EduTECH 2019, Sydney

Learning Analytics & AI for Future-Focused Learning

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University of Technology Sydney
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UTS:CIC — CONNECTED INTELLIGENCE CENTRE

Deep acknowledgements to the team whose joint work I'm sharing today…

https://cic.uts.edu.au/about/people

Simon Knight — Lecturer

Ágnes Sándor — Honorary Associate

Shibani Antonette — PhD Student (Learning Analytics)

Radhika Mogarkar — Applications Developer

Andrew Gibson — Research Fellow (Reflective Writing Analytics)

Kirsty Kitto — Senior Lecturer (Data Science)

Carlos Prieto — PhD Student (Learning Analytics)

Gabrielle Gardiner — Senior Manager

Sophie Abel — PhD Student

Roberto Maldonado Martinez — Research Fellow (Educational Data Science)

Vanessa Echeverria Barzola — PhD Student

Ming Liu — Research Fellow (Educational Data Science)

I asked Twitter and Facebook…

Simon Buckingham Shum
@sbuckshum

OK @EduTECH_AU people (and the universe)…

If I say "Analytics and Artificial Intelligence" in Education, what ideas and feelings spring to your mind?? We'll review responses on Friday 2.50pm… #EduTECHAU

UTS:CIC @UTS_CIC
Join CIC's Director Simon Buckingham Shum at @EduTECH_AU in conversation and on stage Fri 7 June, Sydney International Convention Centre edutech.net.au/speaker-simon-…

2:28 PM - 3 Jun 2019

I asked Twitter and Facebook…

https://twitter.com/sbuckshum/status/1135402977374531585

Shudder

"access, equity" in education

"under-exploited, and over-sold […] The key issues of curriculum, pedagogy and assessment still loom large."

"Learning analytics has potential for doing real good as it has human oversight and (hopefully) can be moderated …but I assume AI does not."

"unfulfilled potential, boundless possibilities, with just a hint of trepidation"

"The potential to misinform/misinterpret seems worrying"

"potential for access, equity and excellence in education"

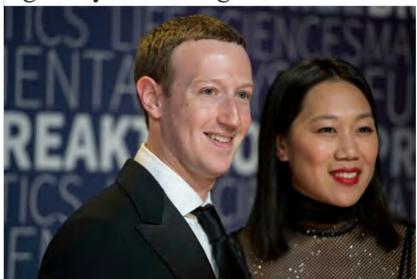# Student and parental concerns about personalised learning platforms

Students' letter to Zuckerberg:

"Unfortunately we didn't have a good experience using the program, which requires hours of classroom time sitting in front of computers.

[…]

Most importantly, the entire program eliminates much of the human interaction, teacher support, and discussion and debate with our peers that we need in order to improve our critical thinking."

The Washington Post
Democracy Dies in Darkness

Answer Sheet

Students protest Zuckerberg-backed digital learning program and ask him: 'What gives you this right?'

Teachers union concerns about personalised learning platforms

Angelo Gavrielatos
@AGavrielatos

Following

#TellPearson

PEARSON: no Artificial Intelligence experiments with children's education
#StudentsBeforeProfit

7:15 PM - 26 Apr 2019

Teachers union concerns about personalised learning platforms

We need trust-building conversations for an informed dialogue. A luddite rebellion won't help anyone…

Angela Gavriel

Following

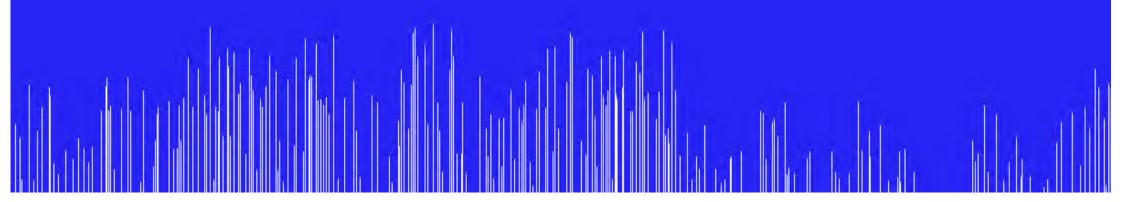no Artificial Intelligence experiments with children's education
#StudentsBeforeProfit

7:15 PM - 26 Apr 2019

https://twitter.com/AGavrielatos/status/1121704316069236739
https://twitter.com/hashtag/TellPearson?src=hash

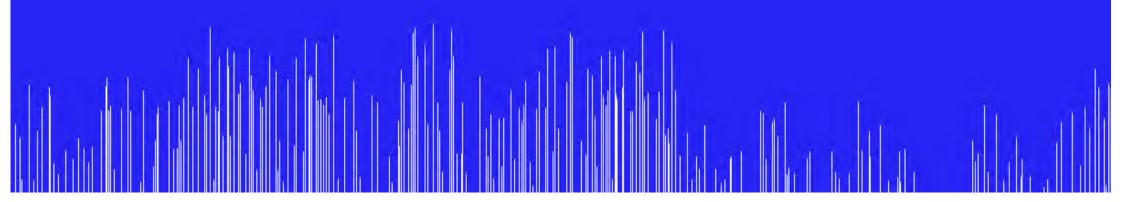Can we all agree that it would be great if we could...

