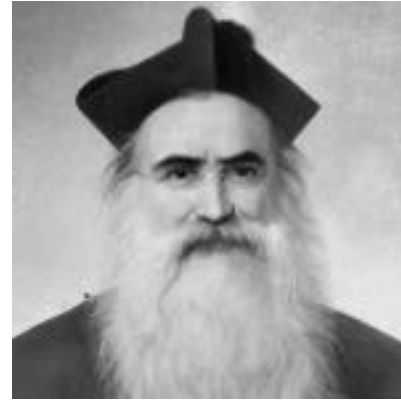


OPEN ANALYTICS AND NGDLE AT NOTRE DAME

Pat Miller, MBA, Team Lead
Learning Management and
Learning Analytics

University of Notre Dame

- Founded in 1842 by Fr. Edward Sorin of the Congregation of the Holy Cross, a French order of priests
 - Holy Cross also founded 4 other US colleges:
 - University of Portland, Oregon
 - King's College, Pennsylvania
 - Stonehill College, Massachusetts
 - St. Edward's University, Texas
- 8500 undergraduates
- 3800 graduate students
- Ranked #18 in latest US News and World Reports rankings of all US universities
- Notre Dame has one of the top 10 endowments of US universities



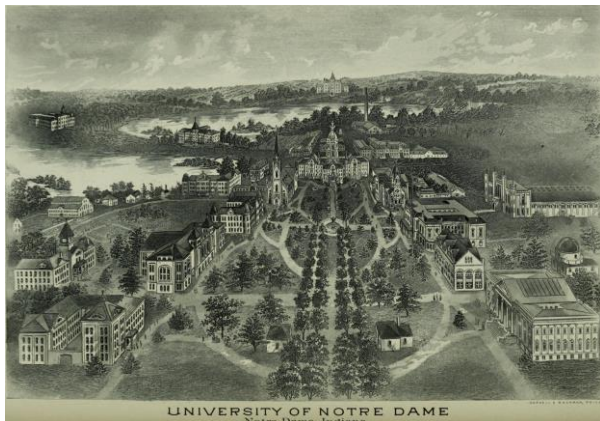
Pictorial History



1843



2015 Central
Campus



1903



2018 Stadium View
of Campus

Notre Dame Study Abroad Programs in Japan

- Nagoya at Nanzan University
- Tokyo at Sophia University
- Tokyo at Keio University -- Mita campus

Notre Dame also hosts business persons from the Central Japan Industries Association during a week long program in the summer sponsored by our Mendoza Executive Education Program



What is Learning Analytics?

- Focus is on behavior of learners (and instructors) in courses and how analysis of that behavioral data can improve courses
- Closest analogy in business analytics is the analysis of clickstream data to enhance effectiveness of an e-commerce or customer website
- Unlike clickstream data, there are actual standards formulated for the capture of learner events
- The analytics can range from simple reports, visualizations to machine learning predictive analytics that are used to improve retention or other identified outcomes

