UTS
UNIVERSITY OF TECHNOLOGY SYDNEY

Designing for student facing learning analytics

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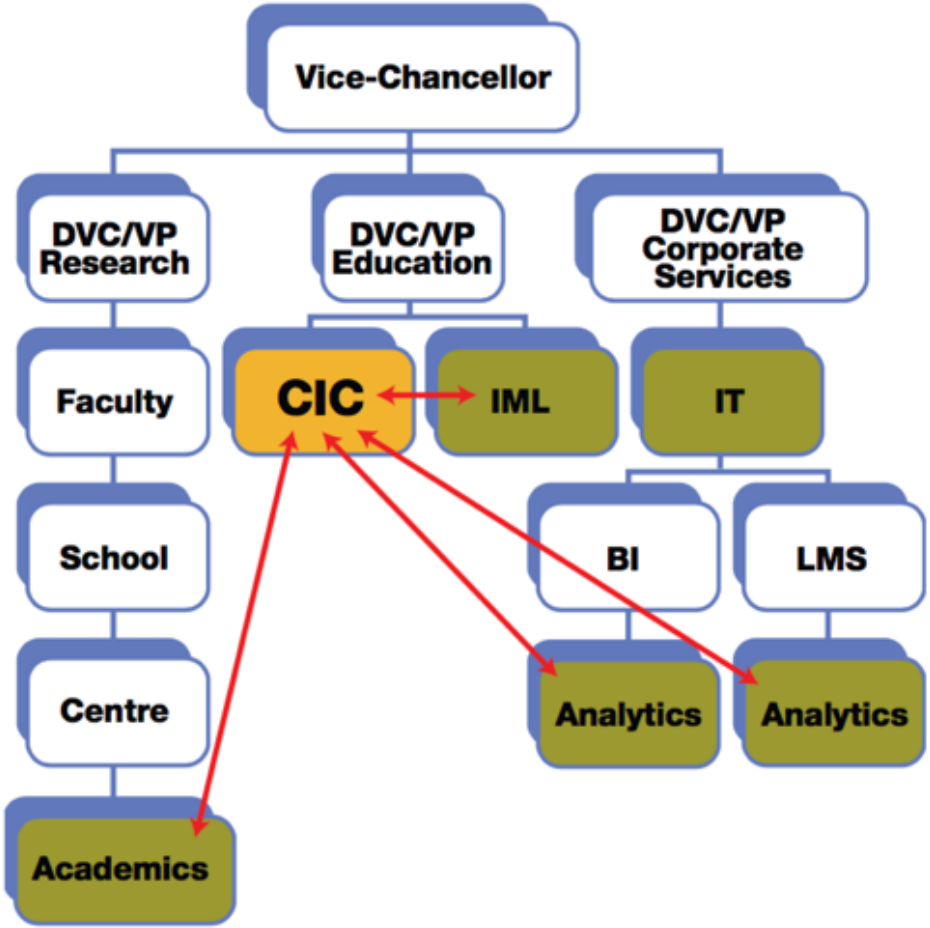
UTS:CIC
CONNECTED INTELLIGENCE CENTRE

utscic.edu.au

what is UTS:CIC?

Connected Intelligence Centre

- UTS innovation lab specialising in Learning Analytics
- provides in house data science consultancy
- academics teach data science and perform research
- trains PhDs in Learning Analytics



Buckingham Shum, S., & Mckay, T. (2018). Architecting for Learning Analytics: Innovating for Sustainable Impact. Educause Review, 53(2), 25-37.

what is learning analytics? (LA)

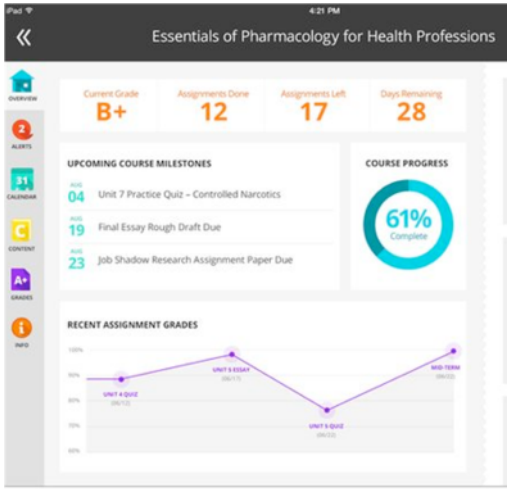
Learning analytics is the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimising learning and the environments in which it occurs

