

The Integration of Data Across Institutional Platforms to Create Comprehensive Learner Records: Challenges and Solutions

During the first phase of the Comprehensive Learner Record (CLR) project, one of the most significant barriers to the development and implementation of the student record was the integration of data to populate the record with data and evidence of learning. These data, learning artifacts, assessment rubrics, catalog information and other potential material that could be included in a CLR reside in many information systems across an institution.

In the past, the sole official record of enrollment was the academic transcript. All transactions needed to create this record were collected and stored in the student information system (SIS). As institutions desire to expand the evidence of learning beyond only academic course transactions, they face challenges in collecting and joining these student data accurately and securely.

In the second phase of work, a Data Integration Workgroup was assembled to identify the barriers to data integration that exist today at most institutions. While some colleges and universities will be able to address these challenges through internal resources and expertise, most lack the infrastructure to address the barriers they may face.

The AACRAO Comprehensive Learner Record (CLR) Data Integrations Workgroup is working with colleagues to provide universities with information on moving forward, creating some potential guidelines and working to promote standards that not only will benefit students but also employers and other admitting institutions. The work of this group is to get others thinking

broader and look to provide consistency. Part of that work will be gathering critical input from colleagues that will enrich the ideas and information available to all.

The AACRAO Comprehensive Learner Record (CLR) Data Integrations Workgroup has identified the following information as components that could comprise a CLR:

- ⇒ Student academic record
- ⇒ Learning outcomes (also called skills, competencies, etc.)
- ⇒ Learner artifacts (dissertations, thesis, certificates, work product, etc.)
- ⇒ Academic program requirements, outcomes, faculty vitas
- ⇒ Student employment history (and associated evidence of work performance)
- ⇒ Student activities (role, responsibility, accomplishments, etc.)
- ⇒ Internships
- ⇒ Research activities
- ⇒ Service learning projects, civic engagements, honors activities
- ⇒ Licensures and certifications
- ⇒ Volunteer activities (role, responsibility, contributions)
- ⇒ Portfolios
- ⇒ Study abroad experiences and evidence of cultural competency

The manner, information systems, process, procedures, and principles by which we administer this information varies greatly between institutions; some more complete and comprehensive than others. Being at the nascent state of institutional support of the CLR, some institutions focus on some of these areas more than others. For those institutions who are involved (to some extent) in the CLR space, various platforms and information systems are used to collect and record multiple facets of this list, examples of which include, but are not limited to:

- ⇒ Vended Student Information System (SIS) platforms (e.g., Oracle/Peoplesoft, Ellucian Banner, Workday, Jenzabar, etc.)
- ⇒ Learning Management Systems (e.g., Canvas, Blackboard, Unizen, Desire 2 Learn, etc.)
- ⇒ Repositories for electronic dissertations, thesis, research (e.g., Scholarworks, DSpace, Fedora, Vivo, etc.)
- ⇒ Repositories for earned credentials (e.g., Badgr, Credley, NSC, Paradigm, Parchment, Credential Solutions, Digitary, etc.)
- ⇒ Curriculum Management Systems (e.g., Courseleaf, DIGARC, SmartCatalog, etc.)
- ⇒ Constituent Relationship Management Systems (CRM) (e.g., Hobsons, Salesforce, Slate, DestinyOne, Odoo, etc.)
- ⇒ Career Services (e.g., Handshake, Suitable, Simplicity, People Grove, etc.)
- ⇒ Imaging Systems (e.g., OnBase, BIS, Perceptive Software, etc.)
- ⇒ Student Organizations and Activity (e.g., AccuCampus, CampusLabs, etc.)
- ⇒ Identity Management System(s)
- ⇒ Standards Bodies (e.g., LEAP, PESC, ANSI, IMS Global, etc.)
- ⇒ Data Warehouses
- ⇒ E-Portfolios (e.g., Digication, Watermark, PebblePad, Portfolium, etc.)

