maintenance and development on PESC standards are on-going and governed by a steering committee and change control board (CCB) under a PESC Standards Forum.

In 2013, PESC's Common Data Services (CDS) Task Force is expected to release results regarding its work in establishing protocols that can be used generically for a variety of data purposes and needs. As a blueprint, these protocols would be used by stakeholders—such as institutions and organizations involved in transcript work—enabling them to communicate with one another through an agreed-upon, neutral platform.

In partnership with Internet2, PESC is launching CommIT, the Common Identity and Trust Collaborative, which is intended to simplify admissions by introducing a voluntary “single sign-on” process for users. Shortly, CommIT will go through testing by pilot institutions; PESC expects the new initiative to be scaled up for broader deployment by hundreds of organizations by summer 2014.

Promising Practice

Virginia Data Speaks PESC XML

Starting in 2004 Virginia began accumulating data about its 1.2 million students into a statewide data warehouse in order to begin to help inform educational decision-making. The collection included data such as assessment results, reading and math performance information, and preschool literacy screening results, among many other types. Three years later the state received federal funding to support additional forms of data and to create an electronic transcript capability. As of mid-2011 about a third of districts had the latter capability in place, with more coming online all the time. Virginia uses SIF to capture transcript data from its school districts and translates that data into the PESC XML format on its way to a transcript broker. Those electronic transcripts have eliminated the need for manual data entry at state colleges and universities. (36)

SIF Implementation Specifications

Website: sifassociation.org/us/sif-specification.asp

Lead Organization: The SIF Association

Funding: Member sponsorship, certification program, grants, and contractual work.

Purpose: This initiative brings together developers of school technology with the educators that use it to define the rules for moving data between applications “efficiently, accurately, and automatically.” (37) Run by the SIF Association, a non-profit organization, the SIF implementation specification provides a common language that allows for secure data transporting between one application and/or organization and another. Previously, this activity would have required human intervention to sort out the different forms of data being shared.

In April 2013, SIF launched version 3.0, which incorporates the CEDS version 3.0 data model and provides the mechanisms—security, reliability, scalability, and other services—for schools and districts to use *CEDS on the Wire*. (38) The SIF Implementation Specification (US) 3.0 standardizes:

- A transfer framework (the infrastructure “wire”)
- A physical data model (the CEDS-aligned data “payload”)

Organizations creating education applications can use the SIF specification and avoid having to create custom interfaces to all the other applications that might need to make use of the data being provided.

As one participant in the work noted, “Think of CEDS as the proverbial brick and SIF as the mortar that lies between to create the solid house.” (39)

Potential Impact on Teaching and Learning: Teachers use a number of different applications during the course of their days. When the SIF specification has been adopted by vendors and developers that create those applications, those instructors have an easier time accessing, moving, and using the data among the various systems. Those systems can also be set up to do a data transfer automatically, so that the latest data is regularly transmitted when and where it’s needed. That may be a student information system locally or a longitudinal student data system at a state level.

Status: The SIF implementation specification is continually being revised and updated, based on member needs as well as the needs of the other data standard bodies with which it works. The latest edition, version 3.0, incorporates all portions of the CEDS 3.0 data model and allows for various infrastructures of choice. SIF 3.0 can be mapped to any modern transport running over HTTP/S. This makes it easier for vendors to staff SIF projects as one or both of these infrastructure technologies are already familiar to the majority of today’s software developers.

The SIF community has committed to updating in parallel with the maturing CEDS dataset. Outside of CEDS, the SIF community will always consider items not already in the SIF specification through a “fast-track” process for possible inclusion.

Future Plans: SIF continues to link up with other organizations addressing data interoperability challenges and figuring out how the SIF specification can attend to those evolving needs. Going forward the two organizations behind SIF and CEDS have committed to working together to ensure that changes in the SIF standard will continue to be integrated into CEDS as well, and that CEDS-originated data model extensions will be evaluated for potential inclusion in the SIF standard too. (40)

Also, recently, the SIF Association was part of an announcement by NCES, which has released the AIF, a set of transport standards that can be used by vendors creating software specifically for Race to the Top Assessments. The SIF organization has committed to incorporating AIF elements into the SIF model during the first quarter of 2013. (41)

New York School District Seeks SIF Compliance for SIS

Ramapo Central School District in New York learned that its student information system (SIS) would no longer be supported. The district had already implemented SIF to eliminate duplicate data entry across a number of administrative software programs. In evaluating replacements for the SIS, the district found that “some vendors did not yet support the SIF data model nor had they developed SIF agents.” Ramapo specifically chose to work with companies in the process of building SIF agents that would support the many applications in use at the district, not only for SIS operations, but also for textbook and library management, special education and individual education plan management, reading applications, and others. As a former director of technology for the district reported, the use of SIF prevents “endless imports and exports” and the “blame game between vendor and end user about accuracy of data,” and the district “can feel confident when querying data that it is accurate and up to date.” (42)

Sharing of Information Across Systems

Digital Passport

Website: slds.doe.k12.ga.us/SEDataExchange/Pages/index.aspx

Lead Organization: Georgia Department of Education

Funding: U.S. Department of Education

Purpose: The Digital Passport project was initiated to broker the electronic transfer of student records from one state to another as students move.

Starting in 2012 Georgia began a project to share K-12 data with other states by creating a data exchange hub. The Southeast Education Data Exchange (SEED), as it was named by Georgia, now consists of eight states (Georgia, Alabama, Florida, Kentucky, North Carolina, South Carolina, Oklahoma, and Colorado) that have agreed to share limited access to their longitudinal student data systems. (43) The interstate initiative is referred to as Digital Passport.

The purpose is to be able to track, monitor, and share basic information for K-12 students in two scenarios: 1) where a student moves across state lines and wants to reregister in a new school system; and 2) to identify students who transfer between participating states but may be reflected as dropouts by their “home” state. (44) Transactions are either to locate a student or to request a student record.

All data is CEDS-aligned to facilitate the exchange. A search can be performed with a minimum of three data elements: first and/or last name, birthdate of the student, and the state or states to search. However, dozens of other search elements are also available to filter results, such as parent last name, former street address, last four digits of the social security number, or birth city.

The goals of this data system are to improve continuity of services, enhance states’ efforts to ensure graduation, validate student mobility, and improve the accuracy and reliability of graduation rates. (45)

States that are part of the initiative agree to adhere to the policies of the Family Educational Rights and Privacy Act (FERPA), and they're not allowed to share data within a state or otherwise store it in a data warehouse.

Potential Impact on Teaching and Learning: When a student transfers from a school in one state to a school in another state, there has traditionally been no easy way to get information quickly about that person to expedite registration. Digital Passport provides a simple mechanism to obtain basic registration data in order to speed up the process of procuring the individualized services that child needs for success within the new school environment.

Status: Currently, three states are piloting the Digital Passport. Deployment by all participating states is expected to be completed by fall 2013.

A sample search screen and results report for Digital Passport.

