Data Storytelling and Learning Analytics in Physical Spaces

Roberto Martinez-Maldonado
Roberto.MartinezMaldonado.net
twitter: @RobertoResearch
background

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2015- Current – Full Time Researcher, Educational Data Science @CIC


2011- 2014 – PhD in Human-Computer Interaction, AI, Data Mining and Dashboards, USYD

2001- 2009 – Engineering and IT training and self-training

1984-2001 – Life in a small Mexican city called Campeche
every day more than 2.5 quintillion bytes of data are generated (2017)
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That is a thousand raised to the power of six \((10^{18})\)
90% of the data that we have available today has only been created in the last 2-3 years.
"we are drowning in information, but we are starved for knowledge".

John Naisbitt, 1982
Oysters = Data
Only 1 in about 10,000 wild oysters will yield a pearl
= INSIGHT
Learning Analytics is the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimising learning and the environments in which it occurs.

1st International Conference on Learning Analytics and Knowledge, Banff, Alberta, February 27–March 1, 2011
...most learning analytics efforts are at the right of the spectrum
classroom data
increasing interest in data

utopian scenario
increasing interest in data
increasing interest in data utopian scenario
Focus of this talk: the **left** side of the spectrum
why is the classroom **SPACE** so “important”?
high investment in new learning spaces
...and it includes all levels, from K-12...
...to higher education
new learning spaces in libraries are cool too
... they often mimic workplace spaces
...inherently blended
‘traditional’ classrooms are now hybrid too
...some learning spaces cannot be moved to the virtual world
learning can be very physical...
... VERY physical!
the importance of the whole

“Online Learning doesn’t happen online! It happens where the learner is. It can’t happen where the learner isn’t”

@PeterGoodyear

https://www.teachingenglish.org.uk
physical learning analytics at three levels

- **Classroom Analytics**
- **Small-group Collaboration Analytics**
- Analytics on **Individual** Psychomotor Skills
brining sensors to the classroom

The translucent classroom

1) assess classroom activity design
2) orchestration and awareness
architecture

Multi-tabletop Classroom components

a) Whiteboard projector
b) Depth sensors (Microsoft Kinect)
c) Microphone array (Microcone)
d) Interactive surface hardware (PQ Labs)
e) Concept mapping application (Python)
f) Multi-platform Orchestration Tool (Python)
g) Centralised logging system (MySQL)

DBMS
authentic deployments

38 tutorials

3 semesters

School of Business and School of IT

~80 small groups

+400 students

4 teachers

A teacher’s dashboard for **classroom orchestration**
Table with wrong propositions

Group in table Blue has 3 wrong propositions. For example:

‘Cognitive walkthrough is a user-method’
‘UMUX LITE is a no-user-method’

USEFUL  NOT USEFUL
adherence to the class script

There was not enough time for activity 2!!!!
Example of **following a teacher** in a collaborative classroom holding a tablet-based dashboard.
Teacher’s mobility and proximity

- Red: Extends 8 feet from the teacher
- Yellow: Another 6 feet (total of 14 feet)
- Green: Beyond 14 feet out from teacher

SOURCE: Fred Jones Tools for Teaching
Instrumenting Learning Spaces

- Infrared people counter
- Ultra-wideband positioning tags
- Real-time dashboard
Tracking workflow during high-stakes resuscitation: the application of a novel clinician movement tracing tool during in situ trauma simulation

Andrew Petrosoniak, Rodrigo Almeida, Laura Danielle Pozzobon, Christopher Hicks, Mark Fan, Kari White, Melissa McGowan, Patricia Trbovich

ABSTRACT

Introduction Clinician movement and workflow analysis provides an opportunity to identify inefficiencies during trauma resuscitation care. Inefficient workflows may represent latent safety threats (LSTs), defined as unrecognised system-based elements that can negatively impact patients. In situ simulation (ISS) can be used to model resuscitation workflows without direct impact on patients. We report the pilot application of a novel, especially during trauma resuscitations, can be difficult as clinical environments are often dynamic and complex.