improve feedback

timely • evidence-based • personalised • actionable

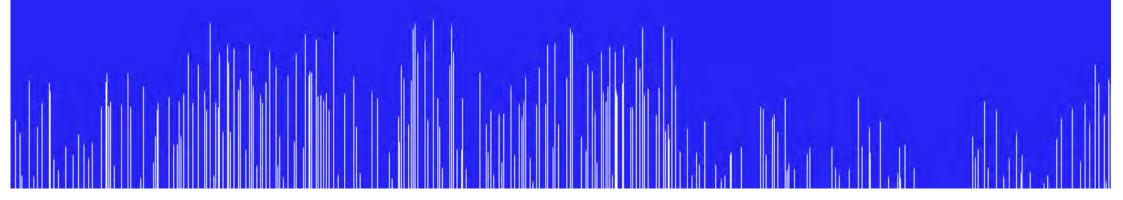And we all know whose responsibility that is…

teachers please work harder

timely • evidence-based • personalised • actionable
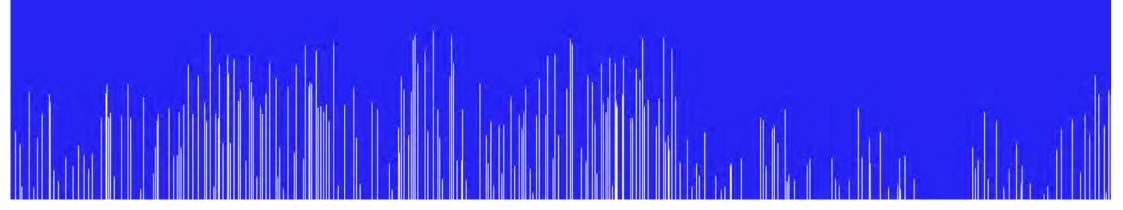
So would we all feel a lot better if AI/Analytics helped…

close the feedback loop?
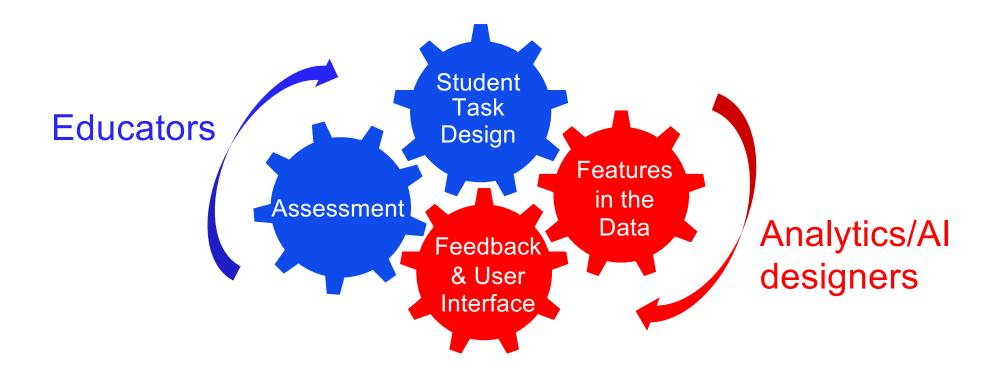
timely • evidence-based • personalised • actionable

Let's take very seriously the challenge to…

integrate AI/Analytics into authentic teaching practice
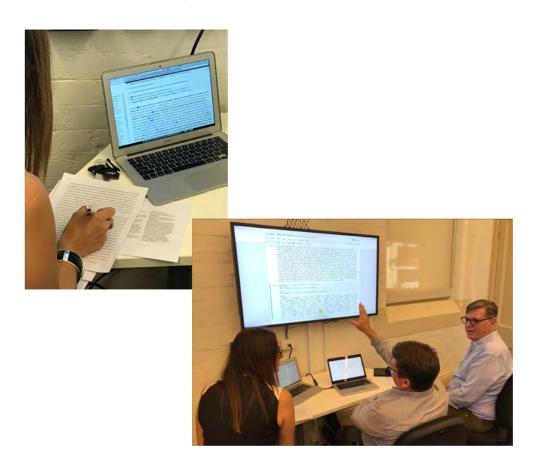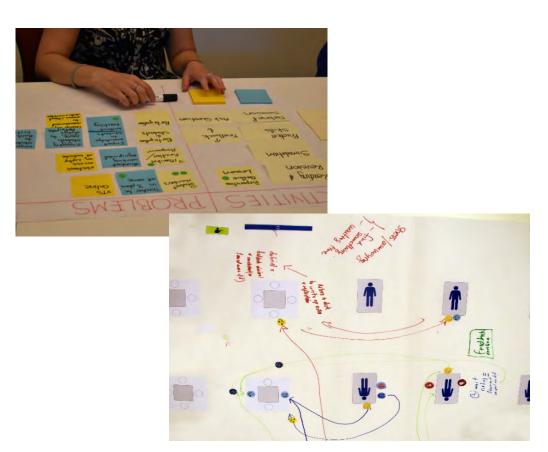
Framework @UTS for educators to **co-design** Analytics/AI → **augment teaching practice**