The screenshot displays the 'EDUCATION DATA EXCHANGE' search interface. At the top, there are 'Clear' and 'Submit' buttons. Below, the search criteria are listed: 'Searching for: Last Name: ALLEN, DOB: 01/12/2003, Searching In: ALL STATES'. The results section, titled 'Search Results (displaying 3 Results)', shows three entries for the state of Georgia (GA), Kentucky (KY), and North Carolina (NC). Each entry indicates '1 record(s) found' and provides detailed personal information for a student: Last Name: Allen, First Name: Timothy, DOB: 01/12/2003, Middle Name: M, Suffix: . Gender: Male, Race: Hispanic Or Latino Ethnicity, Last Four digits of SSN: 4176, Grade: 01, Parent First Name: ., Parent Last Name: ., State ID: 1001357736, Birth Country: ., Birth State: ., Birth City: ., Former State Student ID: ., Former Street Address: ., Former State: ., Former Cty: ., Former ZIP: .

The bottom portion of the screenshot shows the search form with the following fields:

- Current State: (dropdown)
- * Last Name: Allen
- * First Name: Not Provided
- * Birth Date: 01/12/2003
- * State or States to Search: (checkboxes for All States, Georgia, Kentucky, North Carolina)
- Middle Name: Not Provided
- Name Suffix: Not Provided
- Gender: Any
- Race/Ethnicity: Any
- Last 4 digits of SSN: Not Provided
- Number of Years to Search: Not Provided
- Birth Country: Any
- Birth State: Any
- Birth City: Not Provided
- Parent Last Name: Not Provided
- Parent First Name: Not Provided
- State Student Unique ID: Not Provided
- Former State Street Address: Not Provided
- Former State Student Unique ID: Not Provided
- Grade Level: Any
- City: Not Provided
- State: Any
- ZIP Code: Not Provided

 Clear and Submit buttons are located at the bottom right of the form. Below the form, the search criteria are repeated: 'Searching for: Last Name: ALLEN, DOB: 01/12/2003, Searching In: ALL STATES'.

Source: SEED Cross-State Data-Sharing System Presentation. (46)

Ed-Fi Solution

Website: ed-fi.org

Lead Organization: Ed-Fi Alliance

Funding: Michael & Susan Dell Foundation; now under the auspices of the Ed-Fi Alliance.

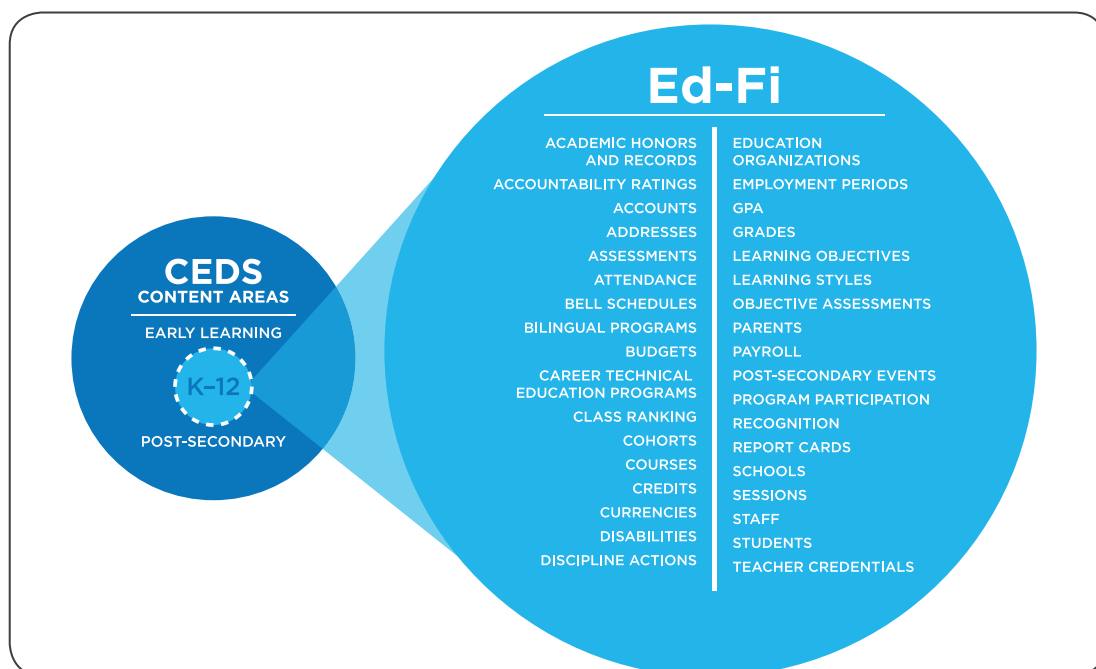
Purpose: The Ed-Fi solution is a data specification for the storage and exchange of student data combined with a tool suite for accessing the student data. The data standard and model are vendor-neutral, open, XML-based, and designed to integrate information from a broad range of existing sources. The technology extracts student information from education systems and then standardizes, integrates, and communicates it to educators and other parties through web-based dashboards, reports, and other applications.

Developed to improve K-12 student achievement, the Ed-Fi work can also be used by school and district administrators and state and federal agencies to supplement or replace tools used for broader accountability reporting purposes. The Ed-Fi data specification aligns with and is based on CEDS version 2.0.

The Ed-Fi solution equips educators with insights they can use to make informed decisions for improving the academic outcomes of students. The solution is available for use via a free license from the Ed-Fi Alliance.

inBloom (formerly the Shared Learning Collaborative) has adopted the Ed-Fi XML specification as a way to work with the CEDS data dictionary and data model. (The Ed-Fi solution also offers additional classroom-level elements in its specification that the inBloom work takes advantage of.) (47) The important point here is that the application of data specifications from Ed-Fi, CEDS, and inBloom will simplify data integration between different systems in use by schools, districts, and states.

The Ed-Fi data model aligns with CEDS version 2.0 and is committed to CEDS to provide access to data for assisting teachers in personalizing instruction for students.



Source: Ed-Fi Alliance (48)

Potential Impact on Teaching and Learning: Ed-Fi-powered dashboards enable educators to monitor critical student performance indicators from a number of sources in a single location, bolstering their abilities to identify early warning signs and hidden growth opportunities and to intervene and ensure that all students avoid failure and reach their full potential. Views can be tailored as needed for a variety of roles, including teacher, principal, campus leader, and district leader.

Usage Examples:

Ed-Fi addresses (49):

- Moving data between applications, such as a grade book program and a student information system
- Moving data between a local education agency and a state or federal education agency
- Accepting data from external sources, such as testing services
- Pulling data from various sources into an operational data store or data warehouse
- Transferring records among districts when a student transfers from one school to another
- Developing dashboards and reporting tools to help teachers monitor student progress in near real-time

Status: The standard and toolset launched in July 2011. The Alliance made version 1.1 available in December 2012, with CEDS version 2.0 alignment, expanded dashboard features, alignment to the CCSS and alignment with other data efforts, including the Learning Resource Management Initiative, and the inBloom work.

