Possibility of Learning Assistance Robot: Understanding Learner's Status

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Self Introduction

- Professor, Dept. Information Science,
  Sophia University, Tokyo Japan
  - Learning Technology, Digital Textbooks, Learning Analytics,
    Motor-skill Learning Support
- Chair, Japanese Society for Learning Analytics
- Chair, Japan e-Learning Association
- Advisory Member, Educational System Project, Ministry
  of Internal Affairs, Japan
- Director, ICT Connect 21, Japan
  - Industry-government-academia Alliance for Digitalization of
    Education
- Member, ISO/IEC JTC1/SC36 WG8
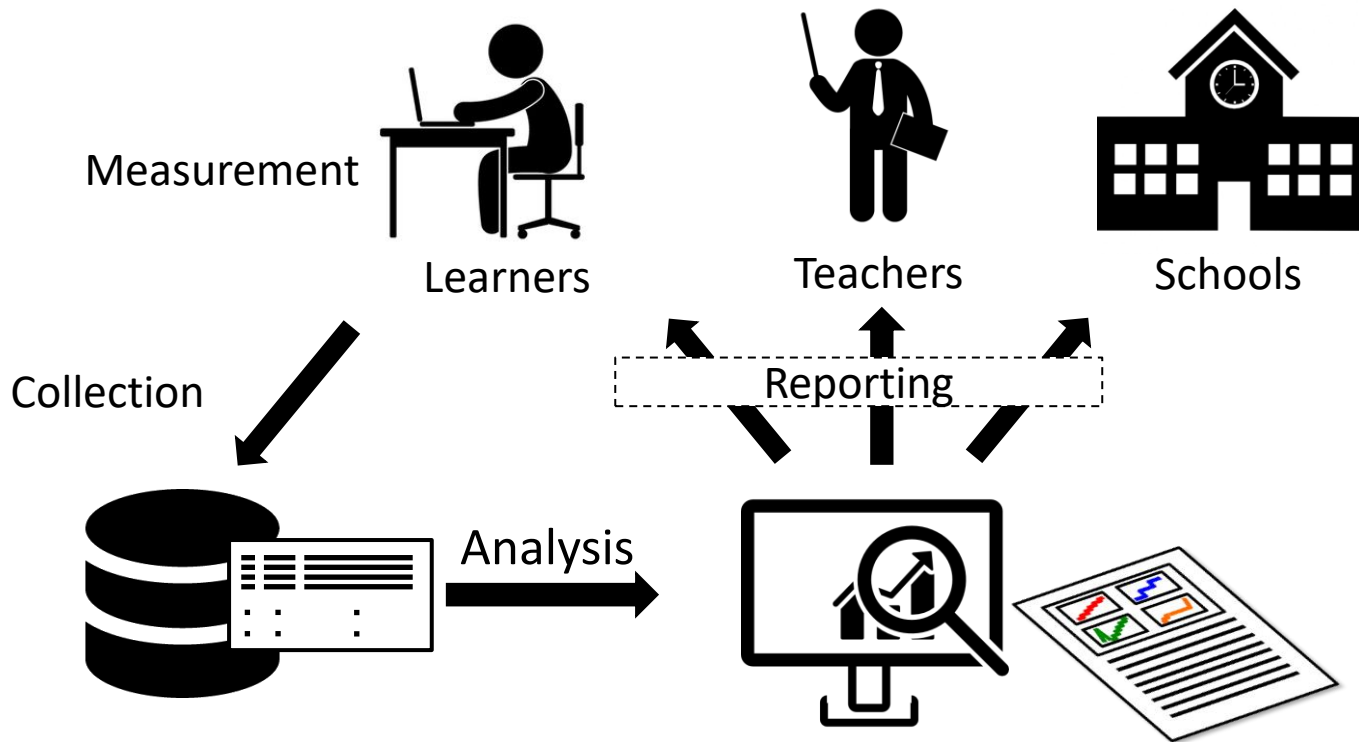 - WG8: Learning Analytics Interoperability