Educators

Student Task Design

Assessment

Features in the Data

Feedback & User Interface

Analytics/AI designers

Shibani, A., Knight, S. and Buckingham Shum, S. (2019). Contextualizable Learning Analytics Design: A Generic Model, and Writing Analytics Evaluations. *Proc. 9th International Conference on Learning Analytics & Knowledge (LAK19)*. ACM Press, NY, pp. 210-219. DOI: https://doi.org/10.1145/3303772.3303785. Eprint: https://tinyurl.com/lak19clad

Co-design to build educators' trust in AI/Analytics

http://heta.io/how-can-writing-analytics-researchers-rapidly-codesign-feedback-with-educators
Carlos G. Prieto-Alvarez, Roberto Martinez-Maldonado, & Anderson, T. (2018). Co-designing learning analytics tools with learners. In Jason M. Lodge, Jared Cooney Horvath, & L. Corrin (Eds.), *Learning analytics in the classroom: Translating learning analytics research for teachers* (Vol. 1). London: Routledge.

Instant feedback on collocated teamwork
→ nursing

High performance teamwork: nursing simulations
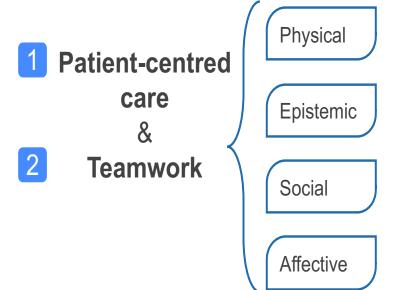
Student Task Design

Assessment

Physiological wristbands

Omnidirectional microphone

Ultra-wideband positioning tags

THE ANALYTICS CHALLENGE:
Making multimodal streams meaningful

From multimodal logs to higher-order constructs:

Assessment

Curriculum outcomes

1 **Patient-centred care**
&
2 **Teamwork**
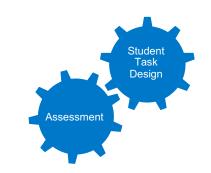
THE ANALYTICS CHALLENGE:
Making multimodal streams meaningful

From multimodal logs to higher-order constructs:

Curriculum outcomes

Dimensions of collaborative activity

Student Task Design

Assessment

1 **Patient-centred care**
&
2 **Teamwork**

- Physical
- Epistemic
- Social
- Affective

THE ANALYTICS CHALLENGE:
Making multimodal streams meaningful

From multimodal logs to higher-order constructs:

Student Task Design

Assessment

Curriculum outcomes

Dimensions of collaborative activity

1 **Patient-centred care**
&
2 **Teamwork**
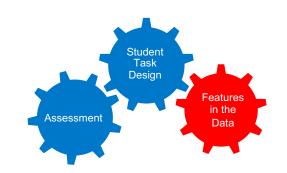
Physical
- Embodied strategies
- Proximity to patient/objects
- Intensity of physical activity

Epistemic
- Actions and procedures

Social
- Communication with patient
- Teamwork communication

Affective
- Changes in emotional arousal
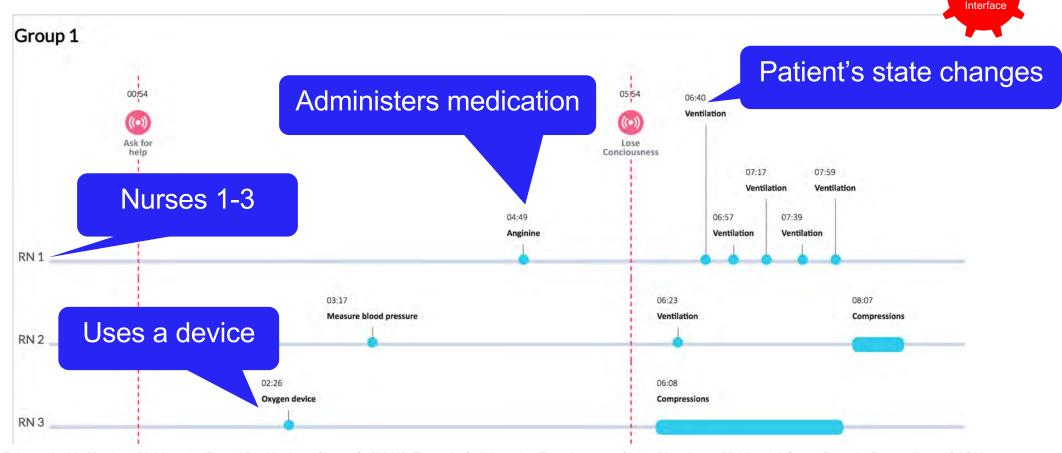
THE ANALYTICS CHALLENGE:
Making multimodal streams meaningful

From multimodal logs to higher-order constructs:

Curriculum outcomes

Dimensions of collaborative activity

Multimodal data sources

1 **Patient-centred care** & 2 **Teamwork**

Physical
- Embodied strategies ← Presence in meaningful zones
- Proximity to patient/objects ← Distance to the patient and the trolley
- Intensity of physical activity ← Wrist acceleration intensity

Epistemic
- Actions and procedures ← Actions registered by the manikin
- ← Critical procedures
- ← Interactions with objects

Social
- Communication with patient ← # and length of utterances by the patient
- Teamwork communication ← # and length of utterances by nurses

Affective
- Changes in emotional arousal ← Electrodermal activity peaks

Student Task Design

Assessment

Features in the Data

Personalised feedback on high performance teamwork
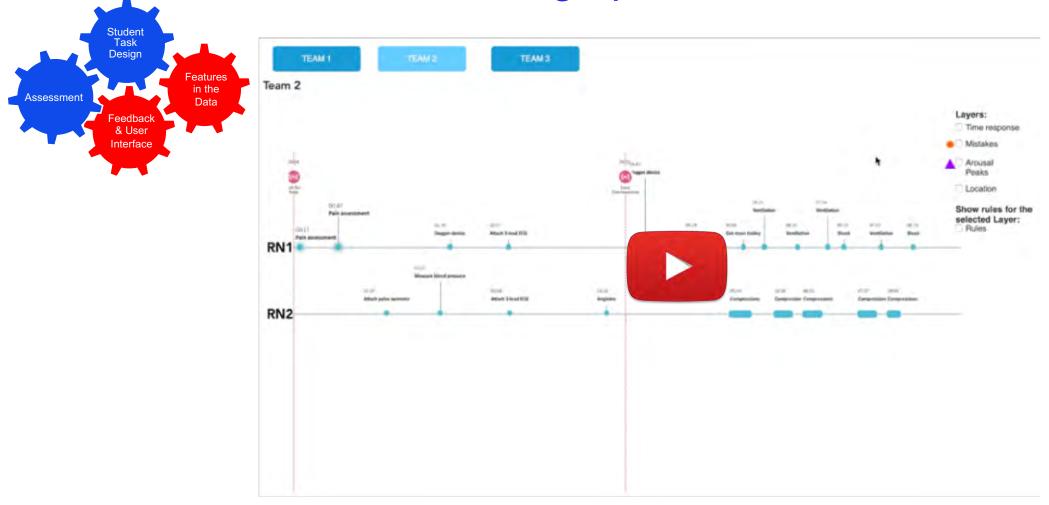
Who did what, when in a nursing simulation? Team Timeline for evidence-based debriefings

Echeverria, V., Martinez-Maldonado, R. and Buckingham Shum, S. (2019). Towards Collaboration Translucence: Giving Meaning to Multimodal Group Data. In *Proceedings of ACM Conference on Human Factors in Computing (CHI'19)*. ACM: NY. Paper 39, pp. 1-16. https://doi.org/10.1145/3290605.3300269 Open Access Eprint: http://bit.ly/chi19utscic

Personalised feedback on high performance teamwork

Student reaction to automated feedback on teamwork
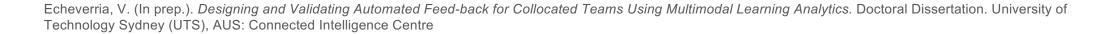
"This tool helped me have quantitative data to reflect on.
I can actively look back and see my exact actions, not just other perceptions of it"

"…while RN4 and RN2 were doing the fluids I was staying with the patient. It is good to step back and look at what each person was doing, one thing at the same time, I think it shows you how you worked as a team"

Echeverria, V., Martinez-Maldonado, R. and Buckingham Shum, S. (2019). Towards Collaboration Translucence: Giving Meaning to Multimodal Group Data. In *Proceedings of ACM Conference on Human Factors in Computing (CHI'19)*. ACM: NY. Paper 39, pp. 1-16. https://doi.org/10.1145/3290605.3300269 Open Access Eprint: http://bit.ly/chi19utscic

Educator reaction to automated feedback on teamwork

"I think it would be really helpful for students … if you gave them really structured reflection questions … and asked them to reflect on what they were doing — whether it was accurate or not, how they're engaging with the patient and other team members, what they were thinking and feeling at the time — it would be a really valuable tool for deep reflection."

Echeverria, V. (In prep.). *Designing and Validating Automated Feed-back for Collocated Teams Using Multimodal Learning Analytics.* Doctoral Dissertation. University of Technology Sydney (UTS), AUS: Connected Intelligence Centre

Instant feedback on academic writing

→ personal, experiential, reflective

UTS

AcaWriter: how we introduce students to automated feedback on their writing

https://youtu.be/xUoe3c0ErSY

Maintaining learner agency in response to AI
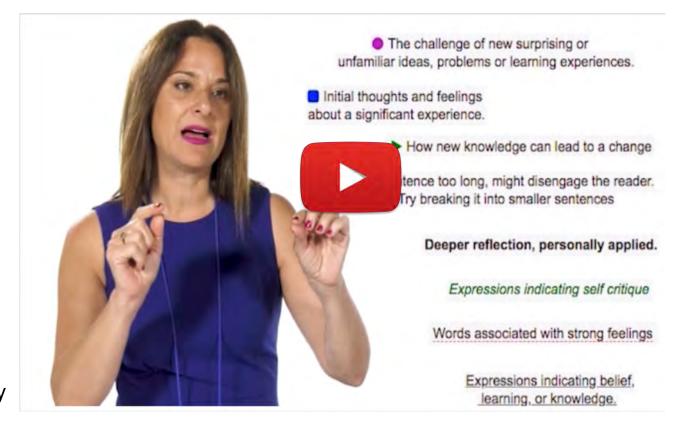
Analytical Report | **Feedback** | **Examples**

The rhetorical moves highlighted by AcaWriter are used in good academic writing but use them with caution according to the context. Remember, AcaWriter does not really understand your writing, the way people do. You may have written beautifully crafted nonsense - that's for you to decide! Moreover, writing is complex, and AcaWriter will get it wrong sometimes. If you think it got it wrong, that's fine - now you're thinking about more than spelling, grammar, and plagiarism.

Educator: AcaWriter supports professional reflection by Pharmacy students following work placements

Dr Cherie Lucas
Lecturer
UTS School of Pharmacy

https://cic.uts.edu.au/immediate-personalised-feedback-on-reflective-writing

Writing Context – Postgrad. Pharmacist reflection

Reflective Rubric [1]

Reflective Statement Assessment Rubric	Categories of reflection		
	Non-Reflector (0 Marks)	Reflector (0.5 Marks)	Critical Reflector (1 Mark)
Stage 1: Returning to experience	Statement does not provide a clear description of the learning event itself	Statement provides a description of the learning event	Statement provides description of the learning event chronologically and clear of any judgments
Stage 2: Attending to feelings	Statement provides little or no evidence of personal feelings, thoughts	Statement conveys some personal feelings and thoughts of the learning event but does not relate to personal learning	Statement conveys personal feelings, thoughts (positive and or negative) of the learning event and relates to future personal learning
Stage 3: Association: relates new knowledge with previous knowledge	Statement does not provide any links between new knowledge and previous knowledge	Statement provides evidence that prior knowledge may be consistent with new knowledge gained through this task	Statement clearly relates new knowledge learned with previous knowledge and sees how accommodating new knowledge will assist with future clinical pharmacy practice
Stage 4: Integration	Statement shows no evidence of integration of prior knowledge, feelings or attitudes with new knowledge, feelings or attitudes, thus not arriving at new perspectives	Statement provides some evidence of integration prior knowledge, feelings or attitudes with new knowledge, feelings or attitudes and arriving at new perspective	Statement clearly provides evidence of integration of prior knowledge, feelings or attitudes with new knowledge, feelings or attitudes, thus arriving at new perspectives.
Stage 5: Validation: ("Internal consistency") self-assessing our beliefs, approaches, assumptions	Statement shows no evidence of self-reflection and self-assessing of previously held beliefs, assumptions, approaches and does not relate to experience	Statement demonstrates self-reflection, self-assessment of previously held beliefs, assumptions, approaches, and occasionally relates it to previous experience and	Statements clearly conveys self-reflection and self-assessment of previously held beliefs, assumptions, approaches, consistently relating it to previous
Stage 6: Appropriation: internalising the knowledge gained in the learning event	Statement		

Assessment

Features in the Data

Feedback & User Interface

Key to the automated annotations on writing

Important aspects of reflective writing:

- ■ Initial thoughts and feelings about a significant experience.
- ● The challenge of new surprising or unfamiliar ideas, problems or learning experiences.
- ▲ How new knowledge can lead to change

Bold: Deeper reflection, personally applied.

Plain: Expressions indicating belief, learning, or knowledge.

Dotted: Expressions indicating self critique.

Dashed: Words associated with strong feelings.

AcaWriter feedback tuned for Pharmacy reflection

Feedback
& User
Interface

■ **It is hard to believe** that I started placement almost three months ago. ● It has definitely been full of challenging experiences which have shaped my understanding of the role of a pharmacist. During my time at   Pharmacy I was able to observe different sides of pharmacy including pharmacist-patient interactions, retail, administration and the clinical aspects. To be honest my first thoughts going into placement were negative. I dreaded the idea of having to interact with patients as well as engaging with employees of the pharmacy. ● I felt that my lack of experience would cause an inconvenience and I would leave a negative impression in front of the pharmacist and other employees. However, I came to realise that my preceptor is an exceptional teacher and as the weeks progressed I begun to look up to him as a mentor. ● Despite my lack of experience my preceptor ensured I observed different counselling situations and even encouraged me to engage directly with patients from the early days of placement. By allowing me to engage with patients I have been able to build on important communication skills. ▲ **My preceptor would also observe my weaknesses and bring them to my attention so that each week we would work on overcoming my weaknesses and turning them into strengths.**

AcaWriter feedback tuned for Pharmacy reflection

Feedback & User Interface

It appears that you've acknowledged your first thoughts, feelings and/or reactions to an incident, or learning task, within the first paragraph.

Well done, it appears that you've reflected on how you would change/prepare for the future. Is there anything further to say about these new insights that have led to change.

While it appears that you've reported on how you would change/prepare for the future, you don't seem to have reported first on what you found challenging. Perhaps you've reflected only on the positive aspects in your report?.

Instant feedback on academic writing

→ persuasive, argumentative

UTS

A hallmark of academic writing is that it works with ideas.

Such writing typically displays specific "rhetorical moves" — a clear signal to the reader what the sentence's purpose is in the persuasive narrative, e.g.

Contrast

"However, a recognized challenge is…"
"Despite repeated efforts…"
"Although it was predicted that…"

Signalling to readers that we're "working with ideas"
Archetypal rhetorical moves made in academic writing

Move	Examples
Background	While data was previously studied in educational research, analytics now enables more… Recent studies indicate that the effects of the drug could be permanent.
Summary	This paper will examine the question of how we develop scalable learning analytics applications
Contrast	However, a recognized challenge in the field of learning analytics is the uncertainty around LA's pedagogical relevance
Question	Little research exists on how automated feedback impacts student writing.

Signalling to readers that we're "working with ideas"
Archetypal rhetorical moves made in academic writing

Move	Examples
Emphasis	The key elements for this approach are... It is important to note that the policy applies to all universities.
Novelty	This new model suggests a view of learning that is an embodied and relational process
Surprise	Surprisingly, the results indicate a weak link between customer satisfaction and brand value.
Trend	With the growing quantity of data generated, there is increasing interest in analytics

Educator: explains to her students why good lawyers know how to use rhetorical moves

Using Writing Analytics software in UTS Civil Law

Connected Intelligence Centre | University of Technol... - 2 / 5

1. Introduction to LESA Project with Writing Analytics, UTS 1:05
   Connected Intelligence Centre | Universit...

2. Persuasive writing for lawyers using rhetorical moves 5:54
   Connected Intelligence Centre | Universit...

3. More examples of rhetorical moves in legal writing 2:38
   Connected Intelligence Centre | Universit...

4. Using AcaWriter software for law essays 3:40
   Connected Intelligence Centre | Universit...

DR. PHILIPPA RYAN
Faculty of Law, UTS

https://youtu.be/ruN_Vy3knB8

"[rhetorical moves] indicate to the reader the writer's *attitude* to the text.
Why do we worry about that? Because as lawyers, our job is to […] argue that the way that *we* see the facts and the law favours a certain position or outcome."

Writing Context – Undergraduate Civil Law essay

Genre: critical analysis and argumentation

Assessment

Rubric Element	AcaWriter Tag	Example Sentence
Engagement with law and scholarly literature	B Background	The Concept of good faith **has previously been thought to be** a work-in-progress in Australia
Statement of thesis/ argument	S Summary	**This article will** trace the origins of good faith and its development in the common law.
Essay plan	S Summary	**This essay contains** three parts. The first part will talk about [...]
Critical analysis, evaluation, original insight	C Contrast E Emphasis	**However**, where the obligations are found in statute and they conflict with contractual obligations, it is **important to note** that the former must prevail.
Drawing together themes and reaching logical conclusion	S Summary	**In conclusion**, the reasonable behavior required under the standard of good faith does not preclude strong bargaining techniques [...]

Features in the Data

AcaWriter feedback tuned for Civil Law

Feedback & User Interface

NOTE: Computers don't understand writing like humans. So, AcaWriter may highlight rhetorically good sentences that actually make no sense, or leave un-highlighted a sentence that you feel is really good. It's fine to disagree with the feedback — but it's also your job to check your facts!

| Analytical Report | Feedback | Examples |

The analytical report highlights salient rhetorical moves AcaWriter identified in your essay for reflection. For more specific feedback, go to the Feedback tab.

Rhetorical Moves

- **S** Summarises or signals the authors goals   **P** Perspective or stance   **E** Emphasis to highlight key ideas
- **N** Novel improvements in ideas   **C** Contrasting idea, tension or critical insight
- **B** Background information and previous work   **S** Surprising or unexpected finding
- **Q** Question or gap in previous knowledge   **T** Trend or tendency related to ideas

Technology is an enabler in providing greater access to justice through its ability to connect people with legal needs to legal assistance, information, and advice. **T** With the increasing popularity of internet-enabled hand held devices and laptop computers, there is a tendency to assume that even the socio-economically vulnerable in our society have access to technology and the skills to use online services with confidence. This is not necessarily the case.
Examples of the application of technology to provide legal information and assistance include case studies, guides and virtual legal advice clinics. **S** **C** The 2012 Review does not address the role of courts in serving the legal needs of the community. The court system is not regarded as a part of the wider legal assistance services. **C** This omission questions the role of the court in facilitating access to its services, including dispute resolution and trials. It also identified uses of technology to expand the delivery of services, many of which are transferable to an online court. These services include e-access for remote communities, availability outside of business hours, interactive processes and virtual appearances. **S** This essay will discuss uses of technology to expand the delivery of services, many of which are transferable to an online court.

AcaWriter feedback tuned for Civil Law

Feedback & User Interface

Analytical Report	Feedback	Examples

ℹ The rhetorical moves highlighted by AcaWriter are used in good academic writing but use them with caution according to the context. Remember, AcaWriter does not really understand your writing, the way people do. You may have written beautifully crafted nonsense - that's for you to decide! Moreover, writing is complex, and AcaWriter will get it wrong sometimes. If you think it got it wrong, that's fine - now you're thinking about more than spelling, grammar, and plagiarism.

❗ It looks like you are missing a Summary move that highlights the purpose (thesis) statement of your essay and your essay plan. Try including linguistic cues to make this move clearer in your writing. Examples: This essay talks about.., In this essay, I analyse..., This essay consists of three parts... The first part talks about..., In conclusion,...

❗ It looks like you are missing a Background move in your text, which highlights background information and previous literature on the topic. Try including linguistic cues to make this move clearer in your writing. Examples: The past decade has seen ...., Recent studies indicate ... ,It is generally accepted that..., the concept has previously been thought to be...

❗ It looks like you are missing Contrast/Question move, which highlights the critical insights in your essay. Try including linguistic cues to make this move clearer in your writing. Examples: However, the issue seems to be..., the study fails to consider, little research has been done..., ...raises various questions...

What does success look like?

- The writing exercise was meaningful without AcaWriter, but with AcaWriter it was rated significantly more useful

- Students who used AcaWriter made significantly more academic rhetorical moves in their revised essays

- A significantly higher proportion of AcaWriter users improved their drafts (many students degraded them across drafts)

- Students who used AcaWriter produced higher graded submissions if they engaged deeply with AcaWriter's feedback

Shibani, A., Knight, S. and Buckingham Shum, S. (2019). Contextualizable Learning Analytics Design: A Generic Model, and Writing Analytics Evaluations. *Proc. 9th International Conference on Learning Analytics & Knowledge (LAK19)*. ACM Press, NY, pp. 210-219. DOI: https://doi.org/10.1145/3303772.3303785. Open Access Eprint: https://tinyurl.com/lak19clad

Shibani, A. (2019, In Prep). *Augmenting Pedagogic Writing Practice with Contextualizable Learning Analytics*. Doctoral Dissertation, Connected Intelligence Centre, University of Technology Sydney

What does success look like?
Students feedback on AcaWriter

"It's like having a tutor or another person check and **give constructive feedback on your work.**"

Shibani, A., Knight, S. and Buckingham Shum, S. (2019). Contextualizable Learning Analytics Design: A Generic Model, and Writing Analytics Evaluations. *Proc. 9th International Conference on Learning Analytics & Knowledge (LAK19)*. ACM Press, NY, pp. 210-219. DOI: https://doi.org/10.1145/3303772.3303785. Open Access Eprint: https://tinyurl.com/lak19clad

What does success look like?
Students feedback on AcaWriter

"When you're editing your own writing, **you automatically think that your work sounds good** and that all your ideas and views have been clearly conveyed. This exercise was useful in the sense that it **indicated areas where I needed to be more explicit, which on my own I would not have noticed.**"

Shibani, A., Knight, S. and Buckingham Shum, S. (2019). Contextualizable Learning Analytics Design: A Generic Model, and Writing Analytics Evaluations. *Proc. 9th International Conference on Learning Analytics & Knowledge (LAK19)*. ACM Press, NY, pp. 210-219. DOI: https://doi.org/10.1145/3303772.3303785. Open Access Eprint: https://tinyurl.com/lak19clad

What does success look like?
Students feedback on AcaWriter

"I think what is being taught is something I was already aware of. However, by being forced to actually identify **ways of arguing, along with the types of words used to do so**, it has broadened my perspective. I think I will be **more aware of the way I am writing now.**"

Shibani, A., Knight, S. and Buckingham Shum, S. (2019). Contextualizable Learning Analytics Design: A Generic Model, and Writing Analytics Evaluations. *Proc. 9th International Conference on Learning Analytics & Knowledge (LAK19)*. ACM Press, NY, pp. 210-219. DOI: https://doi.org/10.1145/3303772.3303785. Open Access Eprint: https://tinyurl.com/lak19clad

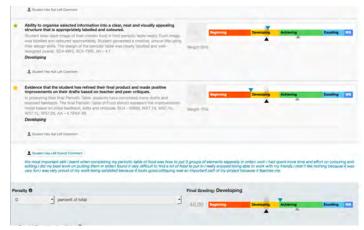# What does success look like?
Academics feedback on AcaWriter

"**We can't afford to give formative feedback when we have 400 students** because it already takes us maybe about 20 hours to mark one class of these assignments — and so we can't have the tutors spend that time again giving formative feedback. So, we had to do it in a way that is time-efficient."

Shibani, A. (2019, In Prep). *Augmenting Pedagogic Writing Practice with Contextualizable Learning Analytics.* Doctoral Dissertation, Connected Intelligence Centre, University of Technology Sydney

What does success look like?
Educators' feedback on AcaWriter

"Overall, since we've been working with CIC around written communication over the course of the last four of five semesters, **we have seen marked improvement in students' written communication**. Overall their individual assignment pass-rate is going up... We are seeing improvements in the number of students who are either **meeting or exceeding the expectations** around written communication"

Shibani, A. (2019, In Prep). *Augmenting Pedagogic Writing Practice with Contextualizable Learning Analytics.* Doctoral Dissertation, Connected Intelligence Centre, University of Technology Sydney

That's just 2 examples: 2 more to check out from UTS research into the future of assessment….

http://academ.com.au/review

Change assessment, and you change the system
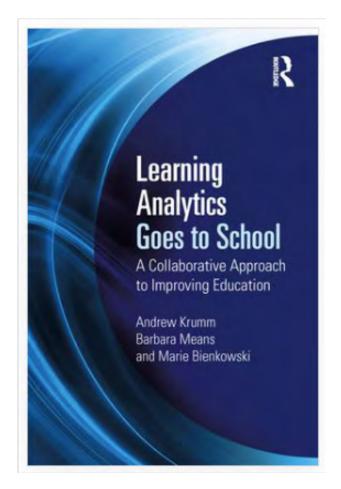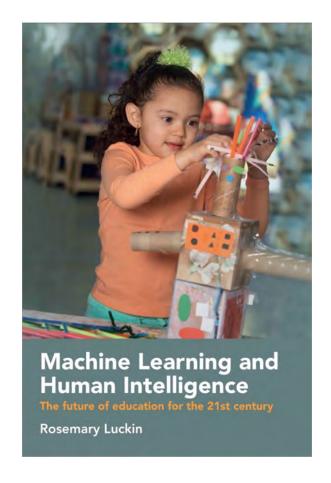Mapping learning outcomes to track General Capabilities

https://jearni.co

Rigorous assessment of Learning Dispositions
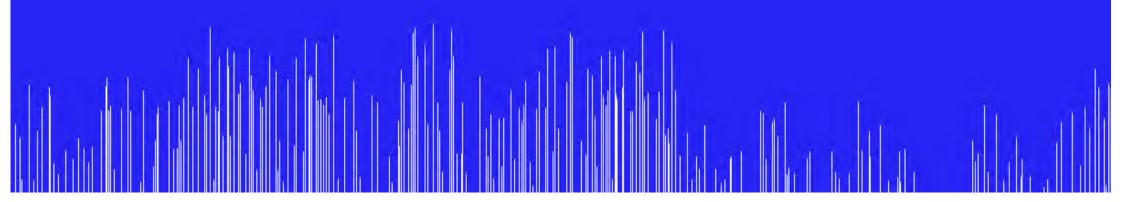Learning Journeys platform for self-directed projects.

Recommended…

https://www.routledge.com/Learning-Analytics-Goes-to-School-A-Collaborative-Approach-to-Improving/Krumm-Means-Bienkowski/p/book/9781138121836
https://www.ucl-ioe-press.com/books/education-and-technology/machine-learning-and-human-intelligence

This is what it looks like when we use AI/Analytics to teach transferable competencies…

close the feedback loop

timely • evidence-based • personalised • actionable