Potential Contributions from Student Employment and the Challenges of HR Systems

Another area warranting additional exploration is in the area of Human Resource (HR) systems for those institutions viewing campus student employment as a component of the CLR. These institutions seek to identify and measure student learning outcomes resulting from their employment experiences. These learning outcomes potentially relate to the domains of intellectual growth, social responsibility, leadership development, appreciating diversity, effective communication, etc.

Through university employment, students are provided an opportunity to be exposed to and strengthen workplace learning outcomes. Such workplace outcomes may include:

- ⇒ demonstrating effective stakeholder and customer-focused communication;
- ⇒ assessing and contributing to customer satisfaction; corresponding through oral and written word;
- ⇒ appreciating diversity through valuing differences from their own -- working effectively with individuals who may be different from themselves;
- ⇒ respecting the values and beliefs of others by seeking out others to enhance their knowledge on diversity issues;
- ⇒ understanding and abiding by the office's policies and procedures by being accountable for their work and maintaining a high level of accuracy and integrity with their work product;
- ⇒ enhancing their intellectual growth by identifying what their job entails, using critical thinking skills in problem-solving, understanding how office processes are connected with one another, and,
- ⇒ applying prior information to a new situation or setting; and demonstrate leadership skills by setting goals, thinking creatively to improve the quality of our services, collaborating with coworkers, and projecting a positive image of themselves and the office.

Our quick assessment is that commonly used HR systems are not as open as needed to integrate the available HR information with the other platforms comprising data included as part of the CLR.

Additional Challenges and Potential Solutions

Challenges to building the CLR fall into three main areas, two of which will be addressed in this paper. The first is developing the technology to interoperate or build the infrastructure to integrate data from these various platforms. The second main challenge is related to institutional culture and buy-in to support, prioritize, and resource the creation of the CLR. A third, learning frameworks, their governance and learning outcomes/competencies, is not addressed in this document. However, the [first phase final report](#) contains a good deal of information on this topic.

When institutions deploy new services, administrators must sort out the details. In the Information Age, these details are often a tangle of system specifications and interoperability requirements. Resident experts, when available, or outside assistants, when needed, must determine how to integrate a solution without upsetting the precarious balance of the organization's existing data ecosystem. Without proper support, this process is often characterized as frustrating, resource-intensive, and time-consuming. It is essential to keep in mind when implementing that technology is continuously changing. Institutions must ensure

that there are scalable and sustainable solutions to meet ever-growing demands. Further, they must determine if a data retention plan is necessary or if archiving will be required. Also, institutions must think about whether the data is compatible or convertible as technologies emerge.

Managing competing demands and projects with limited resources is often a barrier to creating innovation at a college or university. When new projects are placed into the queue of technology projects, the demands on employee time and expertise are typically justified by campus-wide investment or an institutional or governmental mandate, and even then, it can be a mighty task to override resistance from employees who are asked to support existing systems while entertaining additional technology solutions. A collaborative mindset and an openness to ideation are critical elements for building a productive, successful project. A focus on the benefits to students should be maintained, especially when gaining buy-in from essential campus partners.

Information Systems Architecture, Configuration, and Design

As evident by the lists of data and respective data sources found earlier in this paper, integrating the information system data repositories that may house CLR data is critical to achieving the objectives outlined in this paper. In the early initiatives, it became apparent that

there were ample data in various places within our institutions, but much of it was not in the form that could easily be aggregated, formatted and routinely delivered without a lot of manual curation.

There are a number of approaches to architecting a CLR environment. The current prevailing design of a CLR environment makes use of an Institutional Data Store (IDS) or Electronic Data Warehouse (EDW) for which “copies” of desired data are feed from the source systems. For example, there are at least three approaches that may be considered outlined as follows;

1. Data propagated to the IDS/EDW in real-time upon updates to the source system,
2. Routine extracts from the source systems for which data are copied into the IDS/EDW based on regularly defined intervals, and
3. Data comprising the CLR are retrieved from the source systems in real-time upon access to the IDS/EDW

The manner and design of such an IDS or EDW environment is highly dependent on the interoperability and integration capabilities of the information system platforms that house the source data. For the first option, a key characteristic of the source system is being able to perform a remote procedure call (RPC) as an exit upon adding a new or updating a record to the source repository. In this case, the IDS/EDW environment will need to be “listening” for the RPC from the source system to record the new or updated record in the IDS/EDW.