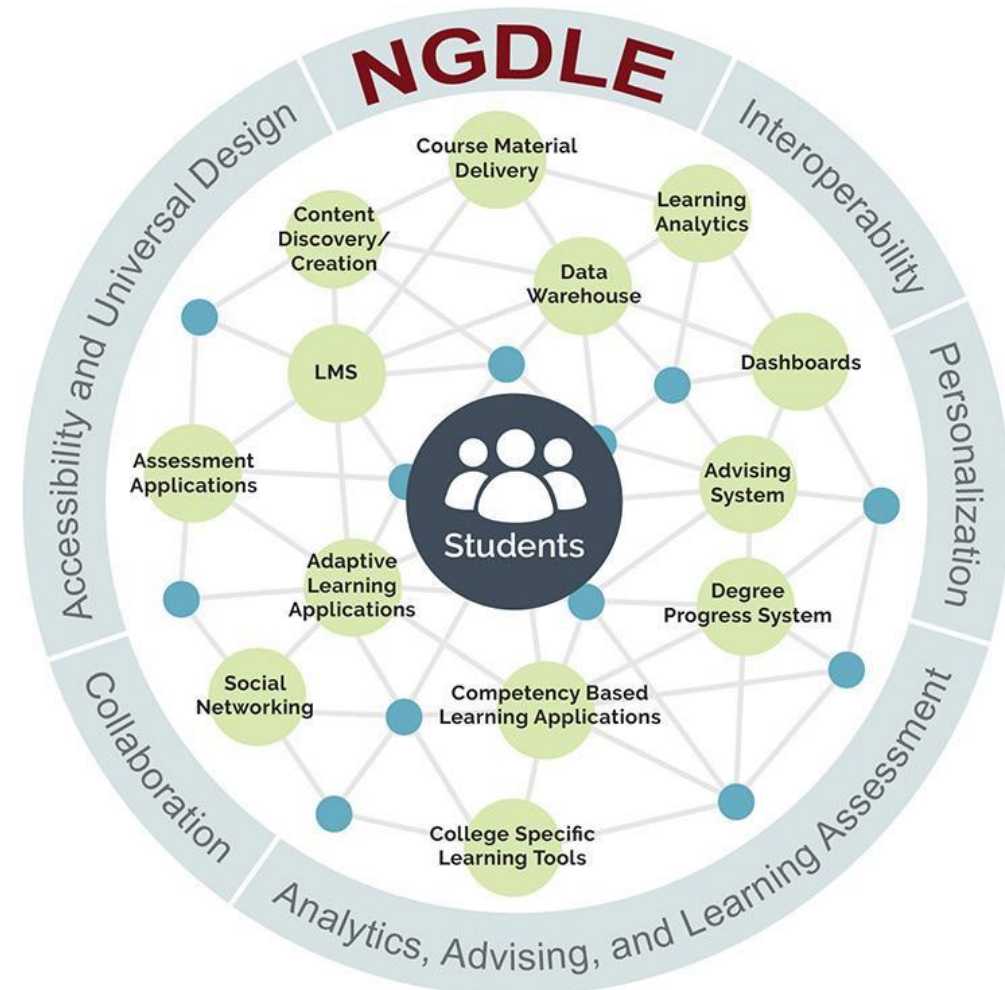
What is NGDLE?

- Next Generation Digital Learning Environment (NGDLE) was proposed in an Educause [research paper](#) in 2015 by Malcolm Brown, Director of Educause Learning Initiatives
- It proposes that the next generation ideal digital learning environment should be an integrated system of tools following standards that facilitate improvements in teaching and learning
- We see as a key part of this to be a central core Learning Record Store or Warehouse
- That is why we chose to implement the Apereo Learning Analytics framework at Notre Dame



NGDLE Goes beyond LMS and Tools

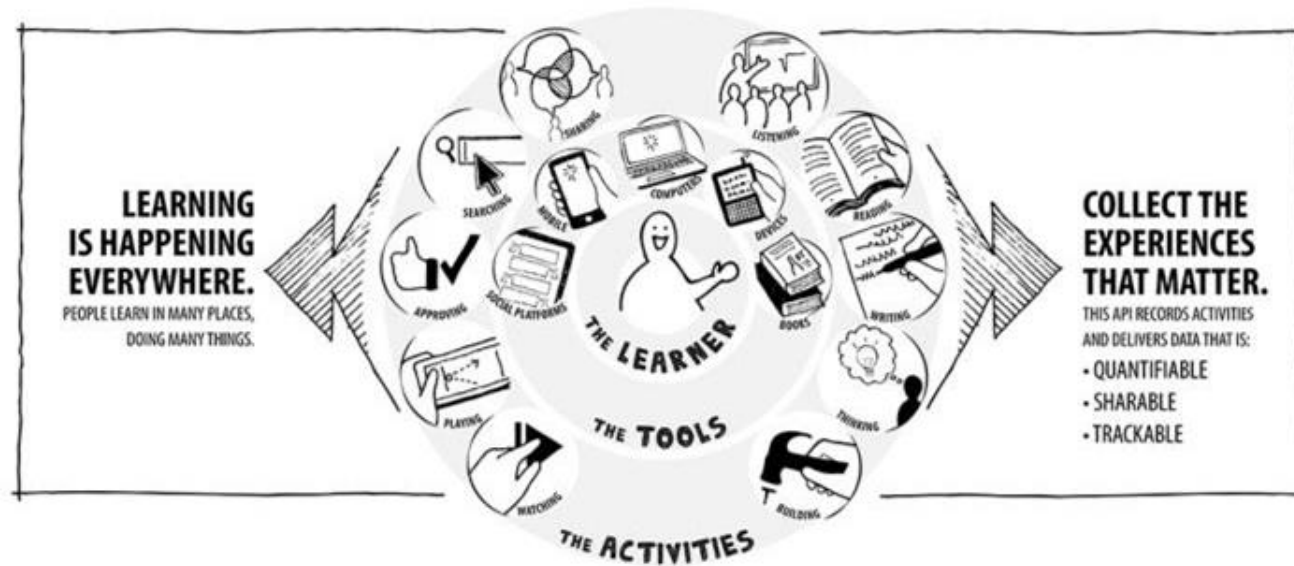
We will not address all aspects of the NGDLE but focus on Learning Analytics, the Learning Record Warehouse and standards that feed into the Learning Record Warehouse.



