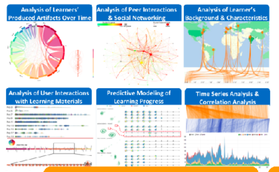
An Open Learning Design, Data Analytics and Visualization Framework for E-Learning

Project Goal:

To serve MOOC instructors, instructional designers, institutional curriculum leaders and learning scientists by developing an open framework for E-learning.

Achievements (Phase 1, Milestone 1,2,3)



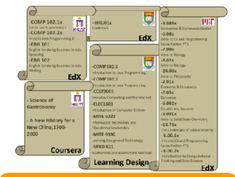
3 Journal papers
4 Conference papers
4 Theses
6 Projects
1 Patent
1 Technical Report
1 Poster

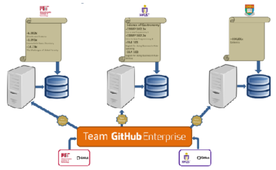
LDS-HE Launched
Prototype refined, extended, validated & launched

Linked

Analytics & Visualization
6 categories of analytical tasks visualized

Publications
15 published & 5 to be submitted





MOOC-Learner-Project Software
MLC
MLQ
MLV*
MLM*

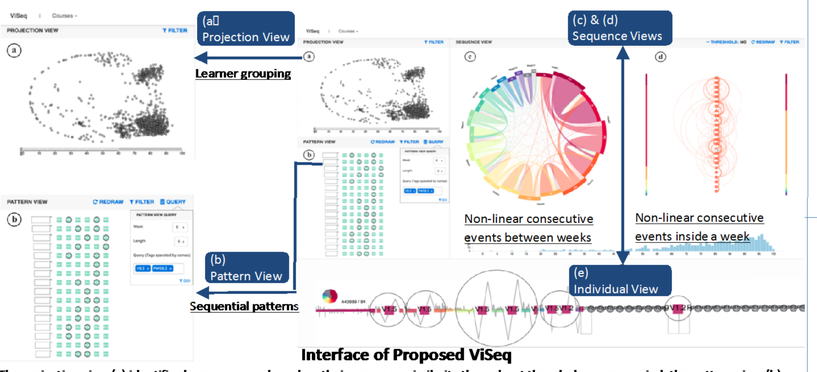
VisMOOC-Web-End
VisMOOC-Front-End
VisMOOC-Data-Server

Data Curated
19 MOOCs (HKUST, MIT, HKU), 7 LDS (HKU) collected

MOOCs Shared
Data privacy protected in data sharing

Software Released
Software released on Jan., May, and Dec. 2017

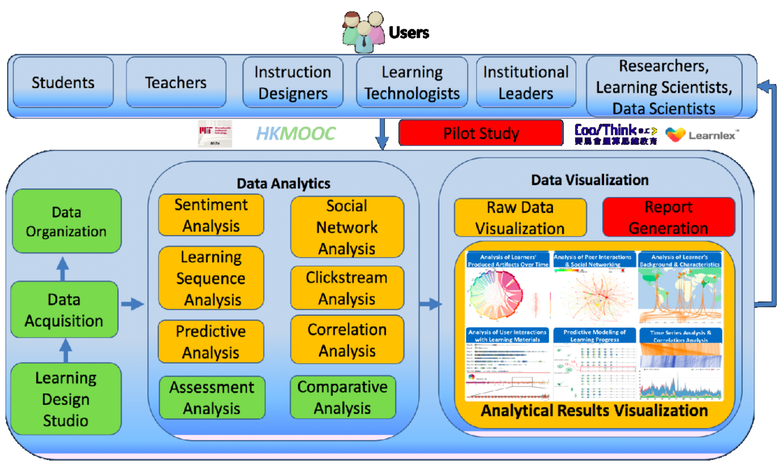
Learning Sequence Analysis



Interface of Proposed ViSeq

The projection view (a) identifies learner groups based on their sequence similarity throughout the whole course period; the pattern view (b) presents the mined sequential patterns within a selected learner group; the sequence view shows the non-linear consecutive events between weeks (c) and inside a selected week (d); the individual view (e) helps explore individual learning sequence and find similar individuals. The screenshot function aims to record stories found and to return to previous explorations.