SoLAR definition

example: course signals at Purdue

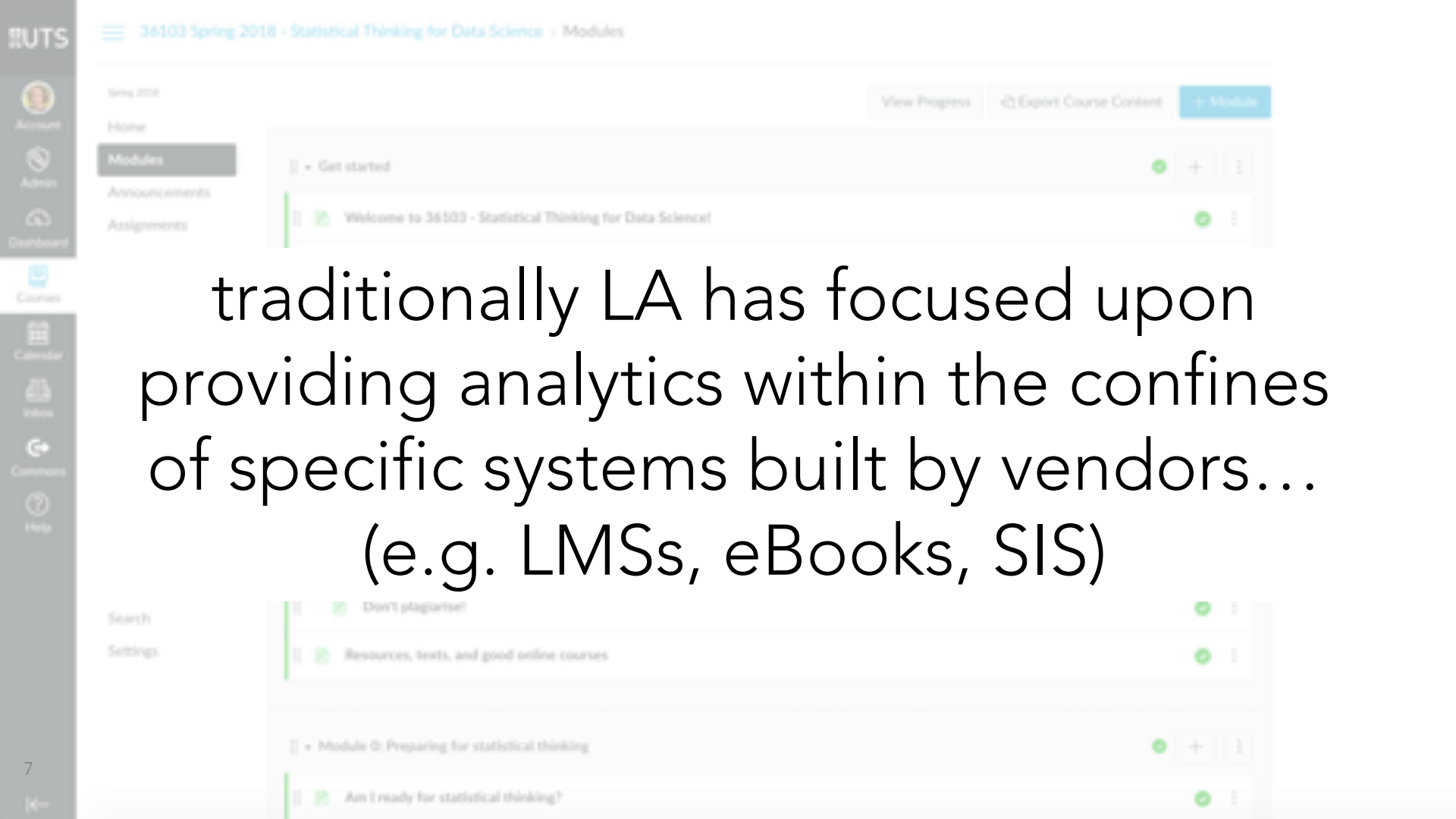
Arnold, K. E., & Pistilli, M. D. (2012). Course signals at Purdue: Using learning analytics to increase student success. In Proceedings of the 2nd international conference on learning analytics and knowledge (pp. 267-270). ACM.

many EdTech systems offering some form of LA



BUT is it any good?

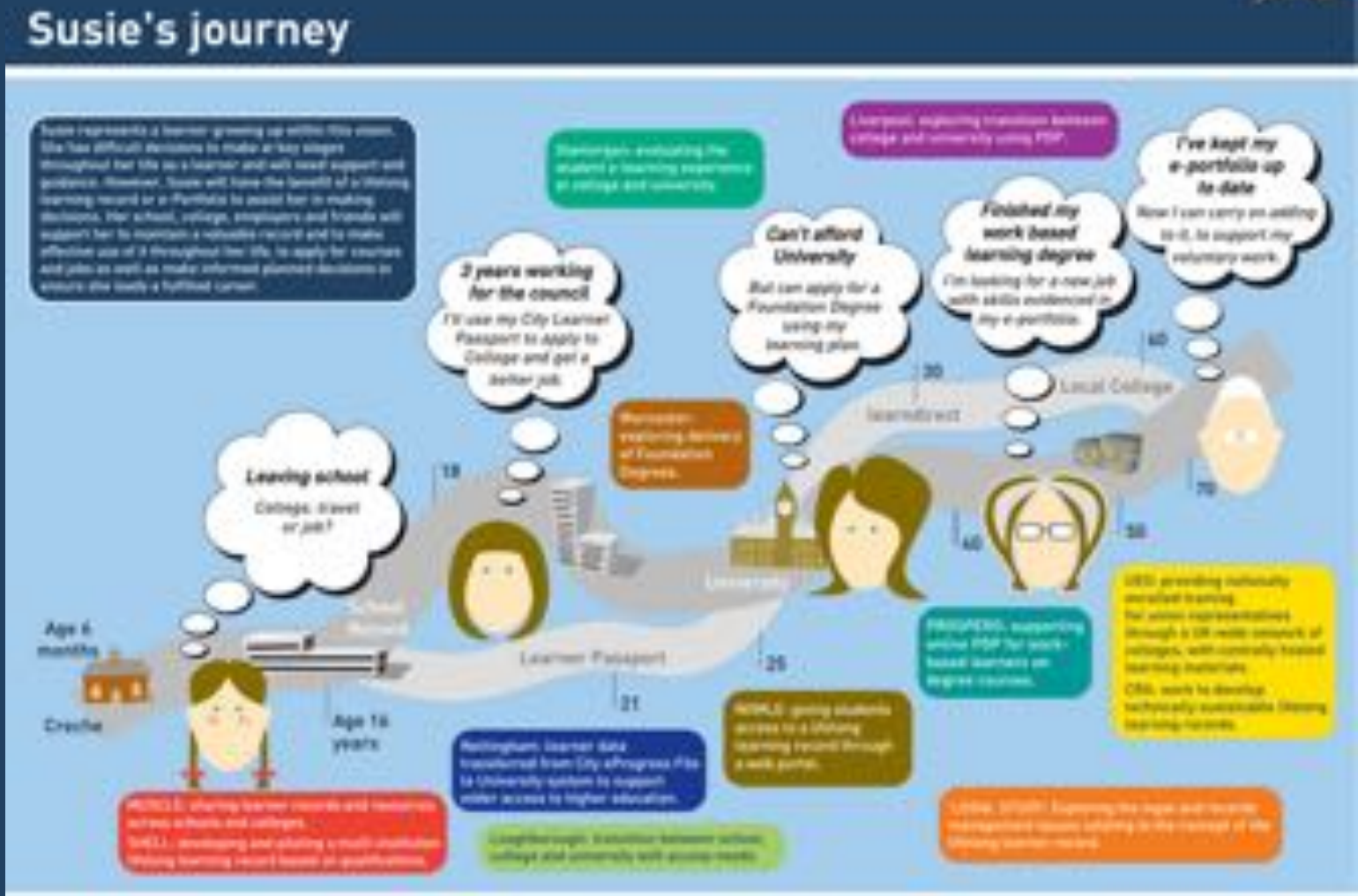
where does learning happen?


