

Connect Global, Create Future **KERIS**

A Reference Model for Learning Analytics Service utilizing Open-Source Software

Digital Publishing & Learning Technology Convergence Fair 2015 전자출판 – 교육 기술 융합 페어 2015

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Jaeho LEE, Ph.D (Professor, University of Seoul) Yong-Sang CHO, Ph.D (Principal researcher, KERIS)

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 - xAPI
 - IMS Caliper

Proof of Concept: reference model for learning analytics

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- System deployment using open source SW
- Future works by 2016
- But, keep in mind

What we know is ...









Smart Devices







Source: Smart Devices & Cloud Computing http://www.exelanz.com/blogs/smart-devices-cloud-computing/

Learning applications creation/ classroom							
eportfolio	collaboration	assessment	delivery	ebook	capture		
c&w	Blackboard collaborate.	learning.com	🔊 Bb	vitalsource			
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5	W	- <u>`@</u> - C	Open Assembly	http://develog	pers.imsglobal.org/catalog.html		

What we don't know is ...



What to measure?

How to collect?

Is it connected to each other?

Questions expected from data mining & learning analytics

Educational data mining focuses on developing new tools and algorithms for discovering data patterns



EDUCATIONAL DATA MINING CAN Answer questions like:

What sequence of topics is most effective for a specific student?



Which student actions are associated with better learning and higher grades?



Which actions indicate satisfaction and engagement?



What features of an online learning environment lead to better learning?

Learning analytics focuses on applying tools and techniques at larger scales in instructional systems





LEARNING ANALYTICS CAN Answer questions like:



When are students ready to move on to the next topic?



When is a student at risk for not completing a course?



What grade is a student likely to receive without intervention?



Should a student be referred to a counselor for help?

Source: Collegestats.org http://collegestats.org/2013/01/how-can-data-mining-analytics-enhance-education/

Case Study to explore what we don't know (Data flow and exchange)



LMS: Learning Management System LRS: Learning Record Store

IMS Caliper



Source: New Architect for Learning (Rob Abel, 2014)

http://www.slideshare.net/JEPAslide/day3-edupub-tokyoims?qid=76ce5d4a-1ccf-468f-a428-c652584c395a&v=default&b=&from_search=4

SAMPLE DASHBOARD



Top Students by CourseSmart Engagement Index***

These students have the highest Engagement Index.

Student Name	Engagement Inde 🍦
Juan Mejia	80
Sylvia Cruz	77
Samuel Gallegos	74
Benjamin Martin	73
Stephanie Lujan	72

Students with Room for Improvement.

These students are not as engaged as they could be and may require attention.

Student Name	Engagement Inde: 👙		
Robert Sevilla	21		
Elizabeth Iglesias	21		
Eddie Rodriguez	21		
Joanna Carrillo	21		
Sarah Sandoval	21		

Filters - provide greater levels of detail including: Course Title, ISBN, Book Title, Student Name and Date Range.

2

Summary Table - Key eTextbook usage metrics such as: Average Session Length, Pages Viewed, Books Subscribed and CourseSmart Engagement Index.

3

Trend Analysis - Graphs representing the CourseSmart Engagement Index and eTextbook Activity over a date range.

Top Students and those with Room For Improvement - Lists students based on highest and lowest engagement scores.

http://www.coursesmart.com/go/institutions/analytic

Proof of Concept: a reference model for learning analytics

We want to see the iceberg below to understand

what we don't know yet!!!



To answer,

- what is the general process for learning analytics?
- do we need to define workflows beyond xAPI or IMS Caliper?
- How do we prove the concept?

Step 1. design an reference architecture for learning analytics





Step 1. design a deployment architecture (in 2014)



Step 1. design a deployment architecture (in 2015)



Step 2. design an abstract workflow for the reference mode



Step 2. design a workflow of the reference model v1.0



Step 2. design a workflow of the reference model v1.1



Step 2. design a workflow of the reference model

- data collection process



Step 2. design a workflow of the reference model

- data storing/filtering process



Step 2. design a workflow of the reference model - analyzing process



Step 2. design a workflow of the reference model - visualization process



Step 3. design a scenario

(Basic analytics process)

- 1. Student open digital textbook on Readium-JS viewer
- 2. Data is generated through reading activities by student
- 3. Data capture API crawl the data and send to event store
- 4. On the analytics platform check collected data
- 5. See simple dashboard from collected data (without analysis algorithm)

(Advanced analytics process)

- 6. Design analysis algorithm with data filtering from collected data
- 7. See advanced dashboard pertaining to customized analysis
- 8. Calculate personal learning path connected to LOD for curriculum standard

DEMO

DEMO 1. open digital textbook on Readium-JS viewer

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DEMO 2. Reading activities on Readium-JS viewer