Plan for Phase 2

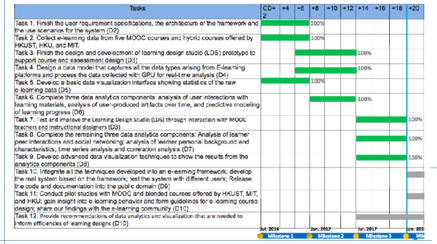


Project Core Members

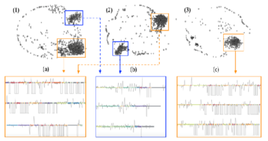
- **HKUST**
  - Dr. Huamin Qu, Project Coordinator
  - Dr. T.C. Pong, Professor
  - Dr. Qiong Luo, Associate Professor
- **MIT**
  - Dr. Una-May O'Reilly, Principal Research Scientist
  - Dr. Erik Hemberg, Research Scientist
- **HKU**
  - Dr. Ricky Kwok, Professor
  - Dr. Susan Bridges, Associate Professor
  - Dr. Nancy Law, Professor

- **Learning & Assessment Design:**
  Nancy Law (HKU)
  Susan Bridges (HKU)
- **Data Analytics & Visualization:**
  Huamin Qu (HKUST)
  Erik Hemberg (MIT)
  Qiong Luo (HKUST)
- **MOOCs and Blended Courses:**
  T.C. Pong (HKUST)
  Una-May O'Reilly (MIT)
  Ricky Kwok (HKU)

Milestone 3

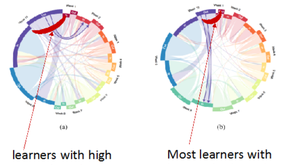


Case Studies



(a) – (c) shows the typical individual sequences for the identified clusters, where (a) and (c) indicates similar patterns with frequent jumps (rectangular lines) during the final exam week.

Three projection views (1) – (3) from the three MOOCs (Java1, Java2, and EBA) are presented with different clusters.



In the week before the final exam, the left figures show the learning sequence transitions flow from week 10.

learners with high scores have large proportion of sequence transitions flow to week 1 and 2.

Most learners with low grades have large proportion of sequence transitions flow to week 9.

Issues

- Existing platforms
  - Pros:
    - **High quality** material made with **UK resources.**
    - **>10k** users from Hong Kong and Mainland.
    - **>20** local schools in Hong Kong.
  - Cons:
    - Lack in **learning design** as well as **learning analytics.**

Learnlex - Item Banks of Mathematics

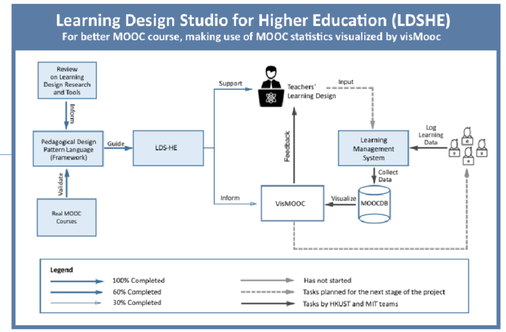
Twig , TigTag- Video Banks of Math, Science, Biology, Chemistry...

- How to **Commercialize** the open-source platform for HE & K12 education industry?

An Open Learning Design, Data Analytics and Visualization Framework for E-Learning

Learning Design Studio for Higher Education (LDSHE)

Project progress overview



An overview of the courses documented and studied

Course title	Institution	Mode
1. COMP102.1 Introduction to Java Programming	HKUST	Fully online
2. COMP102.1 Introduction to Java Programming	HKUST	Blended
3. CCST9003 Everyday Computing and the Internet	HKU	Blended
4. ELEC1601 Introduction of Computer System	University of Sydney	Blended
5. MITE 6023 Information Technology and Educational Leadership	HKU	Blended
6. MITE 6330 Learning Design and Technology	HKU	Blended
7. UPED 621 Assessment and Assessment Methods	University of Bergen	Blended