traditionally LA has focused upon providing analytics within the confines of specific systems built by vendors…
(e.g. LMSs, eBooks, SIS)

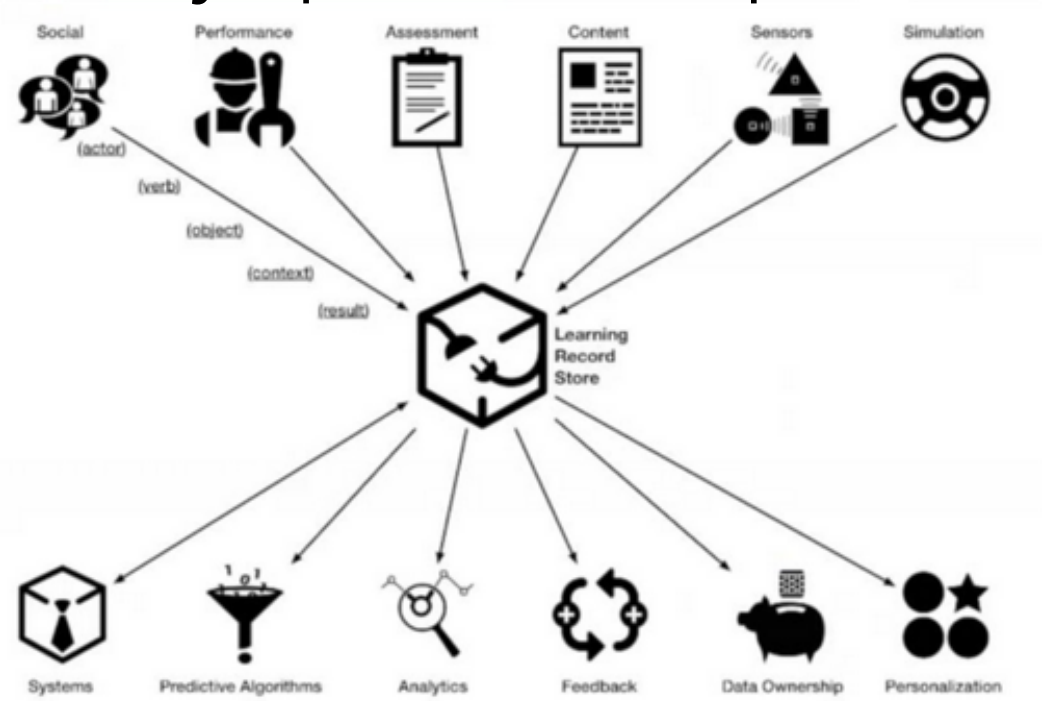
but learning happens everywhere!

https://commons.wikimedia.org/wiki/File:Andrea_Leslie_helps_students_search_(8696541130).jpg

and learning occurs over a lifetime!



new data standards are emerging to help us collect and harmonise data from many spaces and places



http://mfeldstein.com/recommended-viewing-learning-analytics-webinar-on-caliper-and-xapi/


so a lot of data is coming to education!
but how can we use it effectively?

careful… data must be cooked with care!

- *are you capturing all of the relevant data?*
- *is what you are collecting even useful?*
- *or are you just collecting it because you can?*
- *and what metrics are you developing from your data?*

Bowker, G. C. (2005). Memory practices in the sciences (Vol. 205). Cambridge, MA: Mit Press.

the clicks to constructs problem

low level click steam data rarely yields significant insights

BUT a careful mapping to educational constructs can lead to far more useful outcomes

Kitto, K., Buckingham Shum, S., Gibson, A. (2018). Embracing imperfection in learning analytics. In Proceedings of the 8th International Conference on Learning Analytics and Knowledge (LAK '18). ACM, New York, NY, USA, 451-460. DOI: https://doi.org/10.1145/3170358.3170413

http://www.celt.iastate.edu/teaching/effective-teaching-practices/revised-blooms-taxonomy

student facing LA

but what *type* of student facing LA are we talking about?

Are students acquiring:

content and skills?

or

learning to learn?

we should give students access to *rich* LA

In principle this should help to promote things like:

- *learning to learn*
- *metacognition and reflection*
- *interpretation and sensemaking*
- *data literacy*
- *lifelong learning*

And ethically… is it reasonable not to give students access to the data that they themselves generate?