Future Plans: The Ed-Fi Alliance will continue expanding and evolving its solution based on feedback from IT experts and educators in the classroom as they continue to use the unifying data model, data exchange framework, application framework, and starter kits in their work. As state and district implementations progress, new extended capabilities are being developed to support early warning identification, student transcript transfer, and state level reporting. Additional features and functionality from these and other projects will be added to the tool suite over time. Ed-Fi also is in discussions with CEDS leaders to implement CEDS version 3.0 and eventually version 4.0 when it is released. (50)

Watch and Learn: Ed-Fi

<http://www.youtube.com/watch?v=bBXvgzKoWPA>



Arkansas Chooses Ed-Fi Dashboards

The Arkansas Department of Education sought a way to pull together disparate data streams in order to give the state's teachers simple, fast access to information they could use to improve instruction and address issues as they happened. After evaluating a number of solutions, the state adopted the Ed-Fi solution. It's now in the process of extending its statewide information system to encompass the Ed-Fi data standard in order to set up teacher-requested dashboards, such as one that displays local discipline codes (versus just those reported to the state), and another to gain access to local formative assessment data on top of state assessment data. The department is also data mapping its existing systems to an Ed-Fi data dictionary (which maps to CEDS) to expedite federal reporting requirements. By the end of this year, the state expects more than half of its school districts to be able to pull up Ed-Fi-enabled dashboards. (51)

Experience API (xAPI)

Website: xapi.adlnet.gov

Lead Organizations: Deputy Assistant Secretary of Defense (Readiness), Advanced Distributed Learning (ADL) Initiative

Funding: Department of Defense ADL Initiative

Purpose: The Experience API (xAPI) provides a means to store and access data about learning experiences. The xAPI is designed to support existing browser-based capabilities such as the Sharable Content Object Reference Model (SCORM) and extend that support to include non-browser-based capabilities such as mobile applications, games, virtual environments, full-scale simulators, and sensors. The xAPI also allows for much more granular data to be collected, such as learner progress, virtual media, and even real-world experiences. (52)

The xAPI introduces the concept of a learning record store (LRS) to create a “learning experience tracking service.” This store is a database of learning records that can be accessed by other systems, such as reporting applications, human resources programs, a learning management system, or any other authorized system.

The xAPI uses a format for the learning record similar to activity streams used in social media. The format can be thought of as a simple sentence with the structure, <actor><verb><object>: “Alex viewed video” or “Melissa read book.” The standard also is meant to accommodate specific details: “Alex viewed [learning fractions] video” or “Melissa read [The Autobiography of Miss Jane Pittman] book.”

The learning record can infer information based on previously stored data. (A book is read; a video is viewed.) The data contained in those learning records can also be used to build up, assign, or sequence activities for learners: After somebody has written a chapter, for example, another learner can be told to edit it, a third to proof it, and a fourth to add it to an existing chapter. These capabilities allow the xAPI to be used to recommend content, tailor learning experiences, and provide instructor feedback on content or learner assessments.

The xAPI is meant to be “stacked” with other technologies for value-added services. For example, the xAPI can track extremely granular data in several learning record stores, which can then be configured to sync up with data from other technologies like inBloom or the Open Badges Infrastructure. The xAPI can be used to track usage data of content or sub-components of content. This usage data can then be pushed to the Learning Registry or used by

LRMI as valuable paradata for those searching for high-quality educational content. (“Which video on fractions was most assigned by other teachers in my district?”)

Potential Impact on Teaching and Learning: The xAPI provides a capability to store and access information from a diverse set of learning, training, and performance support experiences. Teachers can use this data to determine a student’s true understanding of a concept beyond basic summary data such as quiz or test scores. Systems can automatically tailor content based on a thorough understanding of a learner’s previous course history and interactions with learning content. Learners can choose to include informal and self-guided learning experiences into their learning record store that can later be used to help determine the impact of learning outside of formal curricula.

Status: The xAPI is currently at version 0.95. Version 1.0 was expected to be released in April 2013. Companion documents, or profiles, that include specific community use cases are expected to be released soon after the xAPI 1.0 release.

Future Plans: Future plans include the creation of community-specific vocabularies or profiles that will enhance interoperability of content and systems. Sponsoring organization ADL will serve as a catalyst for additional xAPI profiles. In addition, xAPI tangential specifications for big data query interfaces, learner profiles, and activity definitions are all potential extension points.

The xAPI forms a building block for ADL’s eventual goal: to create a “personal assistant for learning” that can anticipate learner needs, integrate with relevant information, and provide access to personalized learning content. (53)

inBloom

Website: inbloom.org

Lead Organizations: inBloom, Inc.

Funding: Initially provided by Bill & Melinda Gates Foundation and Carnegie Corporation of New York

Purpose: Nonprofit inBloom, formerly the Shared Learning Collaborative, is working on a number of shared data and content services. The goal of this technical “plumbing” is to help teachers have quick and simple access to the data they need to inform and personalize instruction on a daily basis. By providing a secure data interoperability service, inBloom helps states and districts to implement classroom learning tools with all of the information teachers need to help personalize instruction. Access to the data will give teachers the ability to provide personalized instruction that ties with the Common Core or other academic standards. Districts and states can use the information coming back from instructional tool providers to determine the use and effectiveness of tools in classrooms. States will save resources and funds by collectively adopting inBloom’s technology, thereby freeing up funding for them to invest in additional tools and applications to support personalized learning at scale.

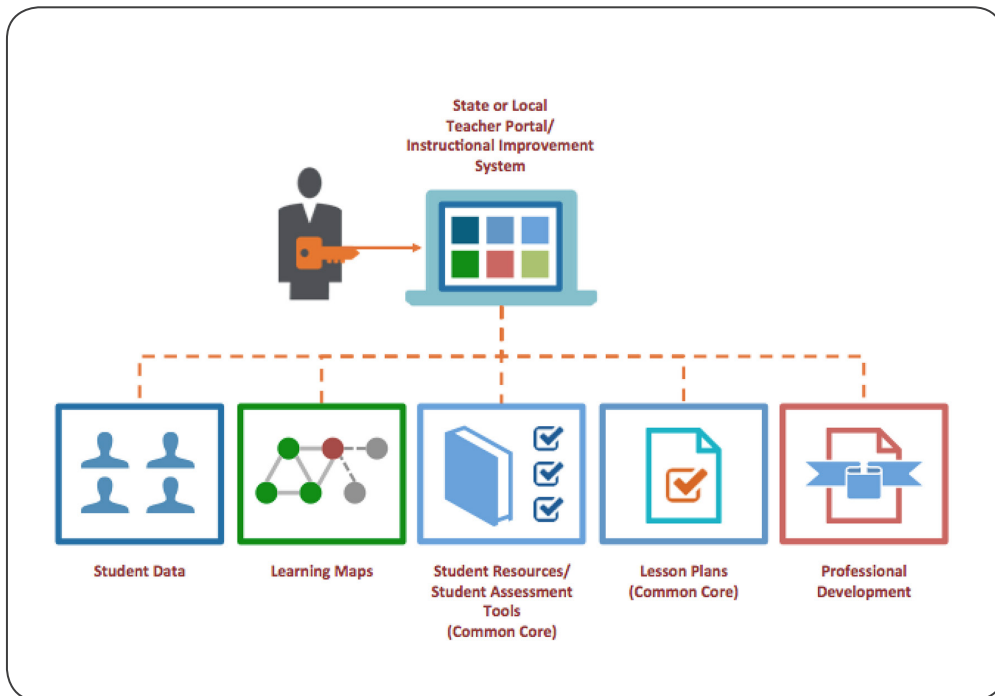
inBloom technology consists of a set of components:

- A cloud service for data storage to offer separate and secured spaces for states and districts to maintain data about schools, employees, and students. Each organization/entity handles management of the data and determines what data will go in or come out, who has access, and which applications can connect to the data. Besides the data storage service, inBloom is providing high-volume data-loading tools. (54) This service will help districts and states launch and evaluate the impact of data-driven tools and applications for teachers, students, and families.