The second approach typically involves the use of Extract, Transformation, and Load (ETL) routines that run at established intervals, extract the data from the respective source system, perform any data transformation that may be required, and send those data (via secure FTP or other method) to the IDS/EDW for loading into the CLR repository. The timing of these extracts, commonly referred to as “refresh rate”, is dependent on how dynamic or frequently the source data are updated and the how critical it is for the CLR to have the most current data. The criticality of how current the information is may vary by use of the CLR and the respective authoritative data source. For example, the refresh rate from the primary Student Information System may need to be more frequent than from the HR/HCM system for student employee data.

The third approach noted above is highly dependent on the interoperability characteristics of both the CLR environment, as well as the source systems, and is possibly the most technically sophisticated of the three approaches. This third approach requires polling scripts to be “listening” for requests first to the CLR, then “calls” from the CLR to tasks “listening” on the source system platforms that results in the data being accessed, retrieved, and sent from the source repository back to the CLR platform for storing in the appropriate IDS/EDW table.

The underlying technologies available to perform these integrations vary by source system and their respective capabilities for sharing data. One of the most straightforward ways to load the CLR is via nightly batch extracts of data from source systems. In this typical approach, scripts run against the source systems, create a data file, then send the file to the designated target via secure FTP. All common software platforms are capable of performing these simple data extracts and ftps.

Other means to integrate disparate platforms include web services, https calls, via specific application programming interfaces (APIs) made available by the respective system software provider, and in recent years communication software systems referred to as an enterprise service bus (ESB) have surfaced as middleware solutions to manage interactions within a distributed computing architecture. In many cases these methods of integration are available via use of open source software using established internet transport protocols and can be made available from 3rd party software integrators.

External Partner Solutions

There are a number of organizations and consortia working in the areas of data exchange and system interoperability standards, and well as developing and making available middleware to integrate disparate platforms. Two organizations, among many, actively developing these solutions are IMS Global and DXtera.

[IMS Global](#) has a number of initiatives centered around the creation and use of standards for integrating and sharing education related data. Of particular interest is IMS Global's work developing standards referred to as [Learning Tools Interoperability](#) (LTI).

Most current generation Learning Management Systems that utilize LTI can integrate their platform into most related products. That said, LTI may be limited in the amount of data that can be shared, so an institution may need to assess the solution of using a combination of LTI extensions along with Application Programming Interfaces (APIs) supported by the LMS. In the case of Canvas, there are APIs for most functions with available documentation (<https://canvas.instructure.com/doc/api/>). Such capabilities and limitations may warrant further review as CLR initiatives grow.

[DXtera](#) is a member-based consortium that focuses on data integration challenges and concerns. Via their membership, a key focus of DXtera is assessing and creating "connectors" that connect legacy information systems to student applications. This approach aims to allow for providers to connect with their consumers through a series of data integration approaches. The DXtera consortium develops and shares technical assistance, education and training, and technology developments among its members.

Two organizations, [Paradigm](#) and [Leepfrog](#), have worked together to create data integration between their platforms. This collaborative approach between companies allows the work completed in academic course management, including learning outcomes listed in Leepfrog's [Courseleaf](#) curriculum management system, to be moved into a CLR format developed by Paradigm, the [Certified Electronic Diploma](#).

Most institutions do not have the resources to provide the technologies students or other entities desire to “encompass” a student’s academic history. As many institutions continue to have budget cuts and focus on other important initiatives, the area of academic records is left behind. Students, national organizations and/or employers may need to come together with regulations/demands or requirements to push for solution development and its critical support funding. It may be possible at this level to create an enhanced repository or repositories for student record information. This is where institutions would need to agree on some guidelines or standards. Even in these early phases of experimentation and development, it is important to consider how these data and records may be exchanged and common data elements that can be used flexibly in a future that has yet to be written.