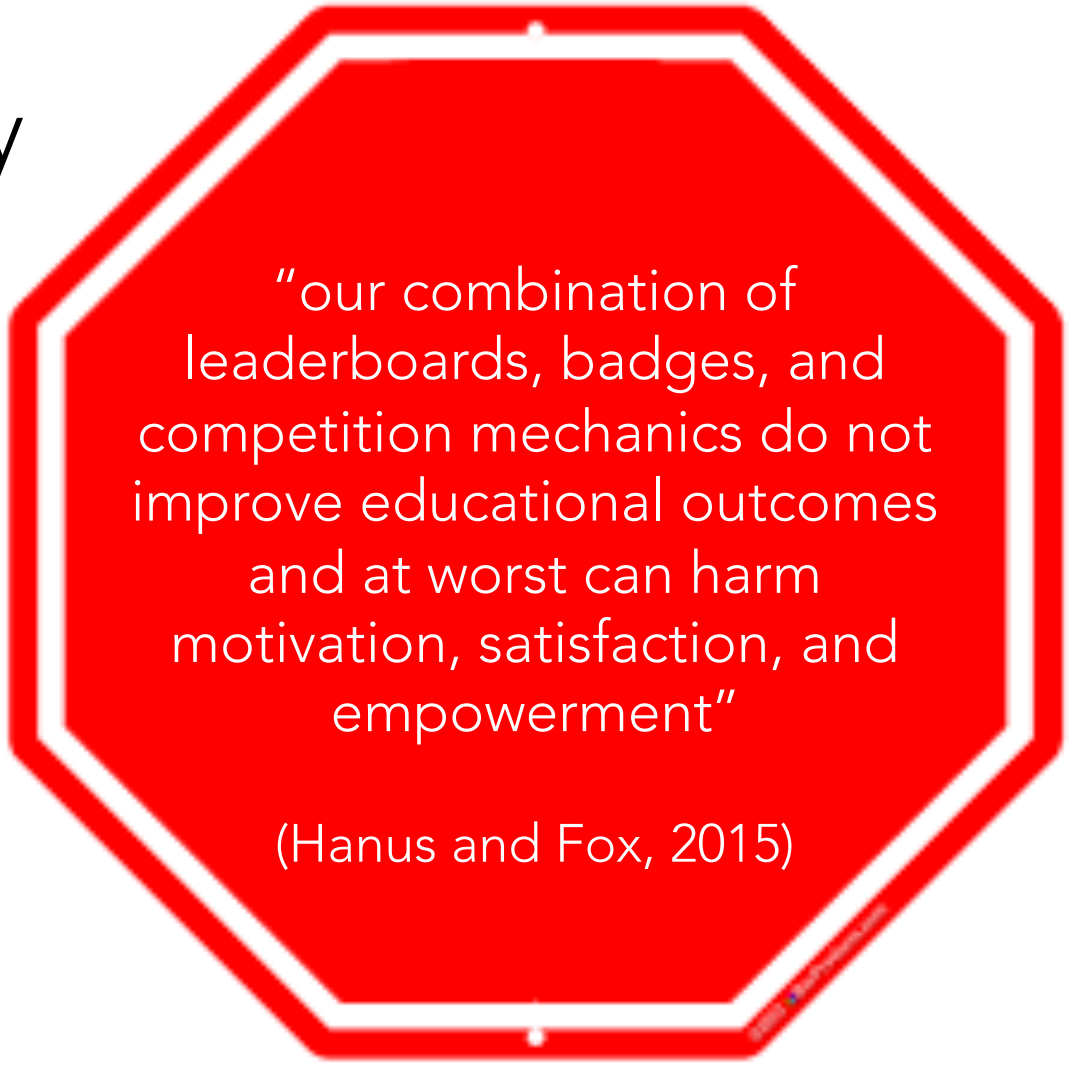
but care is required!

what would a student do if:

- they were told by a predictive model that they were failing a subject?
- a dashboard showed them at the bottom of a leader board?
- … at the top?
- a predictive model told them something they knew was wrong?
- a social network tool showed them as the only student who was not connected to anyone else in class? … and they were suffering from anxiety and depression?

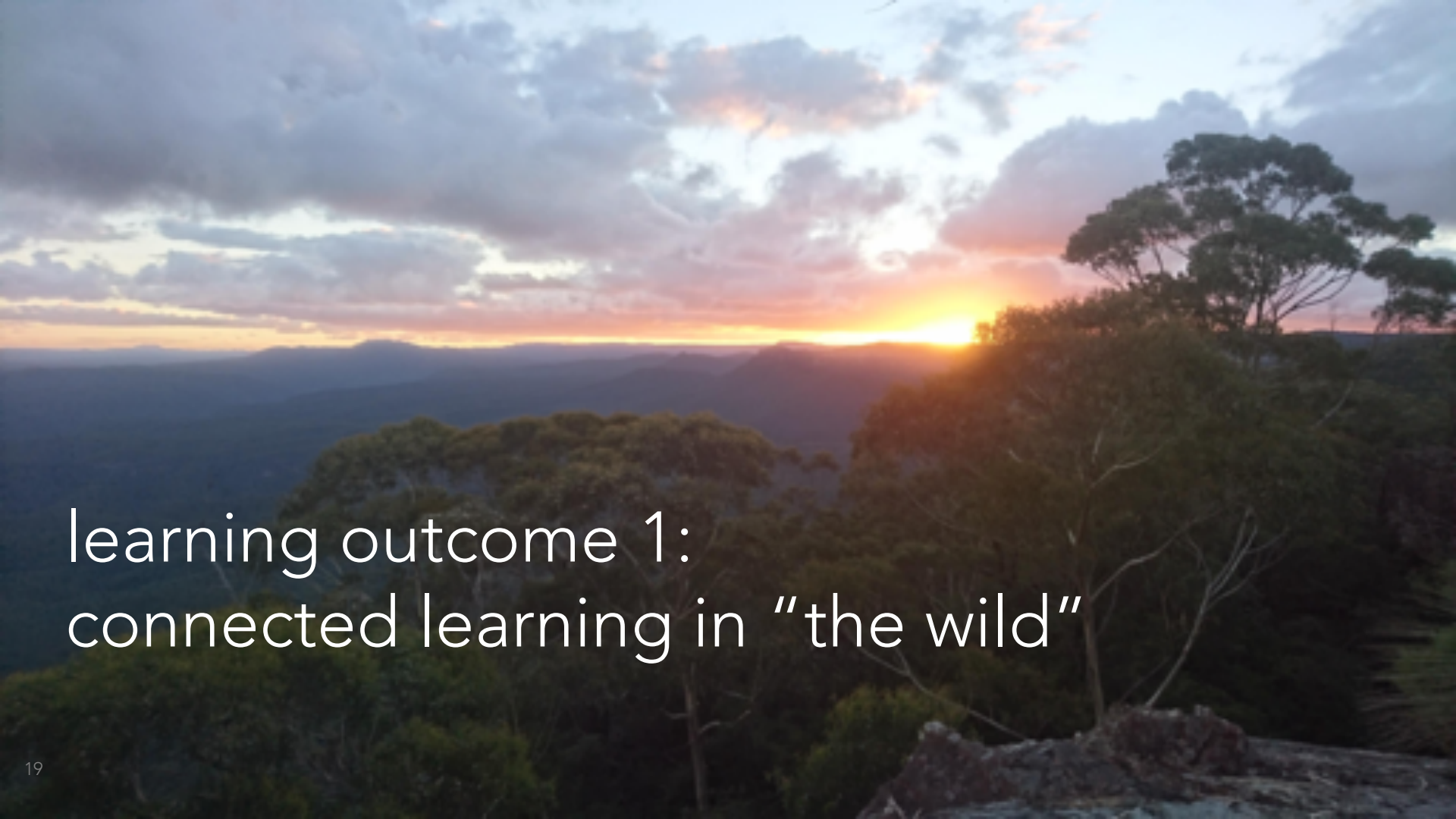
http://maxpixel.freegreatpicture.com/Worry-Angst-Fear-Anguish-Anxiety-Apprehension-802639

things can go very wrong with naïve approaches



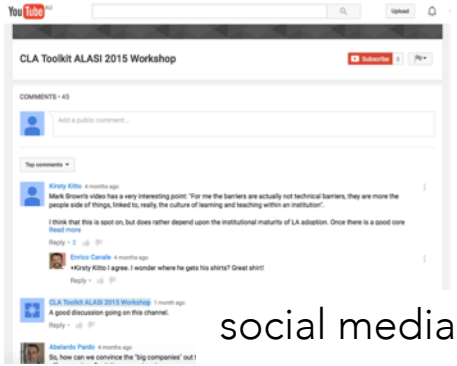
Hanus, M. D., & Fox, J. (2015). Assessing the effects of gamification in the classroom: A longitudinal study of intrinsic motivation, social comparison, satisfaction, effort, and academic performance. Computers & Education, 8, 152–161.

Khan, I., & Pardo, A. (2016). Data2U: Scalable real time student feedback in active learning environments. In Proceedings of the international conference on learning analytics and knowledge (pp. 249–253). Edinburgh, Scotland: ACM.



learning outcome 1:
connected learning in “the wild”

the connected learning analytics toolkit



social media

Learning
Record Store

scraping

xAPI

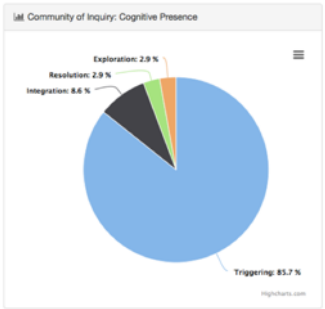
analysis

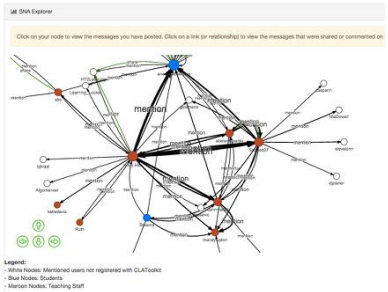
learning analytics

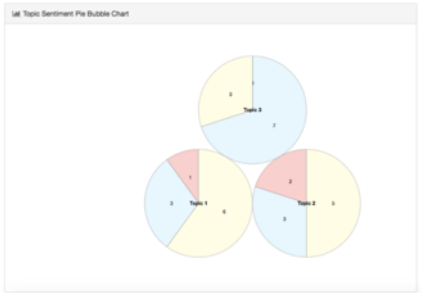
students

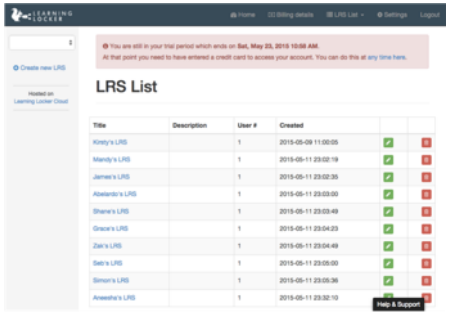
academics

admin & developers









ID14-3821: ENABLING CONNECTED LEARNING VIA OPEN SOURCE ANALYTICS IN THE WILD: LEARNING ANALYTICS BEYOND THE LMS

This project is supported by the Australian Government's office for learning and teaching

QUEENSLAND UNIVERSITY OF TECHNOLOGY:
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UNIVERSITY OF SOUTH AUSTRALIA
Shane Dawson, Dragan Gašević (Uni of Edinburgh)

UNIVERSITY OF TECHNOLOGY SYDNEY
Simon Buckingham Shum (and now Kirsty Kitto!)

UNIVERSITY OF SYDNEY
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UNIVERSITY OF TEXAS (ARLINGTON)
George Siemens

Queensland University of Technology

University of South Australia

UTS UNIVERSITY OF TECHNOLOGY, SYDNEY

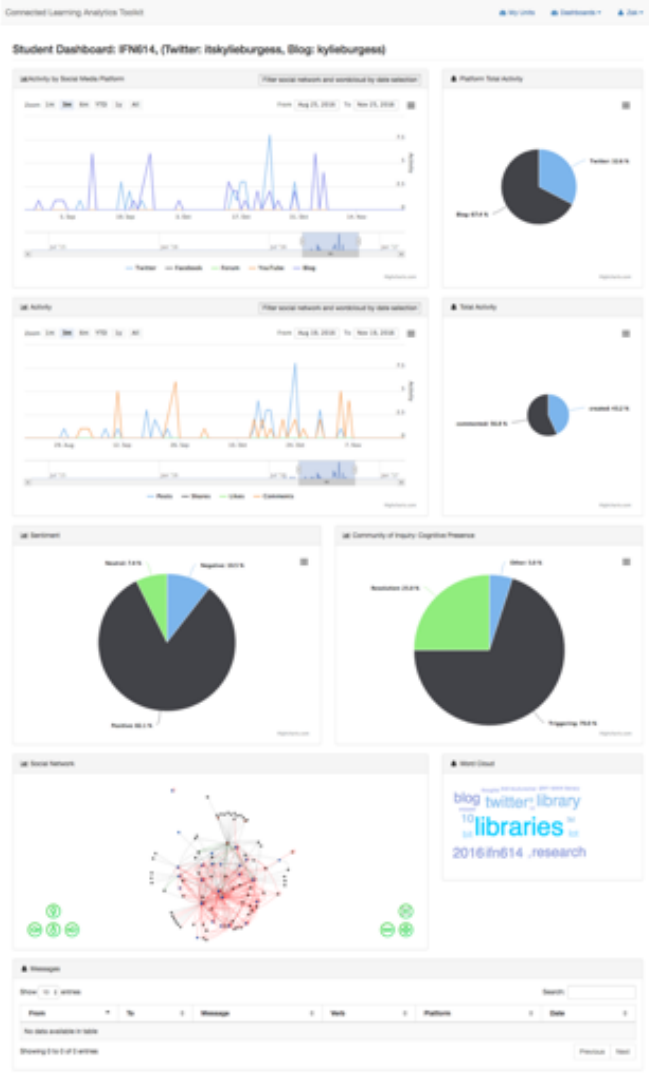
THE UNIVERSITY OF SYDNEY

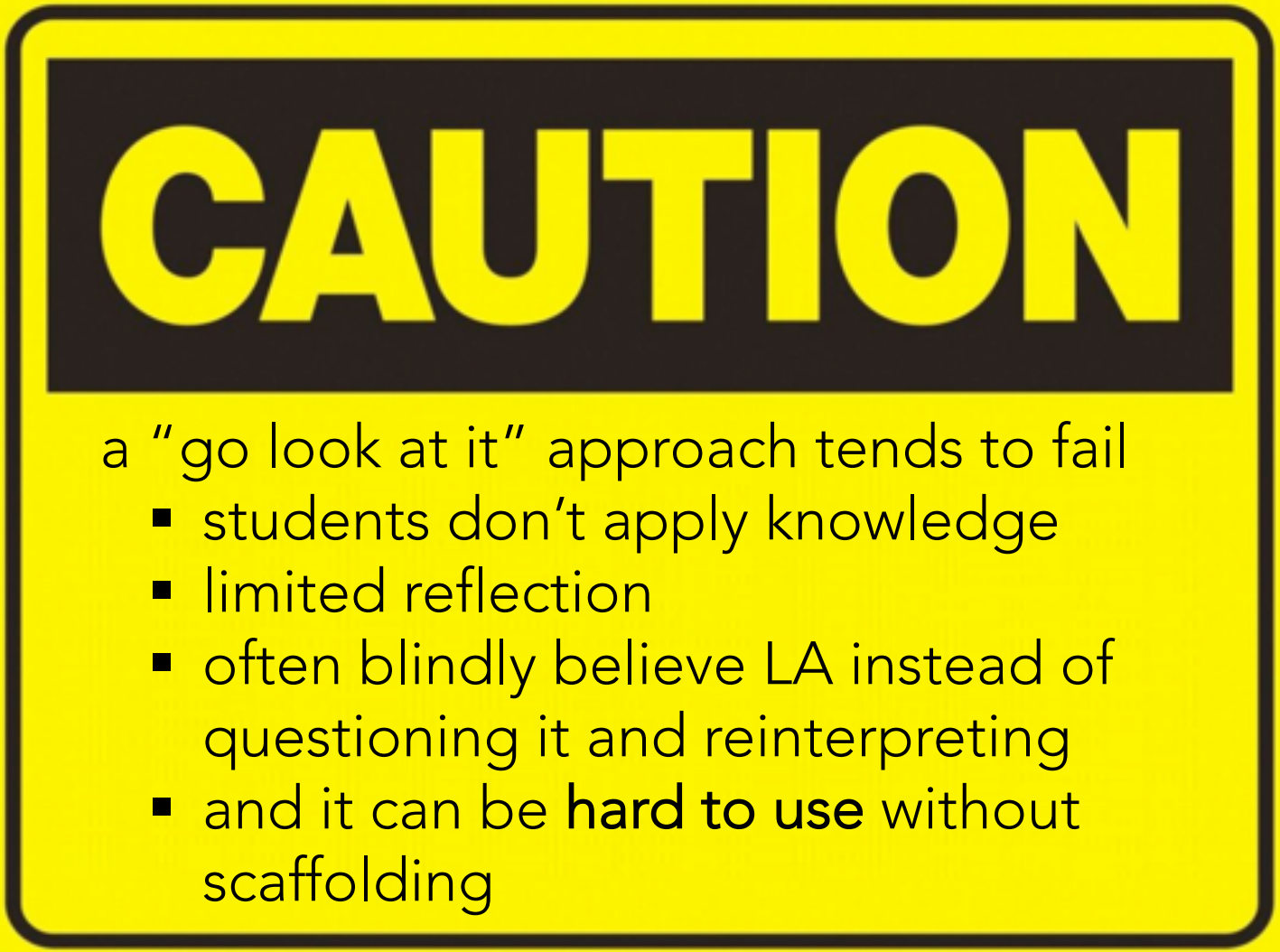
UNIVERSITY OF TEXAS ARLINGTON

some details (CLA toolkit)

1. Has a philosophy of going to the students where they are actually learning (rather than expecting them to come to us)
2. Can currently access data from: wordpress blogs, twitter, youtube, facebook, trello, github, slack
3. Stores data in xAPI format (to ensure future interoperability)
4. Only retrieves data for specific learning activities and only if students sign up
5. And gives students access to their own analytics

Question: How can we give students access to rich LA that encourages metacognition and reflection?





a "go look at it" approach tends to fail

- students don't apply knowledge
- limited reflection
- often blindly believe LA instead of questioning it and reinterpreting
- and it can be **hard to use** without scaffolding


Learning design patterns
for student facing LA

do-analyse-change-reflect

Do: Students are instructed to participate in some sort of activity.

Analyse: Students are encouraged to consider LA dashboards that have data collected during the *do* phase.

Change: Students encouraged to consider *changing* their behaviour as a result of the analytics that they see in the *analyse* phase.

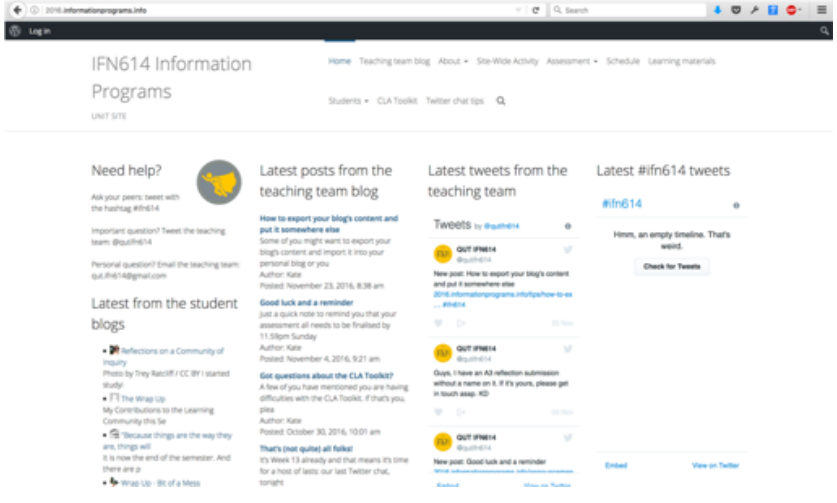
Reflect: Students participate in a reflective process where they explain how they used the LA to make sense of their behaviour, and whether they decided to change as a result (and how).

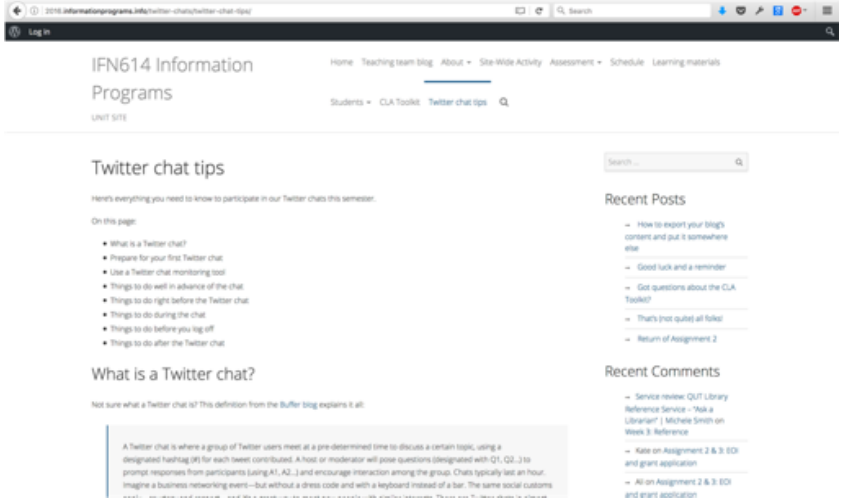
Kitto, K., Lupton, M., Davis, K., Waters, Z. (2017). Designing for Student Facing Learning Analytics, Australasian Journal of Educational Technology, 33(5), 152-168.

Kitto, K., Lupton, M., Davis, K., Waters, Z. (2016). Incorporating student-facing learning analytics into pedagogical practice. In S. Barker, S. Dawson, A. Pardo, & C. Colvin (Eds.), Show Me The Learning. Proceedings ASCILITE 2016 Adelaide, pp. 338-347.

does it work? … maybe

Unit	Semester	Aim/pattern	Linked to assessment	N=
IFN614 Information Programs	S2, 2015	Piquing students curiosity Examine, relabel classifier	No	S:12 AL:6
IAB260 Social Technologies	S1, 2016	Do-analyse-change-reflect	Yes	S:23 B:17
IFN614 Information Programs	S2, 2016	Do-analyse-change-reflect (predict, compare)	Yes	S:21 B:11





for example (Trial 3)

Do: blogging assignment was introduced in the first week of semester

Analyse: In week 2 students were introduced to the CoI model (Garrison et al., 2001) and were encouraged to sign up for the CLA toolkit (optional)

- a class provided an overview of the CoI model and the CLA toolkit
- 23/40 signed up (eventually)
- Students blogged about role and activity they were aiming for

Change: Students encouraged to think about how they were contributing to the community using data in the CLA toolkit dashboard and to change

Reflect: In week 14 students were required to critically evaluate their engagement with respect to their aims in week 2 (assessed!)

Garrison, Anderson, Archer (2001) Critical thinking, cognitive presence, and computer conferencing in distance education. *American journal of distance education*, 15(1):7–23

final blog post prompt for Trial 3

- What role did you want to play in the community this semester? Did you achieve that?
- How many comments did you make on your peers' posts
- Why did you comment as much as you did; what factors influenced the volume of your contributions?
- Did you need to modify your instinctive behaviour to engage the way you wanted to, or felt you should, engage?

Score	Level of analysis	N = 11
1	Included some /all graphs with no reference or analysis	1
2	Included some/all graphs, quantitative analysis relating activity to personality &/or interest	2
3	Included some/all graphs, quantitative analysis relating activity to personality &/or interest, basic analysis on activity in relation to week 2 aim	5
4	Included some/all graphs, referred back to week 2 aim, compared & contrasted, mentioned qualitative aspects	3