Overview

- Introduction of Learning Analytics (LA)
- LA Examples
- LA Information Resources
- Classification of LA by Objectives towards Learner Adaptation
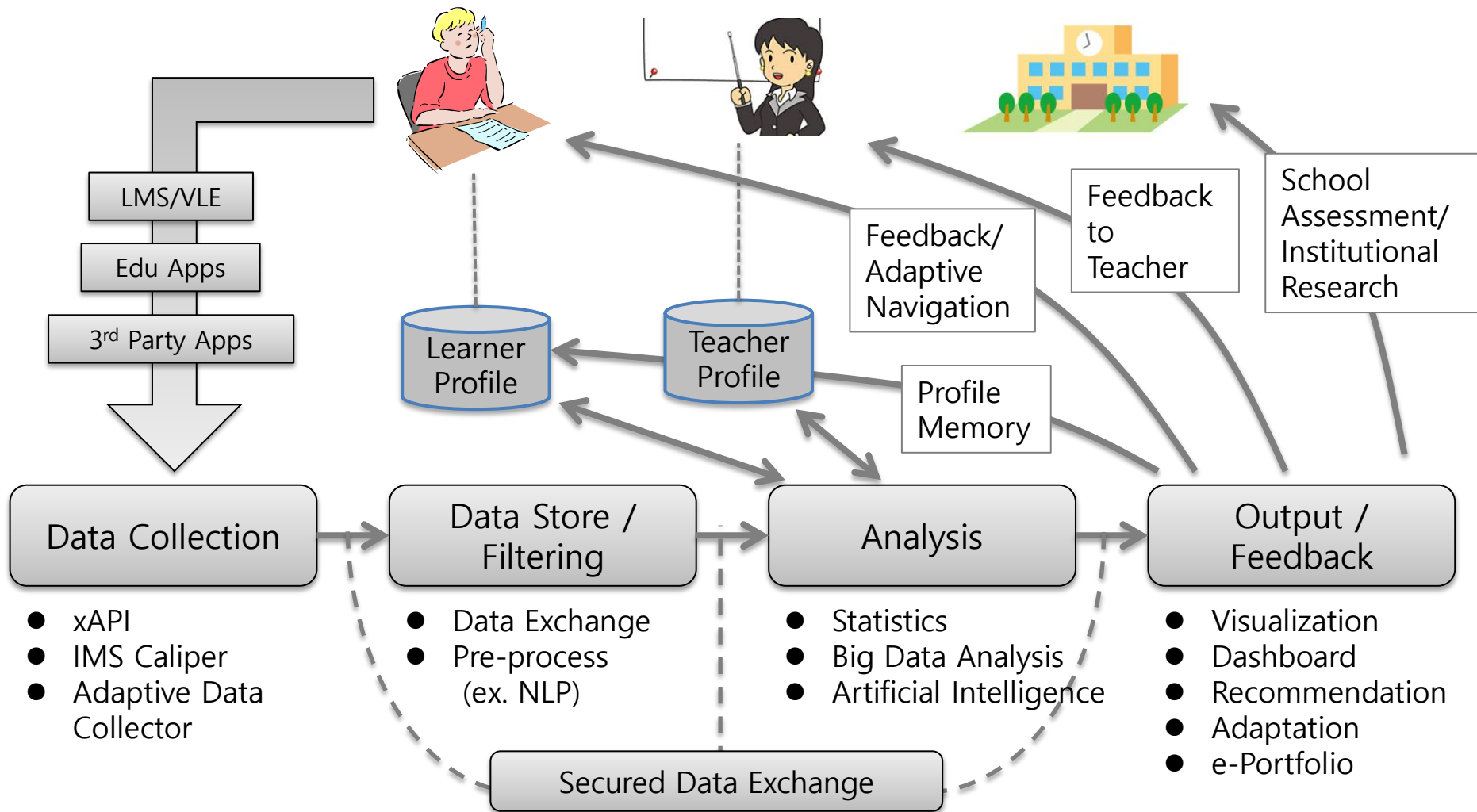
Position of Learning Analytics