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X 12	2 304	HITP	intercode.iptime.or	/epub/2015/06/UCJXNOIZ	0	public,		chrome		@type=http://purl.imsglobal.org/caliper/v1/SoftwareApplication	
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138	3 200	HTTP	intercode.iptime.or	/epub/2015/06/UCJXNOIZ	4/2,645	public,	image/png	chrome		@id=intercode	
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DEMO 3. Reading activity data converted to the RDF format

```
"@context":"http://purl.imsglobal.org/ctx/caliper/v1/ViewEvent",
@type":"http://purl.imsglobal.org/caliper/v1/ViewEvent",
actor":{
"@id":"http://www.intercode.kr/user/user001,"
  "@type": http://purl.imsglobal.org/caliper/v1/lis/Person",
"name":"tester",
   "properties":{},
  "lastModifiedTime":1418283997868
<sup>"</sup>áction":"viewed",
"object":{
__@id":"http://www.intercode.kr/contents/a.html<u>"</u>,
  "@type":"http://purl.imsglobal.org/caliper/v1/Reading",
  "name":"B Section",
   "properties":{},
"objectType":[],
   'alignedLearningObjective":[],
  "keyword":[],
"partOf":{},
   'lastModifiedTime":1418283997868,
   frame":{
     @id":"http://www.intercode.kr/contents/a-1.html".
    "@type":"http://purl.imsglobal.org/caliper/v1/Frame",
"name":"B Section",
    "properties":{},
     "objectType":[],
     "alignedLearningObjective":[],
    "keyword":[],
"partOf":"http://www.intercode.kr/contents/a.html",
"lastModifiedTime":1418283997868,
     "index"∶1
  }
},
 generated":null,
'edApp"{
   "@id":"http://www.intercode.kr/software/contents-viwer",
  "@type":"http://purl.imsglobal.org/caliper/v1/SoftwareApplication",
"name":"Contents Viwer",
   'properties":{},
'lastModifiedTime":1418283997868
},
 group":{
  "@id":"http://www.intercode.kr/group"
  "@type":"http://purl.imsglobal.org/caliper/v1/Group",
"name":"group",
   properties {},
   "lastModifiedTime":1418283997868,
   organization": {
     @id":"http://www.intercode.kr/part",
     "@type":"http://purl.imsglobal.org/caliper/v1/lis/Organization",
"name":"team a",
     "properties":{},
     'lastModifiedŤíme":1418283997868.
     "parentOrg":{}
   'courseSection": {
     "@id":"http://www.intercode.kr/course/section1"
    "@type":"http://purl.imsglobal.org/caliper/v1/lis/CourseSection",
"name":"course_1",
     "properties":{},
     "lastModifiedTime":1418283997868,
     "parentCourse":{}
'startedAtTime"∶O.
"endedAtTime":O,
'duration"∶O
```

khttp://purl.imsglobal.org/ctx/caliper/v1/ViewEvent/1> :actor <http://www.intercode.kr/user/user001>; :startedAtTiem "0"; :context <http://purl.imsglobal.org/ctx/caliper/v1/ViewEvent>; :action "viewed"; :type <http://purl.imsglobal.org/caliper/v1/ViewEvent>; :object <http://www.intercode.kr/contents/a.html>; :edApp <http://www.intercode.kr/software/contents-viwer>; :group <http://www.intercode.kr/group>. <http://www.intercode.kr/user/user001> :lastModifiedTime "1418283997868"; :name "tester"; :type <http://purl.imsglobal.org/caliper/v1/lis/Person>. <http://www.intercode.kr/contents/a.html> :lastModifiedTime "1418283997868"; :name "B Section"; :type <http://purl.imsglobal.org/caliper/v1/Reading>; :frame <http://www.intercode.kr/contents/a-1.html>. <http://www.intercode.kr/contents/a-1.html> :partOf <http://www.intercode.kr/contents/a.html>; :lastModifiedTime "1418283997868"; :name "B Section"; :index "1"; :type <http://purl.imsglobal.org/caliper/v1/Frame>. <http://www.intercode.kr/software/contents-viwer> :lastModifiedTime "1418283997868"; :name "Contents Viwer"; :type <http://purl.imsglobal.org/caliper/v1/SoftwareApplication>. <http://www.intercode.kr/group> :courseSection <http://www.intercode.kr/course/section1>; :lastModifiedTime "1418283997868"; :organization <http://www.intercode.kr/part>; :name "group"; :type <http://purl.imsglobal.org/caliper/v1/Group>. <http://www.intercode.kr/course/section1> :lastModifiedTime "1418283997868"; :name "course 1"; :type <http://purl.imsglobal.org/caliper/v1/lis/CourseSection>. <http://www.intercode.kr/part> :lastModifiedTime "1418283997868"; :name "team a"; :type <http://purl.imsglobal.org/caliper/v1/lis/Organization>.