- An application programming interface (API) to allow districts and states to approve and manage connections to the data-driven tools they implement. This will eliminate the constant program dipping that teachers need to do to get a complete picture of a given student and eliminate multiple expensive points of custom integration. The approved applications can write code to the API and be assured that their own data will mesh with other data sets also in use by schools and districts. inBloom also provides a sandbox to allow developers to test new applications with dummy data. (55)
- Federation with local identity services to enable single sign-on across all approved applications. Approved applications will act on permissions and roles determined by local policy.
- A set of starter applications that demonstrate data and content interoperability with inBloom services. Code for all starter apps will be released under an open source license.
- A public index for the Learning Registry that stores all LRMI-aligned metadata and related paradata to power internet-scale search and discovery.

The inBloom work builds on the success of other organizations working in this space. The data service is CEDS aligned. States and districts can use Ed-Fi XML as one option for data loading. The service interoperates with SIF. The content service builds on both LRMI and the Learning Registry. (56)

inBloom services focus on delivering data to allow teachers to personalize their instruction for each student.



Source: inBloom (57)

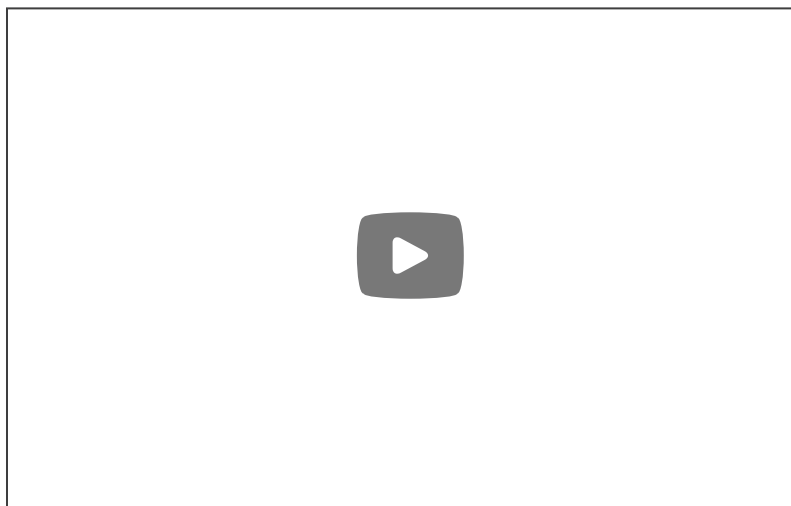
Potential Impact on Teaching and Learning: The core goal is that districts can manage and display data from multiple sources. Teachers will be able to quickly access student information and gain insight into the resources and materials that are available to help meet specific learning needs; students will gain a better understanding of how particular content or lessons fit into their overall education and long-term goals. For example, state assessment results, local interim assessments, and the results of an online math practice game would all be available in a teacher dashboard or that same data set could be fed into a specific engine.

Status: Nine states have participated in the development of inBloom; of those, five have selected districts to participate in the pilot testing, and six have plans to deploy inBloom and compatible applications more broadly this year.

Future Plans: The initial development of the technology services is being made available to pilot states at no charge until 2015. The service will be available to additional states and districts in 2013. States may have charges related to integrating their existing data systems with the inBloom services. The intellectual property will be owned by inBloom, which will publish the underlying code under an open source license. However, the data managed through the various services created by inBloom remain under the control of the individual states, districts, and schools that produce it.

Watch and Learn: inBloom

youtu.be/N1sU_i9fK8s



Districts Seek Access to Student Data with Dashboards

Currently, Everett Public Schools uses more than a dozen third-party assessment packages from just as many vendors to monitor the learning performance of its population of 6,600 K-12 students. As a pilot district for the inBloom shared data services, Everett ideally hopes to consolidate data from all or most of those packages and provide access to that data through a single dashboard. The goal: to give teachers quick and convenient access to a “complete, accurate picture” of a student’s personal learning profile in order to make timely, fact-based instructional decisions. (58)

In New York State, a similar endeavor is under way. But that project is expected to result in offering three different data dashboards, any of which may be adopted by districts, depending on their needs. The state requirements specify that any dashboard selected is expected to “leverage the data store and application interfaces” provided by inBloom as the source for all external data. (59)

MyData

Website: ed.gov/edblogs/technology/mydata/

Lead Organizations: U.S. Department of Education Office of Educational Technology, White House Office of Science and Technology Policy

Funding: Federal and commercial companies choosing to implement MyData will fund their individual initiatives independently.

Purpose: In January 2012 the U.S. Department of Education Office of Educational Technology announced the MyData initiative to encourage schools, education organizations, and software vendors to allow students to access and download their own data maintained by those sources. The larger idea is that students could compile and re-use the records in order to build a personal learning profile.

Where MyData functionality is provided, on websites and in products, a MyData “button” appears. After users log in and access their data, they can click the MyData button to generate and download a machine-readable text version. That data can then be shared or saved to a “data locker,” an online storage service or application developed for this purpose. The recipient is then able to pull the data into MyData-compatible systems without having to do any kind of manual conversion. (60)

During the initial release of MyData, parents have access to information on student schedules, attendance, emergency contacts, grades, demographics, and assignments. Sometime in 2013 additional data is expected to be accessible: health, conduct, assessment test scores, and individual education programs. (61)

The MyData project doesn’t specify what data standard educational providers should use; it simply states it should be any suitable “machine-readable standard,” all of which can use existing XML schemas. Suggestions specifically include SIF, PESC, and the IMS Global Learning Consortium. (62)

MyData may be the first “deposit” most families make into their children’s personal learning profiles, a kind of digital portfolio that could eventually include college records, professional certifications, career achievements, digital samples of work, and other kinds of material that reflect life pursuits.

Potential Impact on Teaching and Learning: This project attempts to eliminate the delays that occur when a student needs to access personal data; for example, when changing schools, applying for financial aid, or applying for college. Those delays can put a student's learning progress or application process on hold until school personnel have access to the records and can share them with the student. The use of MyData-compatible information would allow that data to be more portable; all that's required is for the student or the student's family to make it available to the receiving party.

Status: Students and families are already beginning to pilot the use of MyData as data systems implement a MyData download option. A number of Department of Defense (DoD) schools for military families are acting as pilots for MyData. The students in those families have to transfer frequently, and the MyData project would eliminate delays in transferring student records by making student data more portable. Currently, as part of the pilot, the data is maintained on government information systems, and parents request access to it through the DoD.

As of 2012, any of the 78 million people who have, or have ever had, a federal student loan or grant can download their historical balance and payment history via the MyData download button on the National Student Loan Data System website.