NGDLE implies many tools available for learning

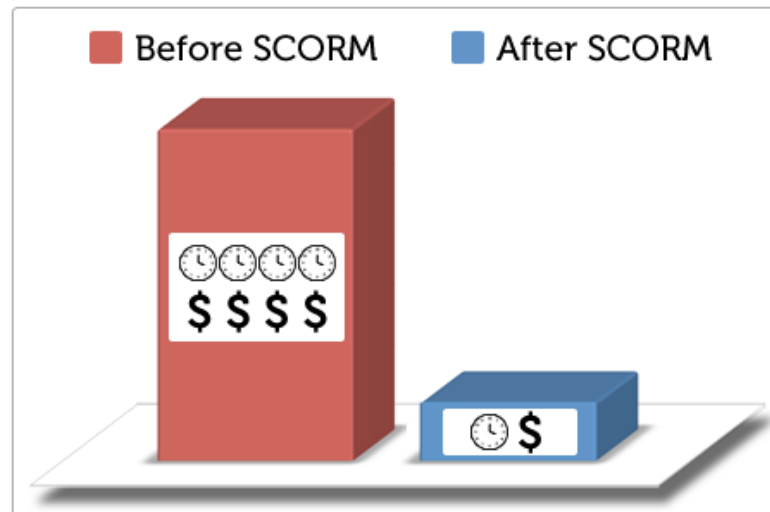
Learning does not just take place in the LMS or any 1 tool so standards were deemed as essential ...

we need to be able to track ANY learning activity EVERYWHERE.



History of learning standards: SCORM

- SCORM
 - “Sharable Content Object Reference Model”
- Developed by [ADL](#), Advanced Distributed Learning, a research group sponsored by the United States Department of Defense (DoD) – to reduce cost of integration



SCORM problems

- All learning was launched from LMS
- Content had to be in same domain as LMS
- Complex
- Not mobile friendly
- Easy to hack – based on old technologies
 - History dates back to 1999, latest version 2009 but still based on the older tech