Usability and Impact Studies

Objectives
- The Learning Design Pattern Language
- To test the capacity of the language in representing the different levels of granularity and dimensions of a course design.
- To test the usefulness of this new way of representing course designs
- To test the usability of the system
- To test the usefulness of LDS in scaffolding teachers' course design
- To find out to what extent and in what ways the LDS changes the way instructors think about learning, and change their course design process

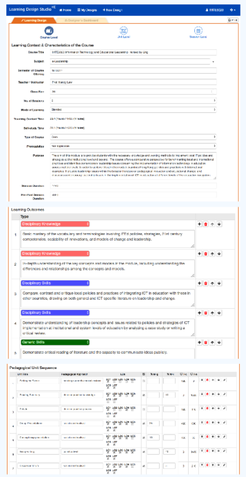
Results and findings
The learning design pattern language were able to effectively capture and communicate
- the learning design patterns adopted in a course;
- the pedagogical approach embedded in each pattern;
- the learning context in which each pattern was situated;
- the particular learning outcomes that each pattern tackled.

The Learning Design Studio
- allows a systematic approach for the course design;
- promotes teachers' pedagogically-oriented design thinking;
- represents the course designs and stimulates the instructors to reflect upon and modify their course designs.

The new design interface of the LDS

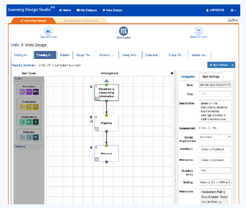
Course Level Design

Improved user-interface for learning design

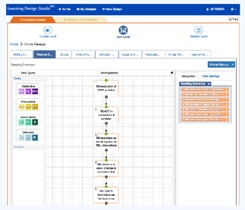


Learning Unit Level Design

Added: construction of reusable patterns



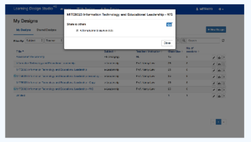
Showing the sequence of patterns that constitute a learning unit



Session Level Design

Added: tool for assigning learning tasks to sessions

Added: option to share designs with other users (public designs)

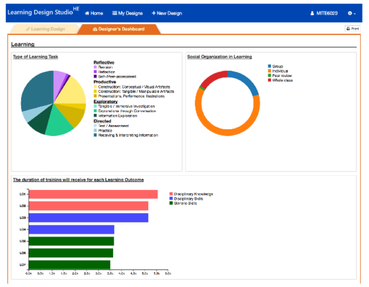


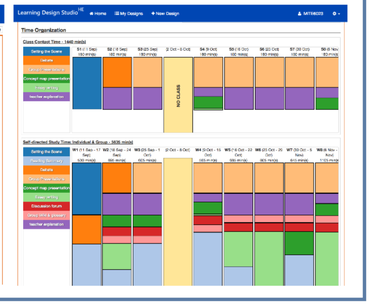
List of System Improvements

- Refined learning theory-based task types
- Improved user-interface for learning design
- Implemented: designer dashboard & printable version of design
- Added: construction of reusable patterns
- Added: tool for assigning learning tasks to sessions
- Added: option to share designs with other users (public designs)

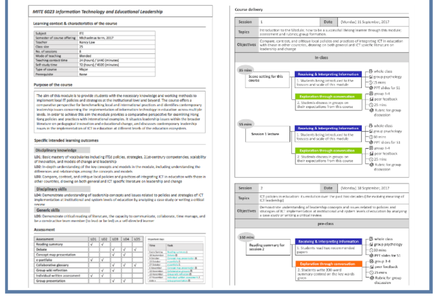
New visualization features

The Designer's Dashboard that facilitates teachers' self-monitoring and self-reflection during the design process





A printable version of course designs to support teachers' course delivery



HKUST MIT Research Alliance Consortium
香港大學 THE UNIVERSITY OF HONG KONG
Massachusetts Institute of Technology
香港科技大學 THE HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY