A Snapshot of Current Research in Learning Analytics
Using Real-Time Analytics in Lectures for Engagement To Boost Positive Student Outcomes

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Future Ideas: Information and the Internet
Content Developer: Critical Approaches to Online Learning (UniSA Online)
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How do we reach individual learners?
How do we make learning experiences engaging for all?
How can we improve learning and teaching at university?
Did I leave the heater on?

I wish I could understand this...

ZZzzzz...

I know how to do this easily.
No longer is education given to the students for recitation through a text and lecture style model. This generation is a collaborative and social generation that has a focus on understanding and building their knowledge through various forms of medium to discover the answers. It is for the educators to provide an arena for engagement and discovery as well as be a content expert and mentor (Monaco & Martin 2007, p. 46).
"While the use of average dimensions is generally unsatisfactory even when only one dimension is being considered at a time, the inadequacy of the "average man" method is compounded many times when more than one dimension is to be considered in a design problem" (Daniels 1952, p. 2).

Daniels highlights an insidious problem in design, namely if you design for an "average" person, not only are you designing for no one in particular, you are in fact, designing for no one at all' (Aguilar 2018, p. 39).
Not the *average* student.....

Why learning analytics?
- Personalised learning
- Timely feedback
- Early intervention (Reyes 2015)

'A meta-analysis of 225 studies researching active learning and academic performance found that active learning increases examination performance by half a grade (on average) and that lecturing increases failure rates by 55%' (Freeman et al. 2014 cited in Matthews, Garratt & Macdonald 2018, p. 7).
Broader benefits.....

• Predicting student learning success and providing proactive feedback (Dawson et al. 2014 cited in Gašević, Dawson & Siemens 2015, p. 65).
• Online and on campus engagement
• Supporting students at risk
• Improved cohort outcomes

Utilising big data, good design, and the input of stakeholders they are meant to serve, learning analytics techniques aim to develop applications for the sole purpose of reducing the classroom size to 1.... These digital innovations will enable us to finally do away with a model of education that teaches toward the non-existent average student, replacing it with one that is more socially just and equitable; one that acknowledges and supports the individual needs of every student (Aguilar 2018, p. 42).
Issues

• Access to technology
• Diversity
• Technology in place
• Educator attitude, university culture and culture of analytics
• Connection to research

Ethics

• 2014 data analysis and move to BYOD
• Raising awareness of analytics
• Issues of consent and data retention
• Privacy – confidential or anonymous?
The Educator and Real-time Analytics

- Shift from 'sage on the stage' to a discursive lecture
- Inclusive and adaptable in practice and pedagogy
- Learning, testing and embedding new technology takes time and persistence
- Navigating new technology for students in supportive ways
- Encouraging interactivity through digital media
- Creating a supportive learning environment
- Modelling positive behaviour with technology

What to do if the technology fails?
Implementing real-time analytics (diagram by Stokes 2018)

1. Design
2. Discuss
3. Deliver
4. Respond
5. Reflect

University of South Australia
Example 1: Student engagement
Example 2: Knowledge development

**Multiple choice**

Which technique did advertising executive Alex Osborne popularize?

- A. Brainstorming
- B. Analogy
- C. Mnemonic device
- D. Six thinking hats
- E. Perspective shift

**Multiple choice**

Why is this picture important?

- A. It reminds us that the sign is not the referent, which is fundamental to understanding semiotics.
- B. It reminds us that smoking is cool, which is a good life lesson.
- C. Magritte was a well-known surrealist who confused audiences with confounding art.
- D. It is classy because it is French.
- E. It makes us consider semiotics by looking at correlations.

**Round 1**

Using only **FOUR** lines you must connect ALL of these dots.

You CANNOT pick up your drawing tool (pen, crayon, Sharpie, pencil, etc.)

Only one dot will be touched more than once. (Magritte 2014)

**Answer**

(Sure, the order does not matter, and you can start in any corner, using the same pattern.) (Magritte 2014)
Example 3: Educator praxis

- Reflect on data
  - In lecture
  - In combination with MOODLE
  - Student progression
  - Students-at-risk
  - After each delivery

'Using technology helped me to engage more, especially with learning catalytics.'

'Learning catalytics was especially helpful because it helped to keep me engaged during long lectures.'

2018 INFS 1022 Student survey

- Continued improvement, with a caveat: 'As a comparable analogy to teaching to the test, rather than teaching to improve understanding, learning analytics that do not promote effective learning and teaching are susceptible to the use of trial measures such as increased number of log-ins into an LMS, as a way to evaluate learning progression' (Gašević, Dawson & Siemens 2015, p. 69).
Outcomes

- Enhancing participation and engagement
- Enthusiastic student response
- Above average retention and pass rate
- Outstanding course evaluations (SP2 Student satisfaction with Jenny's teaching 81.94 (from −100 to +100))

...what do the students think of two hour interactive lectures?

✓ Lectures were great fun.
✓ She was very entertaining, her lectures made me want to listen.
✓ The multimedia style of the lecture is a fun and interesting way to learn.
✓ The content and presentation of the course were highly engaging and often fascinating.
✓ Overall, the course was wonderfully presented and proved to be one of the most engaging lectures of the study period.
✓ Very in sync with today's technology and able to express her enthusiasm for the course. Jennifer has made this course interesting as well as challenging. The interactive learning every week via the learn online site is particularly helpful and worked well. The topic is also very well covered and does not feel rushed.

✗ 2 hours is very long, even with a break. I often found my concentration drifting in the last half an hour or so. I would have preferred if lectures were 1.5 hours with no breaks.

MyCourseExperience 2018
Three key points

When implemented effectively, real-time learning analytics enhance learning and teaching.

1. Learning and teaching at university must engage with cohort needs in order to best engage and support students. A shift toward interactive practice and rapid feedback has become necessary to support Millennial and Gen Z students.

2. There are clear benefits for all students when real-time learning analytics are embedded into lectures and other formats. These include increased student engagement, understanding, and positive learning outcomes.

3. Strategic use of real-time analytics allows educators to better support individual needs. Through employing learning analytics effectively, educators are better able to deliver personalised learning experiences and target early interventions for greater student success (Reyes 2015). This is particularly important for meeting the needs of students from diverse backgrounds (Aguilar 2018).

Questions? Jennifer.stokes@unisa.edu.au
References

• University of South Australia 2015 - 2018 Student surveys, UniSA, Australia.
• Images from iStock, Kahoot, Learning Catalytics, Padlet, UniSA and Unsplash. Media images used for educational purposes.
MOOC Discussions with Machine Learning

Yuanyuan Hu

University of Auckland | New Zealand
MOOC Discussions

Topics ?

Cognitive levels?

Interactions ?

Yuanyuan Hu
University of Auckland | New Zealand
Classification with Supervised Learning

- **Known categories**
- **Pre-classified data**
- **Text → Numbers**

**Training**
- Known X $\rightarrow$ known Y
- X $\rightarrow$ Predicted Y

**Model**

**Training data**  26420  70%
**Testing data**  2936  30%

Yuanyuan Hu
University of Auckland | New Zealand
Classification with Supervised Learning