As of April 21, 2013, anyone filling out a Free Application for Federal Student Aid (FAFSA) form electronically through the U.S. Department of Education can download their completed form in a machine-readable MyData download file. Existing personal data storage vault providers, such as Personal.com and Microsoft's HealthVault, are able to recognize and import these data files, which students can then choose to use to auto-fill additional college, scholarship, and grant application forms. For students with parents who do not speak English or who are absent, this has significant implications for their college selection and affordability. If the student can receive help from a guidance counselor or trusted adult in filling out the FAFSA form one time, the MyData file empowers that same student to navigate and complete many additional forms on his own.

Future Plans: The Department of Defense pilot will continue through the 2013-2014 school year. Eventually, as the MyData button function appears on school sites and within applications, families will be able to access more varied types of data through the MyData project as well.

Usage Examples: MyData will provide families with access to their children's data, including:

- Contact names and phone numbers
- Daily attendance
- Grades
- Unofficial transcripts
- Student performance data
- Schedules
- Subscription details for school or district notifications

MyData Button Empowers Students Budgeting for College

In September 2012, the U.S. Department of Education Federal Student Aid agency added a MyData button, allowing students and their families to download their loan, grant, enrollment, and overpayment information from the National Student Loan Data System (NSLDS) into a machine-readable, plain text file. As the NSLDS said at the time, “A primary goal of the initiative is to empower students with their own data and assist them in making informed decisions about higher education—where to enroll, how to pay for it, and how to manage their debt if they borrow.” (63)

Open Badges Infrastructure

Website: openbadges.org

Lead Organization: Mozilla Foundation

Funding: Mozilla Foundation, MacArthur Foundation.

Purpose: Digital badges are gaining acceptance as an online representation of something learned or achieved. Open Badges is an initiative promoted by non-profit Mozilla for use by organizations to issue digital badges that represent learning and achievement, and by users to earn and display them for job qualifications or school credit. Open Badges includes the open standard for badges, which defines the information required with every badge and ensures each badge can be understood and valued. Thus, these badges have “metadata baked in” about when the badge was issued and the criteria used for issuing it. (64)

For example, an after-school program to teach digital literacy might issue a badge to those who complete a set of requirements; that badge would be kept in a repository or “badge backpack” by the learner and pulled out for display on the learner’s website, Facebook page, job site, or some other online medium. Another organization, such as the school, could recognize the validity of that badge to grant the student extra privileges, or issue credit.

The Mozilla Open Badges Infrastructure (OBI) includes several components:

- An open metadata specification for badges that makes all badges interoperable
- A framework for badge repositories, which also allows the user to control access by others
- The Mozilla Backpack, which serves as a reference implementation of a backpack
- A set of APIs to enable portability and verification of badges

The OBI is designed to be an open framework that allows badge systems to work together to benefit learners. Mozilla has built this infrastructure including the core repositories and management interfaces, as well as specifications required to send badges in and share them out. (65)

Potential Impact on Teaching and Learning: Learning today happens everywhere, not just in the classroom. But it’s often difficult to get recognition for skills and achievements that happen outside of school. Mozilla’s Open Badges project addresses that problem by making it simpler for anyone to issue, earn, and display badges across the web—through a shared infrastructure that’s free and open to all. The result: helping people of all ages learn and display 21st century skills, unlock career and educational opportunities, and find new life pathways.

Status: Currently, over 800 organizations are already issuing digital badges, including the New York City Department of Education and the Dallas Museum of Art. There are many more who are also designing open badges for use by others to issue, including NASA, the Carnegie Mellon Robotics Academy, and BuzzMath.

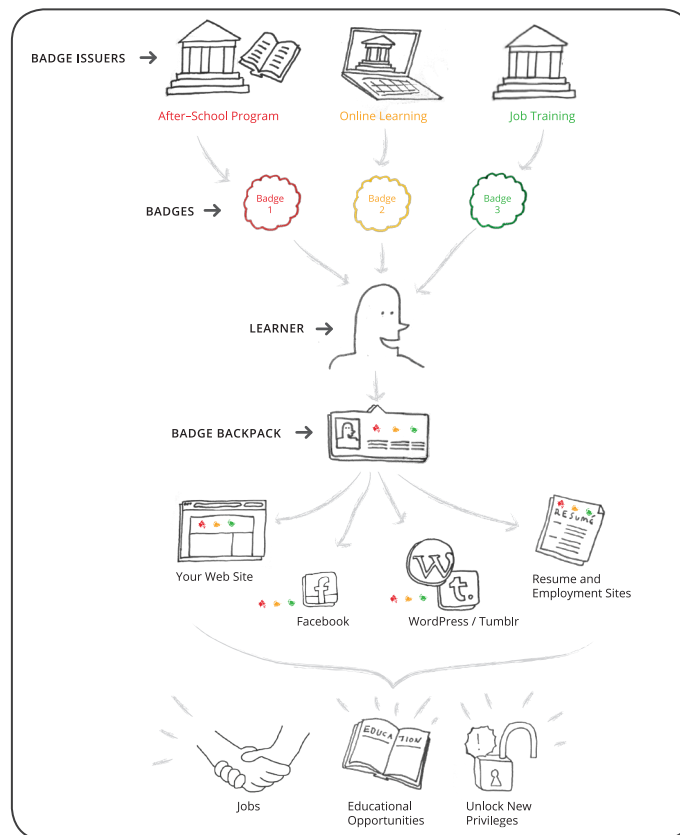
Future Plans: In 2013 Mozilla released 1.0 of Open Badges. Future releases will introduce more integrated display options, discovery of additional learning through available badges, and endorsement, which allows third parties to “endorse” badges and create “trust chains.” Mozilla plans to release Open Badges version 1.0, which is a set of tools and libraries to support organizations in building and issuing badge systems. Mozilla also will work with its community members to build out its Open Badges knowledge base and provide large-scale proofs of concept. (66)

Promising Practice

Rhode Island District Trading Badges for School Credit

The Providence After School Alliance is working with the Mozilla Foundation to set up a program that provides academic credit for out-of-school activities. This project will allow high school students to earn digital badges for participating in “expanded learning opportunities” such as Android app development, English language programming, open source web development, environmental science, debate, and other activities. Each activity aligns with the CCSS and has been approved by the school district. (67)

How open badges work.



Source: Mozilla Open Badges (68)

Search, Alignment, Discovery of Education Resources

Granular Identifiers and Metadata for the Core State Standards (GIM-CCSS)

Website: assess4ed.net/group/gim-ccss-public-updates

Lead Organizations: State Educational Technology Directors Association (SETDA), Partnership for the Assessment of Readiness for College and Careers (PARCC), the Smarter Balanced Assessment Consortium (Smarter Balanced) working in partnership with the Council of Chief State School Officers (CCSSO)

Funding: Initially provided by Bill & Melinda Gates Foundation, the Carnegie Corporation of New York, and the William & Flora Hewlett Foundation.