[Institutional Interest in CLRs: A Significant Integration Challenge](#)

While early innovators participating in the first-round projects were successful in producing prototypes or early production models, it was clear that institutional commitment was a key

ingredient. Participants had to be accepting, broad-based, and willing to make changes, sometimes forcing radical adjustments to organizational structures, data collection processes and procedures, and the roles of selected personnel, which then later determined what technologies were needed to be successful. In these successful projects it was easy to identify at least one enthusiastic, passionate and persistent champion with enough cultural savvy to overcome resistance or to enlist support for what was required to accomplish project goals. What remains to be seen is how widespread the appetite and discipline are to expand participation in CLR.

The second challenge to building the CLR is institutional buy-in for the concept; including establishing framing principles of learning outcomes and what the records would seek to express, and the coordination needed with campus constituents who manage the respective operations and systems. More and more the challenge associated with the prospect of creating and offering alternative learner records is limited or advanced by the culture and the organization of the institution more so than any technological limitations. Cultural limitations include how decisions are made, financial priorities, the degree of buy-in by stakeholders -- including the perceived academic value to expand the learner record beyond course, grade, and credit. Limitations also include the establishment of or interface with existing governance structures, the capacity for addressing and making innovative changes: personnel,

organizational structures and know-how, and ongoing support to socializing changes and sustain momentum.

During the first attempts at creating comprehensive learner records, some of the resources given to the one dozen institutions in that project were applied to acquire or modify needed technologies in order to achieve their goals for their projects. There was clear buy-in by institutional leadership for the project across most institutions in this early phase and the consistency of their leadership and their attention to the project's progress played an important role in the success and speed of the project's completion. In retrospect, this was perhaps symptomatic of early adopters rather than exposing more fundamental hurdles for being successful in creating sustainable alternative learner records.

While the concept for students having access to an electronic Comprehensive Learner Record (CLR) is attractive to many institutions, the task of creating the CLR can be daunting. As with many innovative advances that require campus coordination, shifting culture can trump any limitations in technology as barriers to adoption. As such, what can be done to champion the creation of a CLR on these campuses?

The first step is coalescing a group to envision the consolidation of records. These may include academic history record/transcript, student outcomes and competencies as defined by faculty,

extracurricular activities (i.e. student groups/Greek life), student employment history (i.e. College Work Study and off-campus jobs/internships), and co-curricular activities (i.e. research and overseas study trips). Placing these into a neat and tidy CLR takes imagination and courage. With national standards and guidelines, the CLR could someday migrate to a national cross-institutional repository.

The second step is to address any fears or concerns the group may have related to the creation of the CLR. Common fears are one's campus would never devote fiscal and technical resources to such an effort, the potential elimination of record-keeping staff who maintain this information and that institutional units would never share or allow access to their databases and records needed to create the CLR. With any cultural shift, there is a certain level of stepping out in faith and trust that the benefits of a new technology or innovation outweigh the fears and pains of taking the leap. When one believes the CLR to better enable our students to tell their story, that it will be beneficial for students when seeking employment or admission to graduate school, one is armed with what it takes to impact the cultural and technical shift.

So where and how to begin? Start with an assessment of what records the institution holds and what information comprising the CLR is currently not being collected and stored. Find out how

these records are maintained and create an inventory. Document the elements or records maintained, the kind of storage systems are used, and who has oversight of the records.

Next, convene a task force to explore the benefits of supporting a CLR. Ideas for those who might comprise such a taskforce could include:

- ⇒ The units identified in your inventory of the records to go into a CLR
- ⇒ Information Technology; especially those charged with being creative and innovative and who embrace shiny, new technologies
- ⇒ Student leadership: both undergraduate and graduate
- ⇒ Marketing/Communications to help share message with stakeholders not directly involved with the project
- ⇒ Executive sponsor(s), such as the Provost/Senior Academic Officer or a faculty leader, to kick-off the task force and to champion the CLR as a worthwhile project.

Ask these representatives to join the exploratory task force and begin educating them on the benefits and components of a CLR. Provide them with the information available from AACRAO CLR documents. Take enough time to allow task force members to come up to speed and understand the benefits to the students and to each of them as record keepers for the

institution. Share CLR success stories and examples of projects from Lumina Foundation grant-funded institutions as a way to spark creativity and ideas among your task force members.

Provide an opportunity for task force members to say why this may not be possible at your institution, and then ask the group to imagine the possibilities if money, time, and the trust that this could happen were no object. Recognize that moving to a CLR represents a huge cultural shift away from the current focus on the transcript and diploma as the only student records produced by the institution. By creating an institutionally developed and maintained CLR, students will have the opportunity to tell their story when seeking career and advanced education, validated by the institution in a way that a self-created resume, supplemented by a transcript or diploma simply cannot.

There is plenty of technology available, and much of it is available as a commodity that can be purchased, even on a subscription basis with technical support from the provider. Moreover, there are organizations interested in establishing the standards for formatting and moving data. In fact, there are at least two standards bodies (PESC and IMS Global) within American higher education that are eager to embrace new data standard requests. Finally, there is a growing array of service providers willing to modify their service offerings to accommodate emerging needs.

Over the last ten years, innovative colleges and universities across the nation have deployed extensions to the academic transcript – portfolios, badges, co-curricular transcripts and others – that seek to add context to the academic record. These are rarely among the aforementioned “institutional mandates,” and as such attract little interest from administrators. The traditional transcript has served students and institutions for over a century, so few see a need for adaptation. While there are many cynics who have declared that higher education is insufficient, ineffective or even irrelevant, there are very few who can emphatically and empirically state what and how learning can be successfully, effectively represented. There are divided opinions within our learned academies about what educators are trying to accomplish: are they educating for the workplace or teaching how to learn, or both? This complicates the issue of what we seek to represent in a record. There are many high impact practices, i.e. internships, research, study abroad, non-curricular learning supervised and sponsored by our institutions which are not recorded anywhere, or in any explicit or expressive form that arguably are some of the most valuable learning that takes place.

To represent these learning opportunities adequately will necessarily require cultural change within our institutions. Expanding the academic record is a complex technical undertaking, but the barriers are largely non-technical in nature. Every institution has the ability to increase the utility of its artifacts, and the registrar, through partnership with campus colleagues in

academic and student affairs, has a unique ability to navigate the intricacy of our information architecture.

CLR Guidance in Summary

As one considers the prospect of building the CLR, the following represents the collective wisdom of individuals that either manage academic records or serve, as commercial service providers, those who manage academic records.

1. Acquire a Project Manager

Projects of the scale of CLR involve lots of stakeholders, and it is easy to get overwhelmed in this environment of exploration and uncertainty. Establish a project management approach, establish goals, and determine the criteria for determining success of the project.

2. Prototype Approaches

It isn't always clear how to represent learning that takes place in different settings and contexts. How a learning artifact will be used is an open question for many. Informed decisions are only going to be possible as you try various approaches and receive feedback regarding their value, utility and meaningfulness.

3. Perform Data Mapping Exercises

Where are the data that you wish to represent? How is it managed? What is the frequency of the updates? Are the data easily accessed? Under whose control are the data? In what form is

the data? Standardized, structured, unstructured? Are the data normalized or do they come from multiple data sources?

4. Form a Data Team

Not all data are managed alike. By convening a team of data stewards, you should learn the context of the data: how is it collected and maintained and how is it used. Work with you team in the mapping exercises to ensure that the data consistent, accurate and properly represented.

5. Establish Governance Around the CLR

It is important to establish the authority either providing the programming and/or assessing the learning. That authority must be legitimate and credible, defining what is being learned, clearly stating the rigor of the learning engagement and how it is being assessed. Be clear about what the learner has acquired or mastered as it will be translated as claims about knowledge, skills or abilities.

6. Seek and Adhere to Applicable Data Standards

There are data standards supporting the exchange of data between institutions and organizations; consult possible standards at: PESC.org; MSGlobal.org; and ANSI.org.