Confusion matrix

bag of words

TF-IDF with simple neural network
Clustering with Unsupervised Learning

**Unknown categories**

**No Pre-classified data**

**Text —> Numbers**

Clusters results  11  8  7
Cognitive levels

Revised Bloom’s Taxonomy

Remember → Understand → Apply → Analyse → Evaluate → Create
# Cognitive levels

<table>
<thead>
<tr>
<th>Verbs</th>
<th>Remember</th>
<th>Understand</th>
<th>Apply</th>
<th>Analyze</th>
<th>Evaluate</th>
<th>Create</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Retrieve relevant knowledge from long-term memory</td>
<td>Construct meaning by connecting “new” to “prior” knowledge</td>
<td>Use a procedure to perform exercises or solve problems</td>
<td>Break material into its constituent parts and relate parts to whole</td>
<td>Make judgments based on criteria or standards</td>
<td>Put elements together to form a coherent whole</td>
</tr>
<tr>
<td>Questions</td>
<td>What happened after ..</td>
<td>How would you explain ..</td>
<td>How would you solve ..</td>
<td>What was the turning point?</td>
<td>Is there a better solution to ..</td>
<td>What are possible solutions to ..</td>
</tr>
<tr>
<td></td>
<td>How many ..</td>
<td>Who do you think ..</td>
<td>How would you do ..</td>
<td>How is .. similar to ..</td>
<td>What do you think about ..</td>
<td>How would you design an ..</td>
</tr>
<tr>
<td></td>
<td>What is ..</td>
<td>Why did ..</td>
<td>Why did .. occur</td>
<td>Why did .. occur</td>
<td>and why?</td>
<td>What would happen if ..</td>
</tr>
<tr>
<td></td>
<td>Who did ..</td>
<td>How would you graph ..</td>
<td>What would you say to ..</td>
<td>What were some of the motives for ..</td>
<td>Do you think .. is a good thing and why?</td>
<td>How many ways can you ..</td>
</tr>
<tr>
<td></td>
<td>Where did .. occur?</td>
<td>Which .. corresponds to ..</td>
<td>How would you work a case of ..</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Activities</td>
<td>Make a list showing ..</td>
<td>Write a summary of ..</td>
<td>Solve a problem</td>
<td>Write a biography</td>
<td>Conduct a debate (or a mock trial)</td>
<td>Design an experiment</td>
</tr>
<tr>
<td></td>
<td>Make a timeline</td>
<td>Prepare a flow chart of ..</td>
<td>Write a response to a case study</td>
<td>Make a map showing interrelationships</td>
<td>Write a critique</td>
<td>Create a new product</td>
</tr>
<tr>
<td></td>
<td>Make a chart showing ..</td>
<td>Write an explanation of ..</td>
<td>Perform a lab experiment</td>
<td>Write an analysis of ..</td>
<td>Prepare a case</td>
<td>Plan a marketing campaign</td>
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<tr>
<td></td>
<td></td>
<td>Make a taxonomy of ..</td>
<td></td>
<td>Write an essay examining bias in ..</td>
<td>Write an opinion piece</td>
<td>Create art</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Draw a map/model of ..</td>
<td></td>
<td>Construct a chart to organize related data</td>
<td></td>
<td>Design a building</td>
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<tr>
<td></td>
<td></td>
<td>Draw a graph of ..</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Write possible outcomes of Retell an event</td>
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</tbody>
</table>
Cognitive levels

Testing data sample 2016 comments 5238

Advantages and Disadvantages
Next and Values

Analysing sentences structures
Supervised learning
Unsupervised learning
interactions social roles

Communities in large MOOC courses
Connect similar topics
Understand learning gains
Q & A

Yuanyuan Hu

University of Auckland | New Zealand
PhD Presentation

Learning Analytics implementations in Australian universities: towards a model of success

Jo-Anne Clark
Griffith University
School of Information and Communication Technology

Principal supervisors: Dr David Tuffley & Dr Rene Hexel
Associate Supervisor: Professor Mark Brimble
Background to Research Problem

- Growing accountability for Universities to deliver quality outcomes, improved learning and student success (Arnold, 2010; Dietz-Uhler & Hurn, 2013; Campbell, Deblois & Oblinger, 2007; Oblinger & Campbell, 2007).

- The regulatory environment is likewise becoming tighter, with increasing scrutiny by governments, accrediting agencies and students (Universities Australia, 2013).

- Data-driven decisions are needed, thus Learning Analytics (LA) are introduced (Siemens, 2010: Oblinger, 2012).

- To improve student success, the success of LA system implementations must be examined.

- **Learning analytics** in this study, is the collection, analysis, and reporting of data associated with student learning behaviour (Lockyer, Heathcote & Dawson, 2013).
Information Systems Success

• The Delone & McLean model has tested reliably over time, having been extensively used to gauge information systems success since its conception in 1992 (Delone & McLean, 2003).