New Standard was born ... (circa 2011): Tin Can API or Xapi

Xapi aka. Tin Can API



shared language to capture people's
experiences across systems

Experience API (xAPI): developed by ADLnet to replace SCORM

Experience Streams and Statements



CC: <http://www.slideshare.net/phish108/tincan-in-the-wild>

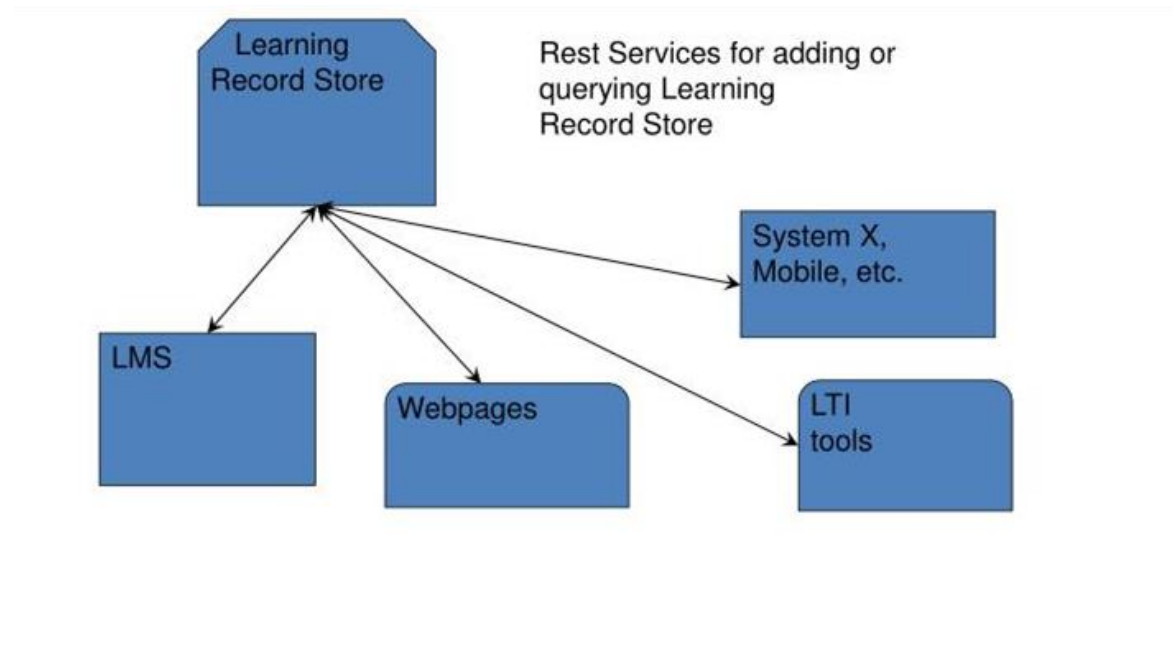
#LMSI_NL, 00:00-01:07:2019

Examples of xAPI tools

- **Adobe Captivate**
- **Articulate Storyline and Storyline 360**
- **H5P**

How to gather xAPI streams from multiple sources?

Learning Record Store--Open standard originally set up for storing xAPI data.



New Standard from IMS Global: Caliper

CALIPER

2015 Caliper 1.0

building on existing specifications, profiles and ontologies



Caliper Metric Profiles and Sensor API

Apereo Open Learning Analytics

Apereo Learning Analytics Strategic Vision An Open Learning Analytics Platform

Learning Activities Collection – Standards-based data capture from any potential source using open standards: xAPI and/or IMS Caliper/Sensor API

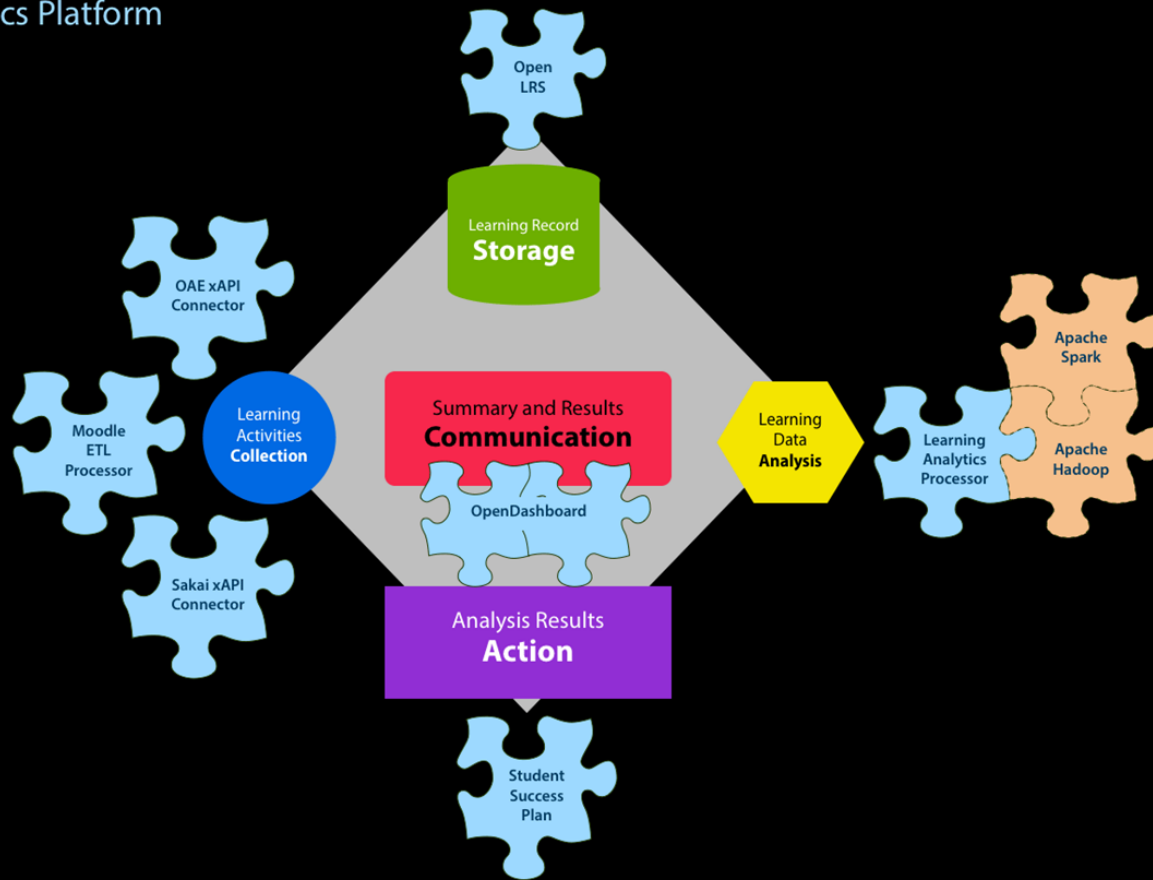
Storage – Single repository for all learning-related data using Learning Record Store (LRS) standard. Over the past year OpenLRS has made significant progress toward maturity. In addition to its support of the Experience API (xAPI), OpenLRS has added support for the IMS Caliper learning event specification. OpenLRS has also seen its first production deployment at the University of Notre Dame. Several additional production deployments are planned for 2016 at both higher education institutions and global publishers.