Purpose: State academic content standards are the touchstone for state education reform and school improvement efforts, undergirding state assessment systems, instructional materials adoption, and professional development activities. Indeed, a major driver of many of the data standards and interoperability initiatives underway today is the transition many core education activities and functions are undergoing from “print to digital.” There remains a need to ensure the sharing of standards-alignment information across systems. To that end, GIM-CCSS seeks to facilitate the alignment and sharing of assessment resources across states that have adopted the Common Core, with a focus on ensuring that assessment resources being created by PARCC and the Smarter Balanced Assessment consortia faithfully represent the full breadth and depth of the standards. The project is tackling “last-mile” work to create precise digital identifiers that can be used to associate education resources with the Common Core and therefore facilitate search, discovery, and filtering. It is also directly addressing the need for open, interoperability standards across the two assessment consortia, which is a requirement of the funding they received under the Race to the Top Assessment program.

Two years after the academic content standards were released by the National Governors Association Center for Best Practices and the CCSSO, the two organizations released an initial digital representation of the standards, including basic machine-readable identifiers and XML for referring to individual Common Core standards. (69) In 2012, GIM-CCSS was launched to enhance that earlier work and meet the more demanding needs of states for more precise standards alignment tools, particularly those working in partnership to develop CCSS assessments via PARCC and Smarter Balanced.

For example, a grade 3 math standard (CCSS.Math.Content.3.OA.A.3) states:

Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.

While there may be appropriate instances to align assessment resources to the standards statement as written, it is more likely that an assessment item would only align to one part of the statement. As such, in order to assure that assessments cover the full breadth and depth of skills and knowledge intended by the standards, GIM-CCSS is assigning digital identifiers to component parts of standards statements. It is envisioned that assessment developers would use the GIM-CCSS scheme to align assessment items to the Common Core in a one-to-one or one-to-many relationship; and GIM-CCSS also supports alignment at higher levels of the standards hierarchy.

Potential Impact on Teaching and Learning: By creating a mechanism to assess standards coverage, GIM-CCSS will help ensure that assessments being developed for the Common Core cover the full breadth and depth of the standards. As a result, both PARCC and Smarter Balanced assessments should better reflect the rich teaching and learning shifts and challenging academic content expectations contained within the Common Core standards.

Status: SETDA recently released “Scope, Technical Requirements, Approaches, and Recommendations,” a document for the GIM CCSS project. (70) It expected to publish a final version of the new identifiers and metadata in 2013. (71)

Correlation Services

Organizations that provide correlation services align or map education content to national and state academic content standards. This process involves associating a given resource to a standard the student is expected to learn via a consistent system of identification.

While not an exhaustive list, curriculum standards correlation services are offered by numerous organizations, including:

Academics Benchmarks

<http://academicbenchmarks.com>

Achievement Standards Network

<http://asn.jesandco.org/>

Agency for Instructional Technology (AIT)

<http://ait.net>

American Institutes for Research/Learning Point Associates

<http://learningpt.org>

Discovery Education

<http://www.discoveryeducation.com/administrators/instructional-services/curriculum-alignment/>

EdGate Correlation Services

<http://correlation.edgate.com/>

McHugh & Associates

<http://mchughinc.com/>

Publishers Resource Group

<http://www.prgaustin.com/>

The Learning Registry

Website: learningregistry.org

Lead Organizations: U.S. Department of Education's Office of Educational Technology, Department of Defense Advanced Distributed Learning initiative.

Funding: U.S. Department of Education's Office of Educational Technology, Department of Defense Advanced Distributed Learning initiative

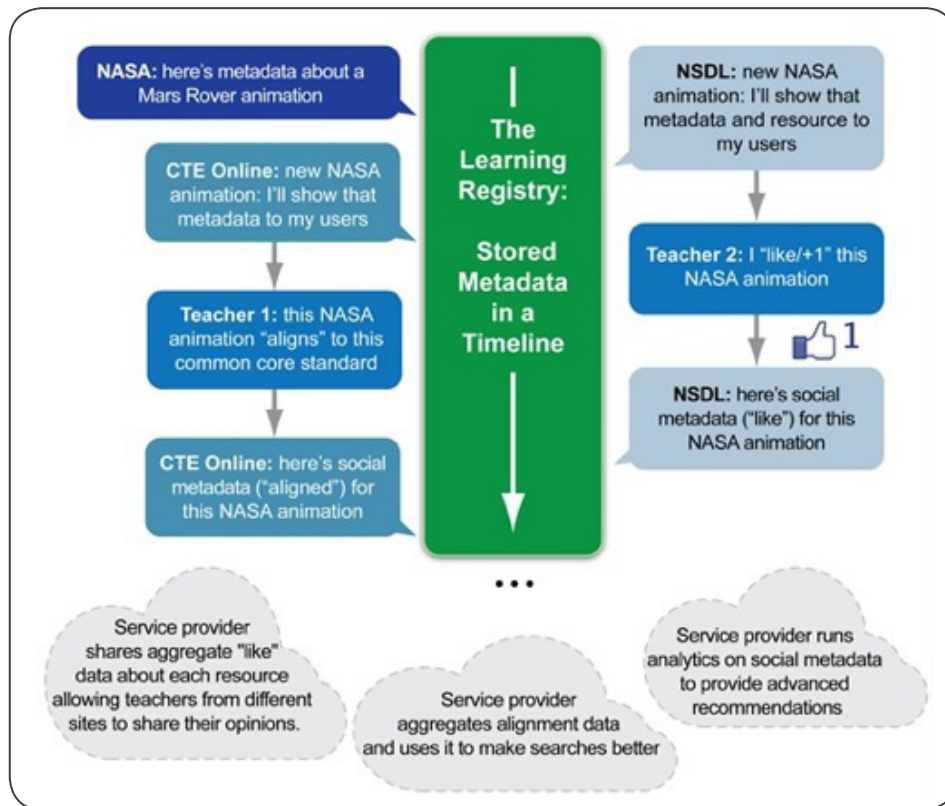
Purpose: The Learning Registry provides a platform with which any person or application can “surface” or uncover the best possible learning resources for any given topic, experience, and audience. The system facilitates the sharing of metadata and paradata about content in order to simplify the process of helping users find distributed digital learning content online. It works “behind the scenes,” by providing a logistical network (an “interstate system” for learning resources) that allows data about learning resources to travel among a federated set of nodes.

The Learning Registry's logistical network simplifies the process by which developers can create interfaces for search and discovery and rating of resources. This network enables educators to post, annotate, and review resources for broad pickup by other educators. It facilitates the exchange of ratings and opinions about the usefulness of those resources as well as their alignment with the Common Core and other state academic content standards. The idea is that teachers will continue using the same applications and websites they currently rely on; they'll just have broader reach because those applications and websites can leverage the data through the Learning Registry.

One example of a tool created to take advantage of the Learning Registry is a plug-in for the Google Chrome browser. This plug-in acts as a “collector” to permit anyone to open up their data via the Learning Registry. The collector organizes the workflow for the user to rate online learning resources from web pages through menus that use rubrics developed by Achieve (achieve.org), a non-partisan education reform organization. The user can also delineate how resources are aligned to Common Core and state academic content standards. To access the resources via the plug-in, the user: 1) installs the plug-in to the Chrome browser; 2) sets up a registry “identity” with occupation, grade level, and areas of interest; 3) navigates to a web page containing access to a learning resource; and 4) aligns the resource, rates it, and publishes that data to the Registry.(72)

The Learning Registry encourages creation of applications to help communities of educators at the local, state, regional, and national level share what they think about digital resources. A hard part of that information sharing—the exchange of those ratings among a multitude of sources—can be handled by the Learning Registry. The Learning Registry collects and shares “assertions” (such as ratings, comments, and usage data) about learning resources through the federated metadata/paradata exchange within its logistical network.