In situ simulation (ISS) provides a valuable opportunity to recreate clinical scenarios for focused analysis of workflows and patient care within the actual clinical environment. Using ISS, high-risk or rarely performed scenarios can be replicated to better understand a complex system and
To our knowledge however, there are no free, readily available tools to objectively analyse clinician movement within the confines of a resuscitation room. As a result, the development of this video overlay tool offers a unique application for workflow analysis. Application of this tool for ISS is useful to comparatively analyse human movement during clinical care for several reasons: (1) scenarios are reproducible and actions/procedures are predictable; (2) rare procedures may be preferentially selected for analysis and; (3) risk to actual patients is minimised.
physical learning analytics at three levels

Classroom Analytics

Small-group Collaboration Analytics

Analytics on Individual Psychomotor Skills
Collocated Groupware
Proximity Analytics in healthcare simulation classrooms
Learning Analytics meet Patient Manikins
Apparatus

- Video camera
- Depth sensor
- Tablet
- Manikin
- Mic array
Raw Proximity Data

Heatmaps of Proximity Data
Student’s activity divided into three parts (T1, T2 & T3)

Group A

Group B
Enactment of the tutorial design in two classroom sessions

Analytics about tutors scripting

new installation: indoor localisation, physiological tracking and audio recording
Initial prototype of a reflection tool

**Simulation:** Chest pain  
**Role:** Medication nurse

Almost there!  
You forgot 2 out of 4 procedures:  
✓ Medication  
✗ Check heat rate  
✓ Check temperature  
✗ Document

Stress level spike!  
Medicine room  
You spent 5 min. in the medicine room
students’ feedback preferences

Our first prototype tackles these

Critical incidents

Positioning

Actions on the manikin

Communication with patient and other nurses

Quantitative information of CPR

Level of stress
second prototype of a reflection tool
physical learning analytics at three levels

- Classroom Analytics
- Small-group Collaboration Analytics
- Analytics on **Individual** Psychomotor Skills
Motion Analytics for Social Dance Education
Pervasive Motion Tracking while dancing

Forró Trainer

Automated detection of dancing mistakes

Student was doing right
starting in beat 1 and resting in
beats 3 and 4

S/he makes a mistake

S/he recovers but enters in the
wrong beat
starting in beat 3 and resting in
beats 1 and 2

Movement Variability
(body acceleration)

Time in seconds – the song has 143 beats per minute (~12 beats each 5 seconds)
why is the SPACE so “important”?

because collaboration and learning are cognitive, affective, social and physical processes?
= INSIGHT
future directions

Data Storytelling

What is data storytelling?

First step: decluttering a graph

before

after
Data storytelling is about **communicating insights**

**Please approve the hire of 2 FTEs**

to backfill those who quit in the past year

**Ticket volume over time**

2 employees quit in May. We nearly kept up with incoming volume in the following two months, but fell behind with the increase in Aug and haven’t been able to catch up since.

Data source: XYZ Dashboard, as of 12/31/2014 | A detailed analysis on tickets processed per person and time to resolve issues was undertaken to inform this request and can be provided if needed.
Most visualisations used in current Learning Analytics deployments are **Exploratory** rather than **Explanatory** therefore, they don’t communicate insights
Exploratory visualisation about student's performance
Data-driven visual analytics approach
Data-driven visual analytics approach

Learning design driven data storytelling approach

[Diagram showing the process for both approaches, including data processing, learning design intentions, and visual analytics for responses and actions.]
Exploratory visualisation about student’s performance
Explanatory visualization about student’s performance

High-performing Team

The team was able to determine all main entities and all main relationships.

The team’s solution improved a lot in a short period of time.

Well done! The team recognised important entities and relationships.
Explanatory visualisation about student’s performance

High-performing Team
The team was able to determine all main entities and all main relationships

The team’s solution improved a lot in a short period of time.

90% “Scholarship - Student” relationship

45% “Scholarship - Deposit” relationship

70% “Scholarship” entity

35% “Student” entity

21% “Student” and “Scholarship” were created as attributes

Decluttering

Well done!
The team recognised important entities and relationships.
Explanatory visualisation about student’s performance

High-performing Team
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Decluttering
“Student” and “Scholarship” were created as attributes

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Selected data points

Decluttering

Explanatory areas
Explanatory visualisation about student’s performance

High-performing Team
The team was able to determine all main entities and all main relationships

Text explaining trends
The team's solution improved a lot in a short period of time

Selected data points
- 35% “Student” entity
- 45% “Scholarship” entity
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Decluttering

Explanatory areas

Well done!
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Text explaining trends
- The team’s solution improved a lot in a short period of time

Assessment narratives
- Well done! The team recognised important entities and relationships.

Decluttering

Explanatory areas
Preliminary analysis

Exploratory visualisation

Explanatory visualisation

Two items for the future Learning Analytics agenda?

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1- Embracing complexity:
collaboration and learning involve cognitive, affective, social and physical processes?

2- Focusing on human factors:
Reporting, communicating or supporting the generation of insights rather than just reporting data
THANKS!

Collaborators and students

For more information and literature visit: bit.ly/utscic

@RobertoResearch