Definition

"Learning analytics is the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs." (Ferguson 2012)
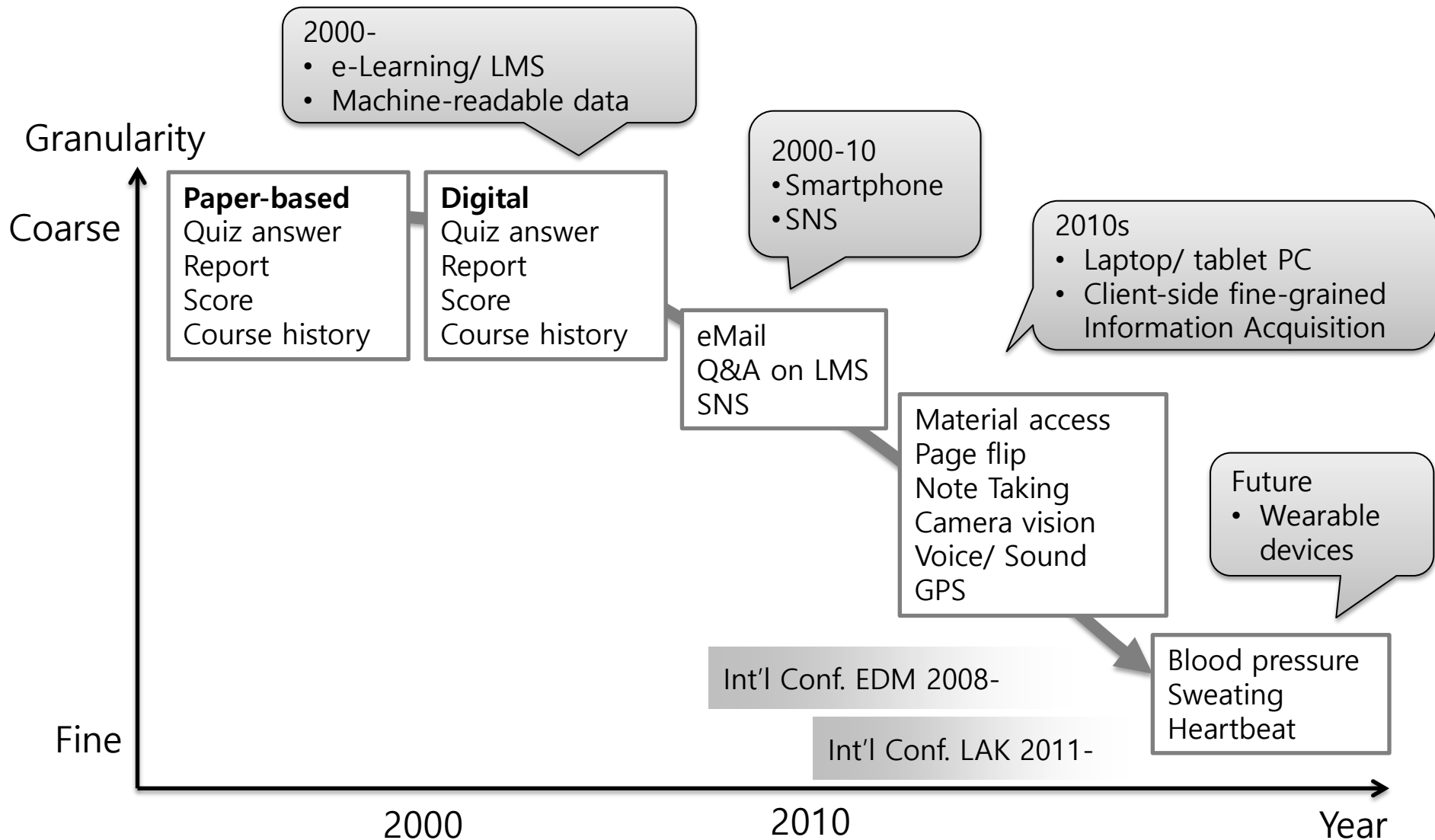
Measurement

Learners   Teachers   Schools

Collection   Reporting

Analysis

Major Components

LMS/VLE

Edu Apps

3rd Party Apps

Learner Profile

Teacher Profile

Feedback/ Adaptive Navigation

Feedback to Teacher

School Assessment/ Institutional Research

Profile Memory

Data Collection
- xAPI
- IMS Caliper
- Adaptive Data Collector

Data Store / Filtering
- Data Exchange
- Pre-process (ex. NLP)

Analysis
- Statistics
- Big Data Analysis
- Artificial Intelligence

Output / Feedback
- Visualization
- Dashboard
- Recommendation
- Adaptation
- e-Portfolio

Secured Data Exchange

Revised from ISO/IEC TR20748-1 Learning Analytics Interoperability: Reference Model

Granularity of LA Data

Granularity

Coarse
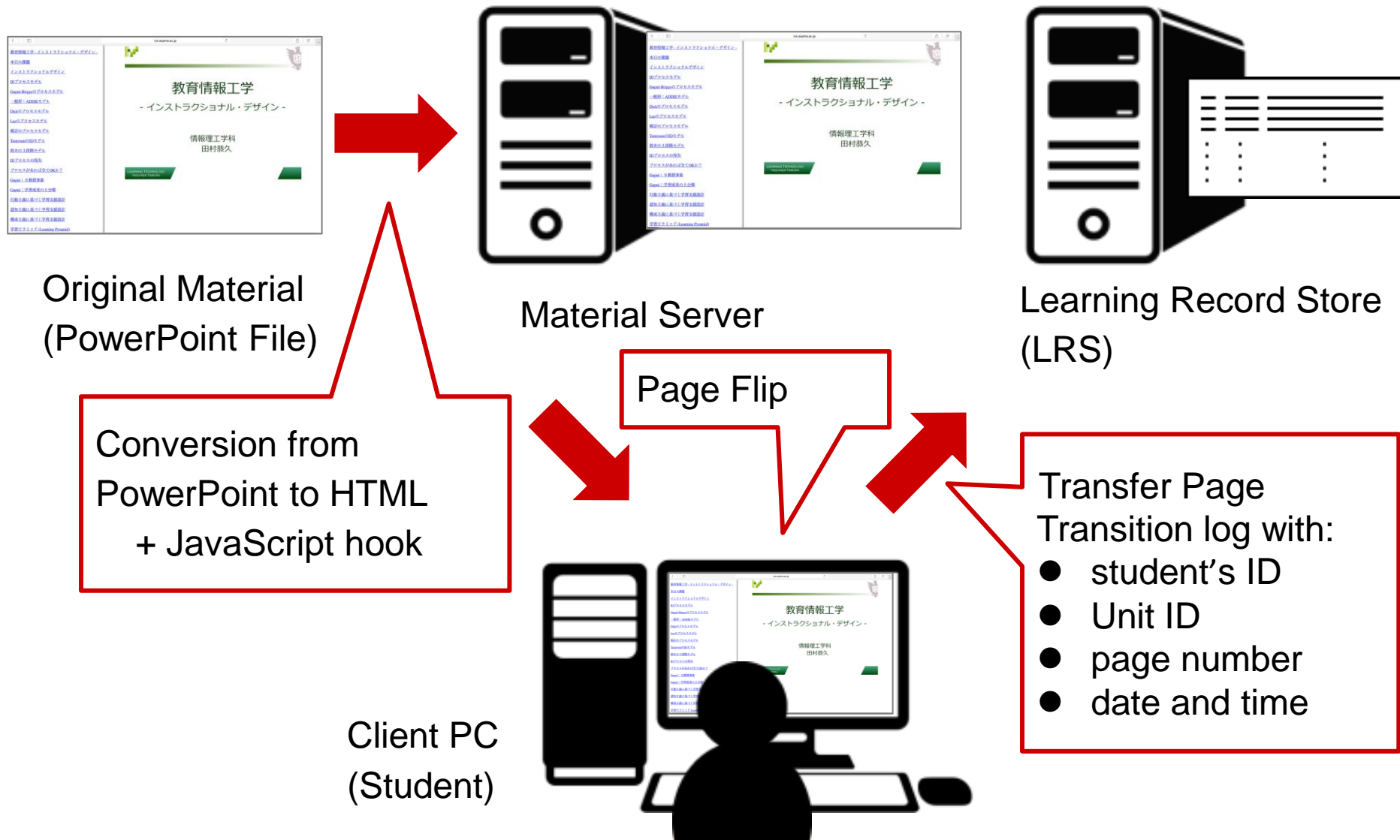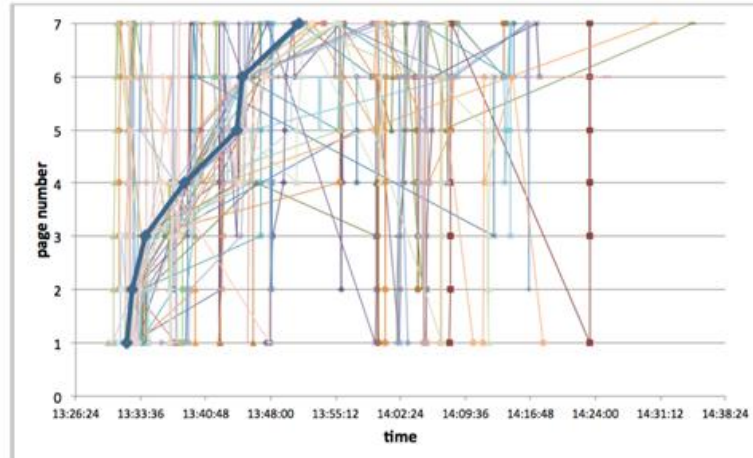
Paper-based
Quiz answer
Report
Score
Course history

Digital
Quiz answer
Report
Score
Course history

2000-
- e-Learning/ LMS
- Machine-readable data

2000-10
- Smartphone
- SNS

2010s
- Laptop/ tablet PC
- Client-side fine-grained Information Acquisition

eMail
Q&A on LMS
SNS

Material access
Page flip
Note Taking
Camera vision
Voice/ Sound
GPS

Future
- Wearable devices

Int'l Conf. EDM 2008-

Int'l Conf. LAK 2011-

Blood pressure
Sweating
Heartbeat

Fine

2000   2010   Year

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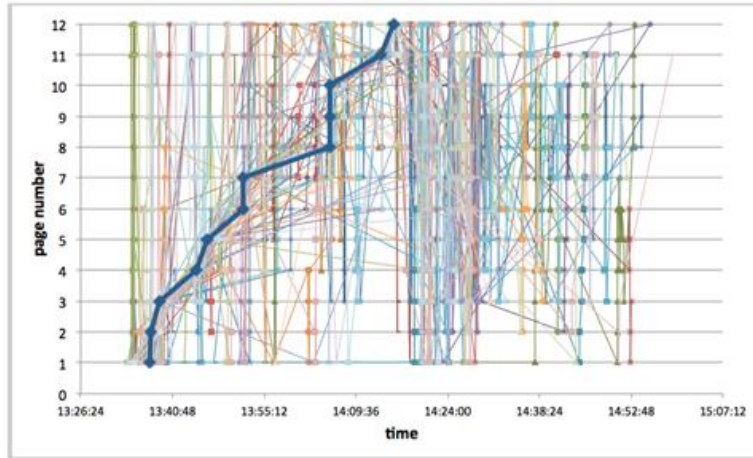# LA Example: Behavior Modeling

- Focuses on page flip behavior of students
  - Developed automatic log acquisition
- Possible hypotheses
  - Learning style estimation
  - Teaching speed assessment
  - Learners' self-regulation skill estimation

- Horikoshi, I., Yamazaki, K. and Tamura, Y. (2015). Learning Style Verification with use of Questionnaire and Page Flip History, ICCE 2015 Workshop on e-Book-based Educational Big Data for Enhancing Teaching and Learning.
- Horikoshi, I., Noguchi, M., Tamura, Y. (2016). Evaluation of Learning Unit Design with Use of Page Flip Information Analysis, International Conference on Cognition and Exploratory Learning in the Digital Age (CELDA) 2016.
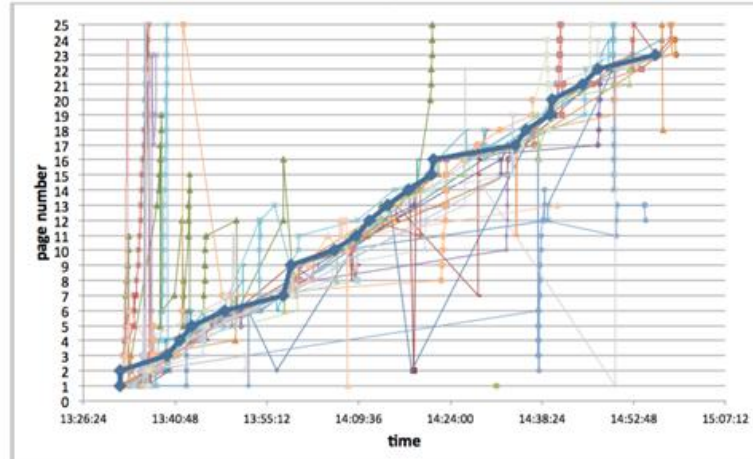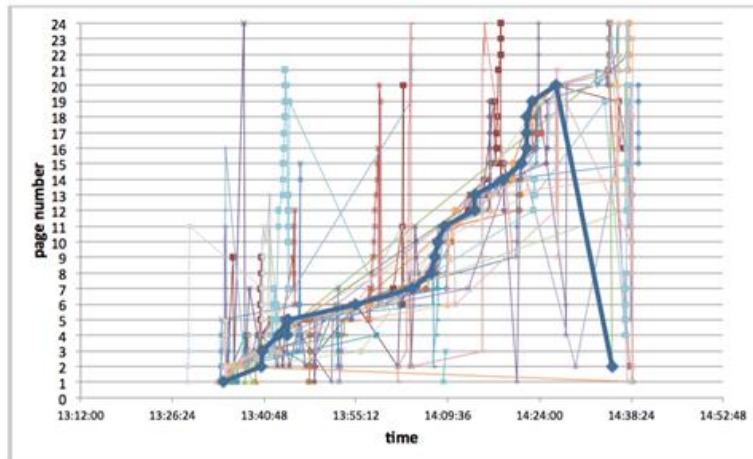
Page Flip Log Collection

Original Material
(PowerPoint File)

Material Server

Learning Record Store
(LRS)

Conversion from
PowerPoint to HTML
+ JavaScript hook

Page Flip

Transfer Page
Transition log with:
- student's ID
- Unit ID
- page number
- date and time
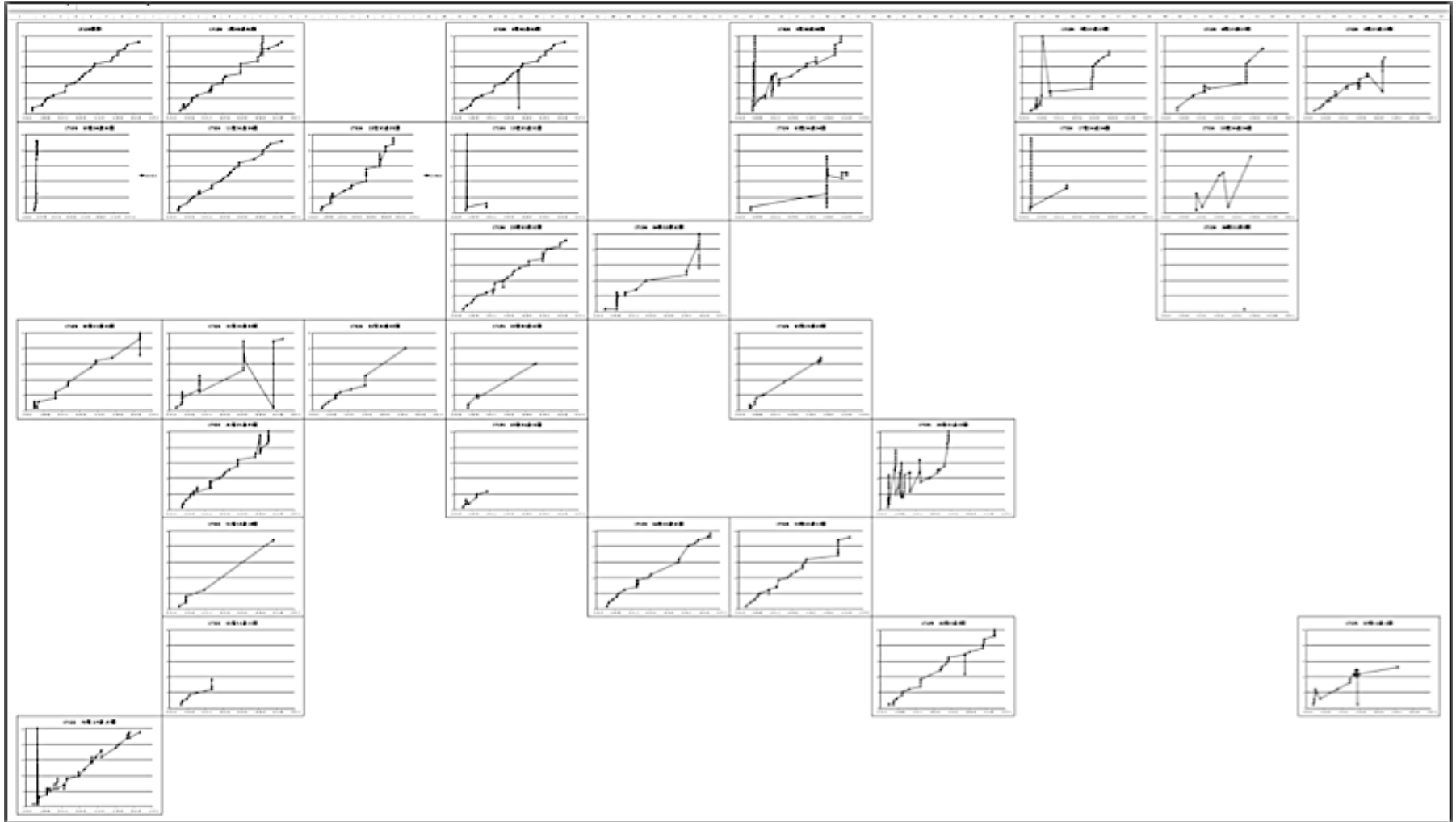
Client PC
(Student)

Page Flip History

Information Literacy (100 level)

Learning Technology (300 level)
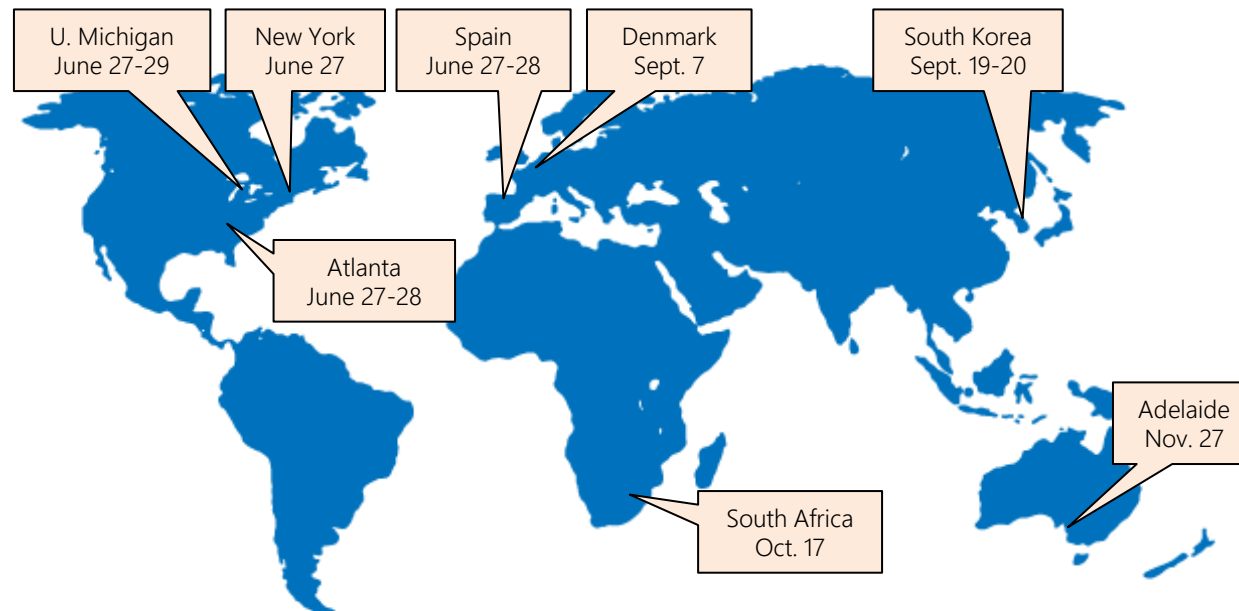
Individual History

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Resources on Learning Analytics

- International Conferences
  - LAK: Learning Analytics and Knowledge, 2011-
  - EDM: Educational Data Mining, 2008-
- Journal of Learning Analytics
- Google groups on learning analytics
- LACE Project (Europe)
- ISO/IEC JTC1/SC36 (Learning Technology) WG8
  - Est. June 2015
- Japanese Society for Learning Analytics (JASLA)
 - Est. May 2015

LAK & LASI

- Hosted by SOLAR (Society for Learning Analytics Research)
- LAK (Learning Analytics and Knowledge)
  - Annual Int'l Conference
- LASI (Learning Analytics Summer Institute)
  - Local Workshops / Tutorials

U. Michigan
June 27-29

New York
June 27

Spain
June 27-28

Denmark
Sept. 7

South Korea
Sept. 19-20

Atlanta
June 27-28

Adelaide
Nov. 27

South Africa
Oct. 17

LACE Project

- Learning Analytics Community Exchange
- LA research/ practice information exchange
- Evidence Hub: LA paper archive
- http://www.laceproject.eu/
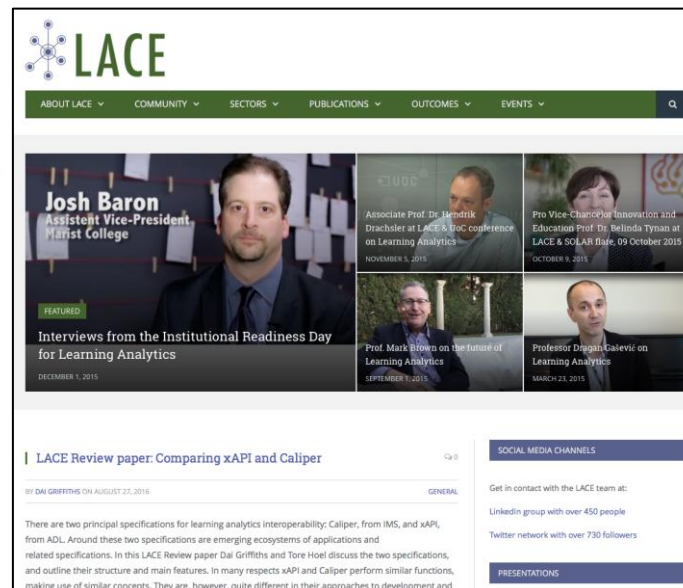
LA Center, Kyushu University

- Est. 2016.2
- In Liberal Arts Section (2700 students/ year)
- Incorporate BookLooper (eTextbook) on BYOD
- Collects and analyzes over 180,000 records/ day
- http://lac.kyushu-u.ac.jp/

ISO/IEC JTC1/SC36 WG8

- SC36
  - Information Technology for Learning, Education and Training (ITLET)
  - Est. 1999
- WG8 (Learning Analytics) from June 2015
  - Convener: Yong-Sang Cho (KERIS, South Korea)
  - ISO/IEC TR 20748
    - Reference Model
    - System Requirements
    - Privacy Guidelines

Classification of LA Objectives

Table 4. Classification of case studies according to the research objectives

Research objectives (goals)	Authors & Year (Paper Ref.)
Student/Student behavior modeling	Abdous, He & Yen, 2012; Baker et al., 2008; Blikstein, 2011; Fournier et al., 2011; He, 2013; Jeong & Biswas, 2008; Kizilcec et al., 2013; Levy & Wilensky, 2011; Li et al., 2011; Pardos et al., 2013; Romero et al., 2008; Shih, Koedinger & Scheines, 2008
Prediction of performance	Abdous, He & Yen, 2012; Huang & Fang, 2013; Lykourentzou et al., 2009b; Macfadyen & Dawson, 2010; Moridis & Economides, 2009; Pardos et al., 2013; Romero et al., 2008; Romero-Zaldivar et al., 2012; Shih, Koedinger & Scheines, 2008; Thai-Nghe et al., 2011
Increase (self-) reflection & (self-) awareness	Ali et al., 2012; Clow and Makriyiannis, 2011; Fournier et al., 2011; Macfadyen & Dawson, 2010; Santos et al., 2012
Prediction of dropout & retention	Dejaeger et al., 2012; Dekker et al., 2009; Giesbers et al., 2013; Guo, 2010; Guruler et al. 2010; Kizilcec et al., 2013; Lykourentzou et al., 2009a
Improve assessment & feedback services	Ali et al., 2012; Barla et al., 2010; Chen & Chen, 2009; Leong et al., 2012; Tanes et al., 2011; Worsley & Blikstein, 2013; Wilson et al., 2011
Recommendation of resources	Khribi et al., 2009; Klašnja-Milićević et al., 2011; Romero et al., 2009; Thai-Nghe et al., 2011; Verbert et al., 2011

Source: Papamitsiou, Z. K., & Economides, A. A. (2014). Learning Analytics and Educational Data Mining in Practice: A Systematic Literature Review of Empirical Evidence. Educational Technology & Society, 17(4), 49-64.

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Learner Adaptation

- Unit-wise Achievement Understanding
  - Result-based
- Pace Adaptation
  - Mastery Learning by Bloom (1971)
- Learning Styles
  - Fine-grained information needed

Learning Styles by Ridings (CSA)

- Wholists (Global Style):

  People who will retain a global or overall view of information

- Analytics (Sequential Style):

  People who will deconstruct information to its component parts

- Verbalizers (Verbal Style):

  People who consider the information they read, see or listen to, in words or verbal associations

- Imagers (Visual Style):

  People who read, listen to or consider information, experience fluent spontaneous and pictorial mental pictures

Page Flip and Learning Styles

Wholists (Global Style):
People who will retain a global or overall view of information

Analytics (Sequential Style):
People who will deconstruct information to its component parts
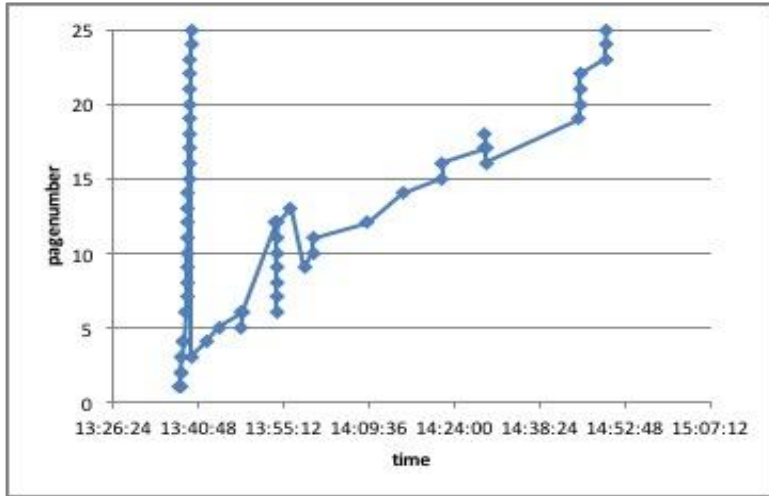
Expected Effects of LA

- Automatic/ semi-automatic acquisition and analysis of learning evidences
  - More detailed and objective
- Learning process to be clarified
- Towards individualization of learning
  - With more precise understanding of learners' situation

Summary

- Research
  - Journals and Int'l Conferences became common
  - Research results to be archived
  - More scientific evidences are needed "what data" for "what to see"
- Development, Practice
  - LRS and data transmission protocol to be free
  - AI and Big data analysis tools available
  - Waiting for research results effective for learning and teaching

Thank you

Questions and comments, please contact
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References

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- Sclater, N. et al.(2016). Learning Analytics in Higher Education, JISC Report https://www.jisc.ac.uk/sites/default/files/learning-analytics-in-he-v3.pdf

- Shacklock, X. (2016). From Bricks to Clicks: The Potential of Data and Analytics in Higher Education, UK Higher Education Commission, http://www.policyconnect.org.uk/hec/sites/ site_hec/files/report/419/fieldreportdownload/frombrickstoclicks-hecreportforweb.pdf