• This study, rather than validate the model, uses a qualitative approach to describe information systems success in terms of LA implementations. The research will describe the success of LA implementations as experienced by staff members working with those systems.
Research Design

• **Qualitative Research** – allows the researcher to conduct in-depth studies about a broad range of topics. Enables researcher to capture the meaning of real-world events from the perspective of a study’s participants (Yin, 2011). Qualitative use of DeLone & McLean’s (2003) model of Information Systems Success.

• **Interpretive Paradigm** – the world will be viewed as a social construction of reality, interpreted and experienced by people and their interactions within the wider social system (Klein & Myers, 1999).

• **Case study research** as “an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident” (Yin, 1984: 13).
Progress to date

Planned

Stage one
• 43 Australian Universities invited to take part
• Intend to interview approximately 3-4 people per institution.

Stage two
• Survey deployment – staff at 43 Universities

Progress

Stage one
‘State of play’ of LA at Australian Universities
➢ Key staff from 3 universities have been interviewed so far
   ➢ Staff work directly with LA
   ➢ Research has found that 3-4 staff work directly with LA

Stage two
Deployment of Delone & McLean (modified) survey
➢ Key staff from 43 universities
Preliminary findings – key themes

• Different definitions of LA exist – importance of defining LA
  • Student-facing
  • Academic facing
• University entry options – e.g. Universities have unique cohorts
• LA implementation at Universities is still in its infancy
• Predictive modeling is a popular method
• Recommender systems being used
• Learning analytics examples applied to course design
• Tools differ e.g. Tableau software used in one case study
Preliminary findings – key themes cont.

Benefits of using LA

- Increased data literacy of staff
- Evidence based practice
- Data driven decision making
- Finding out what drives learning and what does not
- De-privatising the classroom (can be an uncomfortable conversation Increasing accountability)

Limitations/challenges of using LA

- All the cautions of being on the web (security issues, etc.)
- Uninformed inferences – just because someone is logged on to a LMS doesn’t mean they are engaged in the course material “It is like mistaking the leaves for the wind. Measuring the movement of the leaves but the wind is something different.”
Questions?
An investigation into Australian higher education teachers’ interpretation of learning analytics and its impact on practice

DAVID FULCHER
Background

MOTIVATION & FOCUS

• Primary school teaching
• Business intelligence
• The UOW approach to learning analytics
Learning Analytics
A VARIETY OF APPLICATIONS

- Early alert and student success
- Course recommendations
- Adaptive learning
- LA for learning design
- Social network analysis
- Student-facing analytics
## Learning Analytics

### IMPLEMENTATION APPROACHES

<table>
<thead>
<tr>
<th>Top-down</th>
<th>Bottom-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Executive sponsorship</td>
<td>Hearing the voice of students and teachers</td>
</tr>
<tr>
<td>Institution-wide</td>
<td>Communities of practice</td>
</tr>
<tr>
<td>Governance structures</td>
<td>Feedback loops for making adjustments</td>
</tr>
<tr>
<td>Technology foundation</td>
<td>Incremental rollout</td>
</tr>
<tr>
<td>Policy development</td>
<td></td>
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</tbody>
</table>
Different approaches required

ONE SIZE DOES NOT FIT ALL


  – Application: Early alert and academic success
  – Scope: Institution-wide
  – Findings: Different use of LMS features require consideration
Learning Analytics and Learning Design

THE STUDENT SUCCESS PARADIGM


  - Application: Relationship between learning design and student behaviour and outcomes
  - Scope: Institution-wide
  - Findings: Learning design decisions impact student behaviours and partially impact student outcomes
My Proposed Study

RESEARCH QUESTIONS

• What factors influence Australian higher education teachers’ interpretation of learning analytics?
  – What knowledge do Australian higher education teachers have about learning analytics?
  – How are learning analytics actually used by Australian higher education teachers?
  – What is difficult/easy about using learning analytics for Australian higher education teachers?
  – What information do Australian higher education teachers seek when making learning decision decisions?