Usage of the Learning Registry to “expose” metadata about resources to those who can use it.



Source: Learning Registry (73)

In addition, the Learning Registry has been collaborating with inBloom, incorporating Learning Registry architecture into its content strategy for over a year. More recently inBloom has funded the development of open source technologies that leverage Learning Registry as a metadata distribution network. The collection of technologies are collectively referred to as “the inBloom Index” or sometimes “the Learning Registry Index.” The tools are designed to make it much simpler and faster for application developers to discover content resources within the Learning Registry that match criteria of interest to them, as well as help filter content against criteria such as Common Core alignment, subject area, and grade level. In the early stages of development, the inBloom index will be most effective against content that has been submitted to the Learning Registry coded with schema.org or Learning Resource Metadata Initiative (LRMI) tags.

Potential impact on teaching and learning: The greater the participation in the Learning Registry, the larger the likelihood a teacher will be able to find just the right learning resource he or she needs to help a specific student.

Status: A beta version of the Learning Registry was launched in November 2011; development was completed in March 2013. A basic Learning Registry browser is available at free.ed.gov/.

Future Plans: Easy-to-use search and discovery applications will need to be built to effectively digest and present the various metadata and paradata stored in the Learning Registry.

With time, the Learning Registry will “grow in sophistication and scope.” For example, as the national science standards or new state standards are developed, resources aligning with those will be encompassed. Also, as the data systems that work with the Learning Registry mature, they could begin maintaining usage data and collaborative filtering techniques. (74)

Usage Examples:

- Alignment of digital resources to state academic content standards
- Connection of instructional improvement systems to content indexed by the Learning Registry
- Trusted peer ratings on usability and student engagement
- Sharing of learning resources among education portals and repositories
- Trends reporting on resource usage
- Amplification of availability of resources developed by government agencies (75)

Promising Practice

California Brokers of Expertise Website and the Learning Registry

Resources from the Learning Registry, including those from the National Science Digital Library (NSDL), PhET (phet.colorado.edu) and European SchoolNet, are being displayed to teachers through California’s Brokers of Expertise website, myboe.org, which is an online community for teachers across California. Brokers has also experimented with sharing teacher activity data (aka paradata) in a “stream” to other teachers over the Learning Registry, which shows teachers when others bookmark, like, or rate resources that might be of interest to them. When available, Brokers of Expertise displays paradata from other websites next to the main resource view.

An example of a resource made available through Brokers of Expertise.

The screenshot shows the Brokers of Expertise website interface. At the top is a navigation menu with links for Home, Resources, Professional Development Content, Calendar, Community Groups, Standards, and Contact. Below the menu, the page displays 'All Resources' and a featured resource titled 'Anatomy of a Rover' with a view count of 374, full accesses of 51, and zero favorites or bookmarks. The resource is attributed to the National Science Digital Library (NSDL). The main content area shows a preview of the 'Anatomy of a Rover' resource, including a search bar, a sign-in section, and a description of the interactive activity. The description states that unmanned space missions can explore the solar system in ways manned missions cannot, and that robotic spacecraft are able to safely travel into space and radio back scientific data to researchers on Earth. The resource is available in HTML (interactive) format.

Source: State of California Department of Education (76)

Learning Resource Metadata Initiative (LRMI)

Website: lrmi.net

Lead Organizations: Association of Educational Publishers, Creative Commons

Funding: Bill & Melinda Gates Foundation, the William and Flora Hewlett Foundation.

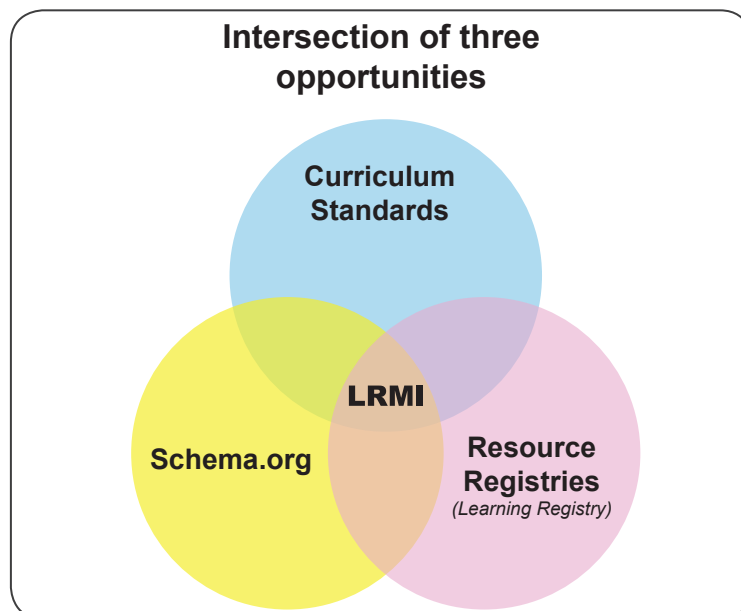
Purpose: The goal of the Learning Resource Metadata Initiative (LRMI) is to create a uniform metadata schema for the tagging of educational content on the internet. LRMI metadata could eventually enable familiar search engines to offer users education-specific filters such as educational standards, the type of educational use, the predominant mode of learning supported by the resource, type of resource, time requirements and the appropriate age. Publishers and other content creators will tag their content appropriately to provide easier access to relevant content for educators and students.

This project builds on the metadata vocabulary that major search providers have jointly developed through Schema.org. Currently, webmasters use tags in creating web pages for specific topics, providing a structure for the information on the page that helps the search engine make more sense of its content, which in turn helps the users find the most relevant content. The major search engines are using filters developed for numerous categories: books, medical terms, events, and many others. (77)

LRMI can employ GIM-CCSS or other state content standards identifiers to associate education content with those standards, which can then be exchanged via LRMI alignment metadata using the Learning Registry protocol.

LRMI is extending the work started by Schema.org specifically for educational materials. The groups of tags that make up this schema were developed by a working group of commercial publishers, open educational resources (OER) providers, and educational specialists with the goal of making it easier for teachers and learners to find the right educational material at the right time.

The LRMI Focus



Source: LRMI Education Metadata (78)

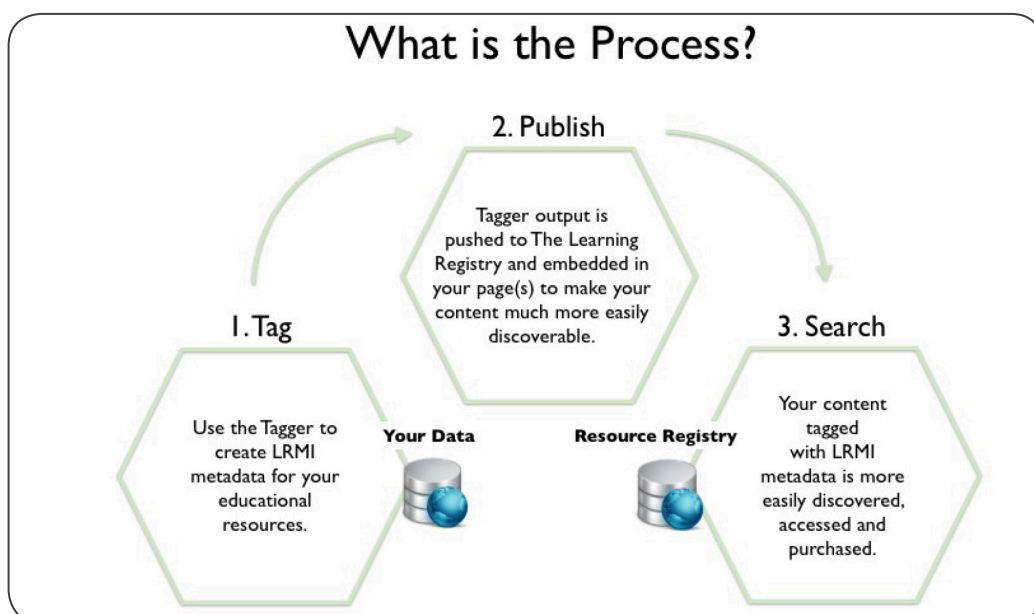
What is Schema.org?

The major search providers, Bing, Google, Yahoo, and others, are working together to create a vocabulary that allows webmasters to mark up their pages in ways that will make search results more relevant for end users. Schema.org (schema.org) is the site that contains the collection of schemas or HTML tags developed by those cooperative efforts.

Potential Impact on Teaching and Learning: Data from surveys conducted by the LRMI indicate that teachers and students are frustrated and overwhelmed when trying to find learning resources online. Search engines tend to deliver from thousands to millions of results that may only be peripherally related to the topic at hand. Presuming the search engines adopt the LRMI schema, learning material providers that use the LRMI tags to describe their content will make the job of locating just the right content much faster, more efficient, and more effective. For example, a student seeking help about adding fractions will be able to specify what age he or she is and what media is preferred. A teacher who wants a presentation 30 minutes long to help students through a specific Common Core or other standard will be able to specify that in the search. In either case, the only results displayed will be those that fit the criteria designated by the user—not the millions that currently show up, but the dozens that fit the specific need at the moment.

Status: Launched in June 2011, the first phase of work was to create a specification that would eventually be submitted to Schema.org for approval and then shared with the search engines and eventually the web developers. (79) Currently, the LRMI specification is ready for inclusion in Schema.org when Schema.org next updates its vocabulary. The major search engine providers will independently decide when to offer search tools that are informed by LRMI. In the meantime, LRMI-encoded metadata will also be shared using the Learning Registry and searched by the inBloom index.

How LRMI Works



Source: LRMI Education Metadata (80)

Future Plans: As the specification works through the approval process with the World Wide Web Consortium and Schema.org, the LRMI is educating web developers, webmasters, and the content provider community about the tags it has developed so that they're prepared to integrate the new schema into their content work.

As part of generating a sustainable LRMI ecosystem in 2013-14, AEP is creating an environment to encourage the development of tools and services that help content creators tag their resources with LRMI metadata. An early example of such a tool, developed with funding support from the Bill & Melinda Gates Foundation, is the inBloom tagger application, found at tagger.inbloom.org.

LRMI also has the potential to spark the development of a host of new delivery platforms, portals, repositories, recommendation engines, and responsive learner-driven environments. The inBloom Search application utilizes LRMI metadata to provide educators with filters such as *Intended End User Role*, *Typical Age Range*, and *Learning Resource Type*. This is an early example of what is possible within environments that take advantage of the LRMI.

Finally, the Bill & Melinda Gates Foundation has also commissioned Benetech (benetech.org/) to develop an extension to LRMI that will enable description of the accessibility of educational content. This enhancement will facilitate the discovery of learning activities best suited to students with disabilities. As with the current LRMI specification, the accessibility extensions will be submitted to Schema.org for inclusion in the general metadata schema.

Teachers Report: We Spend Too Much Time Sifting Through “Junk”

In 2012 the Association of Educational Publishers (aepweb.org) surveyed educators on their internet search practices. Seven in ten said they search for instructional resources online at least “several times a week.” A quarter of users search for resources daily. Two thirds of respondents said they get many “irrelevant results”; nine in ten said they would be more satisfied if they could filter results through their search engines by standard instructional criteria such as grade level, subject area, and media type. (81)

Among the many noteworthy educator comments:

Colleen W., a high school math teacher reported, “I spend many hours looking for engaging lesson- and standards-based assessment items. I would love to be able to search for these by standard instead of keyword so that the results are more relevant.”

Pamela R., a first-grade teacher, stated: “I would prefer when I type in a subject or question that only truly relevant answers came up. I spend way too much time trying to sift through junk that is not helpful.” (82)

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Appendix B: Alphabetical List of Select Initiatives

Name of Initiative	Description
Assessment Interoperability Framework (AIF)	AIF provides a common structure to allow for the transfer of any data associated with assessment systems; including student and teacher information, learning standards, assessment items, results, and related data across systems.
Common Education Data Standards (CEDS)	CEDS provides a common vocabulary and reference structure through a data dictionary and logical data model for information that needs to be shared across education organizations.
Digital Passport	Digital Passport is a tool that brokers the exchange of student data between states or districts to enable electronic record transfer as students move from one school to another.
Ed-Fi Solution	Ed-Fi Solution is a data model combined with a tool suite that streamlines the sharing of student data and also provides the elements of dashboards for use by educators to improve the academic outcomes of students.
Experience API (xAPI)	xAPI is a protocol and simple data format for sharing learning activity streams among systems to track student activities and securely expose data to other learning systems.
Granular Identifiers and Metadata for the Common Core State Standards (GIM-CCSS)	GIM-CCSS is creating a digital representation of the CCSS to meet the need of assessment for standards alignment to ascertain the breadth and depth of standards coverage for testing purposes.
IMS Global Learning Consortium Specifications	IMS content, application, and data standards enable teachers to mix and match educational content and software from different sources into the same learning platforms.
inBloom (formerly, Shared Learning Collaborative)	inBloom is currently working with districts to bring together secure student data, services and educational applications into a unified solution to help teachers more easily track student progress, pinpoint areas of concern, and identify the best learning resources to help students learn.
Learning Registry	The Learning Registry is an open repository of metadata and paradata about digital learning resources across the internet, including location and information about alignment to learning standards.
Learning Resource Metadata Initiative (LRMI)	LRMI provides a common structure for tagging of learning resources that can be used by online search engines and content delivery platforms to deliver more precise results and richer filtering capabilities.
MyData	MyData is the functionality within any system containing student data that allows students and their families to export their data in an open format to maintain a copy of their own education records.
Open Badges Infrastructure (OBI)	The Open Badges Infrastructure is a standard and platform for issuing, storing, and sharing “micro-credentials,” recognition for skills and achievements that learners have completed.
P20W Education Standards Council (PESC)	PESC consists of numerous standards for sharing specific types of education data, such as financial aid, transcript, and admissions information.
SIF Implementation Specification	The SIF Implementation Specification is a technical standard that is used by developers of education software to ease the transfer of data among applications in use by schools, districts and state education agencies.