ViewEvent data in RDF format

ViewEvent data in JSON format

DEMO 4. Collected data on event store

s	р	0
http://demo.uos.ac.kr/sample.user001	http://demo.uos.ac.kr/name	"Son"
http://demo.uos.ac.kr/software/testapplication	http://demo.uos.ac.kr/name	"TestApplication"
http://demo.uos.ac.kr/reading16	http://demo.uos.ac.kr/name	"Page7"
http://demo.uos.ac.kr/reading10	http://demo.uos.ac.kr/name	"Page6"
http://demo.uos.ac.kr/reading9	http://demo.uos.ac.kr/name	"Page8"
http://demo.uos.ac.kr/reading14	http://demo.uos.ac.kr/name	"Page9"
http://demo.uos.ac.kr/reading18	http://demo.uos.ac.kr/name	"Page10"
http://demo.uos.ac.kr/reading1	http://demo.uos.ac.kr/name	"Page11"
http://demo.uos.ac.kr/reading2	http://demo.uos.ac.kr/name	"Page13"
http://demo.uos.ac.kr/reading8	http://demo.uos.ac.kr/name	"Page14"
http://demo.uos.ac.kr/reading7	http://demo.uos.ac.kr/name	"Page15"
http://demo.uos.ac.kr/reading5	http://demo.uos.ac.kr/name	"Page16"
http://demo.uos.ac.kr/reading3	http://demo.uos.ac.kr/name	"Page17"
http://demo.uos.ac.kr/reading4	http://demo.uos.ac.kr/name	"Page18"
http://demo.uos.ac.kr/reading6	http://demo.uos.ac.kr/name	"Page21"
http://demo.uos.ac.kr/reading15	http://demo.uos.ac.kr/name	"Page1"
http://www.intercode.kr/contents/assessment	http://demo.uos.ac.kr/name	"TestContents"
http://demo.uos.ac.kr/sample.user002	http://demo.uos.ac.kr/name	"Kang"
http://demo.uos.ac.kr/reading11	http://demo.uos.ac.kr/name	"Page4"
http://demo.uos.ac.kr/reading12	http://demo.uos.ac.kr/name	"Page2"
http://demo.uos.ac.kr/reading13	http://demo.uos.ac.kr/name	"Page3"
http://demo.uos.ac.kr/reading17	http://demo.uos.ac.kr/name	"Page5"
http://demo.uos.ac.kr/sample.user003	http://demo.uos.ac.kr/name	"Bae"
http://demo.uos.ac.kr/sample.user004	http://demo.uos.ac.kr/name	"ol"
http://demo.uos.ac.kr/sample.user005	http://demo.uos.ac.kr/name	"Byun"
http://demo.uos.ac.kr/software/keris_lcms	http://demo.uos.ac.kr/name	"KERIS_LCMS"
http://demo.uos.ac.kr/event40	http://demo.uos.ac.kr/actor	http://demo.uos.ac.kr/software/testapplication
http://demo.uos.ac.kr/event31	http://demo.uos.ac.kr/actor	http://demo.uos.ac.kr/software/testapplication
http://demo.uos.ac.kr/event63	http://demo.uos.ac.kr/actor	http://demo.uos.ac.kr/software/testapplication
http://demo.uos.ac.kr/event85	http://demo.uos.ac.kr/actor	http://demo.uos.ac.kr/software/testapplication
http://demo.uos.ac.kr/event103	http://demo.uos.ac.kr/actor	http://demo.uos.ac.kr/software/testapplication
http://demo.uos.ac.kr/event104	http://demo.uos.ac.kr/actor	http://demo.uos.ac.kr/software/testapplication
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http://demo.uos.ac.kr/event150	http://demo.uos.ac.kr/actor	http://demo.uos.ac.kr/software/testapplication
http://demo.uos.ac.kr/event165	http://demo.uos.ac.kr/actor	http://demo.uos.ac.kr/software/testapplication
http://demo.uos.ac.kr/event189	http://demo.uos.ac.kr/actor	http://demo.uos.ac.kr/software/testapplication

DEMO 5. Dashboard showing engagement profile

Summary for [Son]

Subscription Period	Page Views	Total Session	Average Session	
7	74	982	35	
DAYS	PAGES	MIN	MIN	



	Top 5 most viewed Page		Most active Users			
1	Page8	1	C	ho	2015-06-21	
2	Page9	2	Ju	ing	2015-06-20	
3	Page11	3	S	on	2015-06-21	

DEMO 5. Dashboard showing engagement profile



Future works by 2017

By February 2017

Complete development for data capture API (beta version)

- collaborate with IMS Global
 - * to improve efficiency of data sharing format

Complete design and development for test-bed of reference model

- complete tests for open source SWs to organize optimized composition
- design interface for analysis algorithm based on R

Complete design for LOD of achievement standards

to connect digital resources with specific topics of curriculum standards
 * connected digital resources, ISO/IEC 19788 MLR will be used



But, keep in mind!



<Gartner Hype Cycle, 2014>

Thank You !!!