Analysis – Flexible Learning Analytics Processor (LAP) that can prototype data mining, data processing (ETL), predictive model scoring and reporting. Work on larger datasets is handled by Apache Hadoop and Apache Spark.

Communication – Dashboard technology for displaying LAP output.

Action – LAP output can be fed into other systems to trigger alerts, etc.

Apereo members are building software around this platform. OpenLRS, Learning Analytics Processor, OpenDashboard and Student Success Plan are early examples of the benefits of a platform-based approach.



Open Apereo LRW at Notre Dame

- Background
 - Notre Dame implemented Open Apereo LRS in 2016
 - LRS was limited to one xAPI source
 - Released prior to IMS Global Caliper standard
 - Open Apereo Analytics LRW features
 - LRW allows multiple xAPI and Caliper feeds of data
 - Important for the era of NGDLE –Next Generation Digital Learning Environment
 - Tools that can use the LMS as a hub will need to feed the LRW with multiple sources of data
 - Examples: Kaltura, H5P, Xerte, Moodle, Panopto, Articulate modules
 - xAPI tools include commercial products like Articulate and Captivate
 - Caliper standard from IMS Global is a standard for K-12 and higher education
 - Supplementing LRW we use Tableau as a visualization and reporting tool



LRS/LRW Work in the past 2 years

- We have targeted our analytics toward the Moreau First Year of studies program
 - This is a course that all 2100 first year students are required to take at the university
 - There are about a 110 sections with about 19 students each
- Our work in this course was illustrated during the ATLAS award presentation at Apereo held in Montreal last year
- We chose to use Tableau for that program since that was a tool widely used at Notre Dame for reporting and visualizations and the focus of the project was early intervention to boost students at risk with reports provided to program directors and advisors



Current LRW/Learning Analytics Projects

- Enhanced dashboards for the Aperreo Learning Analytics platform
 - working with Unicon, North Carolina State University, Marist University to enhance faculty dashboard
 - creating student dashboards
- Discussions with Marist on tailoring the predictive machine learning module for specific populations -- for Notre Dame we are most interested in predicting success in STEM programs at this time
- Working with Chemistry department on customized dashboards tailored for their first year students



Work with science and math courses

- In Fall 2018 we started to work with math, science and engineering programs to apply what we had learned with First Year of Studies program.
- Using Tableau, a commercial product, to create visualizations to inform us of student performance in courses like general introductory chemistry and mathematics
- We are also discussing with vendors to support the Caliper 1.1 standard and LTI 1.3 for better integration and provisioning of student analytics

Thanks to Apereo Foundation

- I would like to take this opportunity to thank the Apereo Foundation and its Executive Director, Ian Dolphin, for making this presentation at your conference possible.
- I encourage you to take a look at the [Apereo Foundation](#) and what it does to encourage Open Source projects to benefit higher education. There are many [examples](#) at the site.
- I also encourage institutions to consider becoming active members to support the important work of Apereo
- Our University has joined as a contributing member of Apereo and we have greatly benefited from this membership



Diving Deeper into the technical details

Xiaojing Duan my colleague will dive deeper into the technical details of our implementation in the next presentation.

Questions?