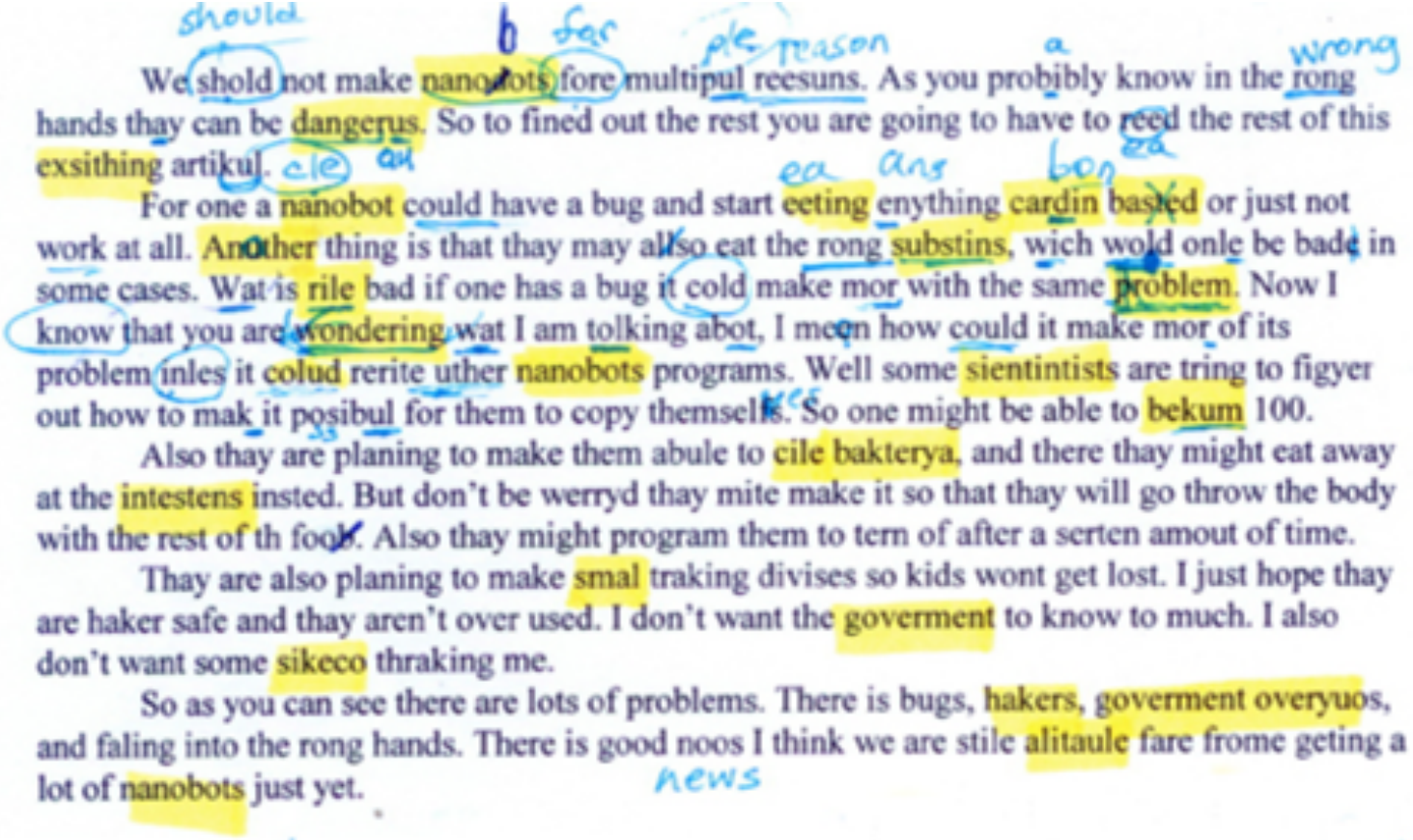
Out of 21 who signed up, 40 total!

a very strong reflection from most recent trial?

In Week 2 I was very aspirational about the role I wanted to play; 'I would like my profile to be professional, respectful, organised, connected and visible. I aim to be an active participant within "reflection and critical discourse that is the core dynamic of a community of inquiry". I achieved my aim of being an active participant as I made over 75 comments on my peers' posts, averaging over 5 per week. **However I feel I did not participate fully in all 4 phases of the cognitive presence in the Practical [sic] Inquiry Model; triggering event, exploration, integration and resolution – despite having sentence openers taped next to my computer!** Triggering events and some exploration were met by sharing an interesting article relevant to a post I had read and also asking some questions, but I felt a lot of my posts were agreeing with and complimenting upon the erudite musings of my peers. I was definitely wary of confronting differing ideas and promoting a critical discourse. **This participation in all cognitive phases needs improving** so the sentence openers will remain up! [score=4]

Kirsty Kitto, Mandy Lupton, Kate Davis, and Zak Waters. 2017. Designing for student-facing learning analytics. *Australian Journal of Educational Technology*, 33, 5 (2017), 152–168.

learning outcome 2: better writing



We shold not make nanobots fore multipul reesuns. As you probibly know in the rong hands thay can be dangerus. So to fined out the rest you are going to have to reed the rest of this exsithing artikul.

For one a nanobot could have a bug and start eeting enything cardin basted or just not work at all. Another thing is that thay may also eat the rong substins, wich wold onle be bade in some cases. Wat is rile bad if one has a bug it cold make mor with the same problem. Now I know that you are wondering wat I am tolking abot, I meen how could it make mor of its problem inles it colud rerite uther nanobots programs. Well some sientintists are tring to figyer out how to mak it posibul for them to copy themselfs. So one might be able to bekum 100.

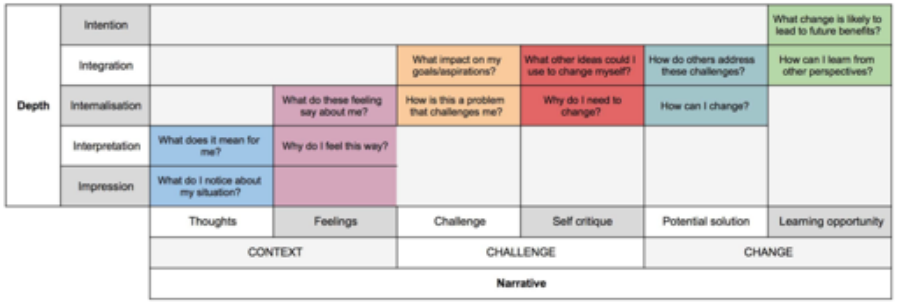
Also thay are planing to make them abule to cile bakterya, and there thay might eat away at the intestens insted. But don't be werryd thay mite make it so that thay will go throw the body with the rest of th food. Also thay might program them to tern of after a serten amout of time.

Thay are also planing to make smal traking divises so kids wont get lost. I just hope thay are haker safe and thay aren't over used. I don't want the goverment to know to much. I also don't want some sikeco thraking me.

So as you can see there are lots of problems. There is bugs, hakers, goverment overyuos, and faling into the rong hands. There is good noos I think we are stile alitaule fare frome geting a lot of nanobots just yet.

LA must be linked to the pedagogical purpose!

reflective writing



Gibson, A., Aitken, A., Sándor, Á., Buckingham Shum, S., Tsingos-Lucas, C., & Knight, S. (2017, March). Reflective writing analytics for actionable feedback. In Proceedings of the Seventh International Learning Analytics & Knowledge Conference (pp. 153-162).

research writing (CARS model)

Move 1 – Establishing a research territory:

- **E** – Emphasis of a significant or important idea
- **B** – Background information and reviewing previous work

Move 2 – Establishing a niche:

- **C** – Contrasting idea, tension, disagreement or critical insight
- **Q** – Question or gap in previous knowledge

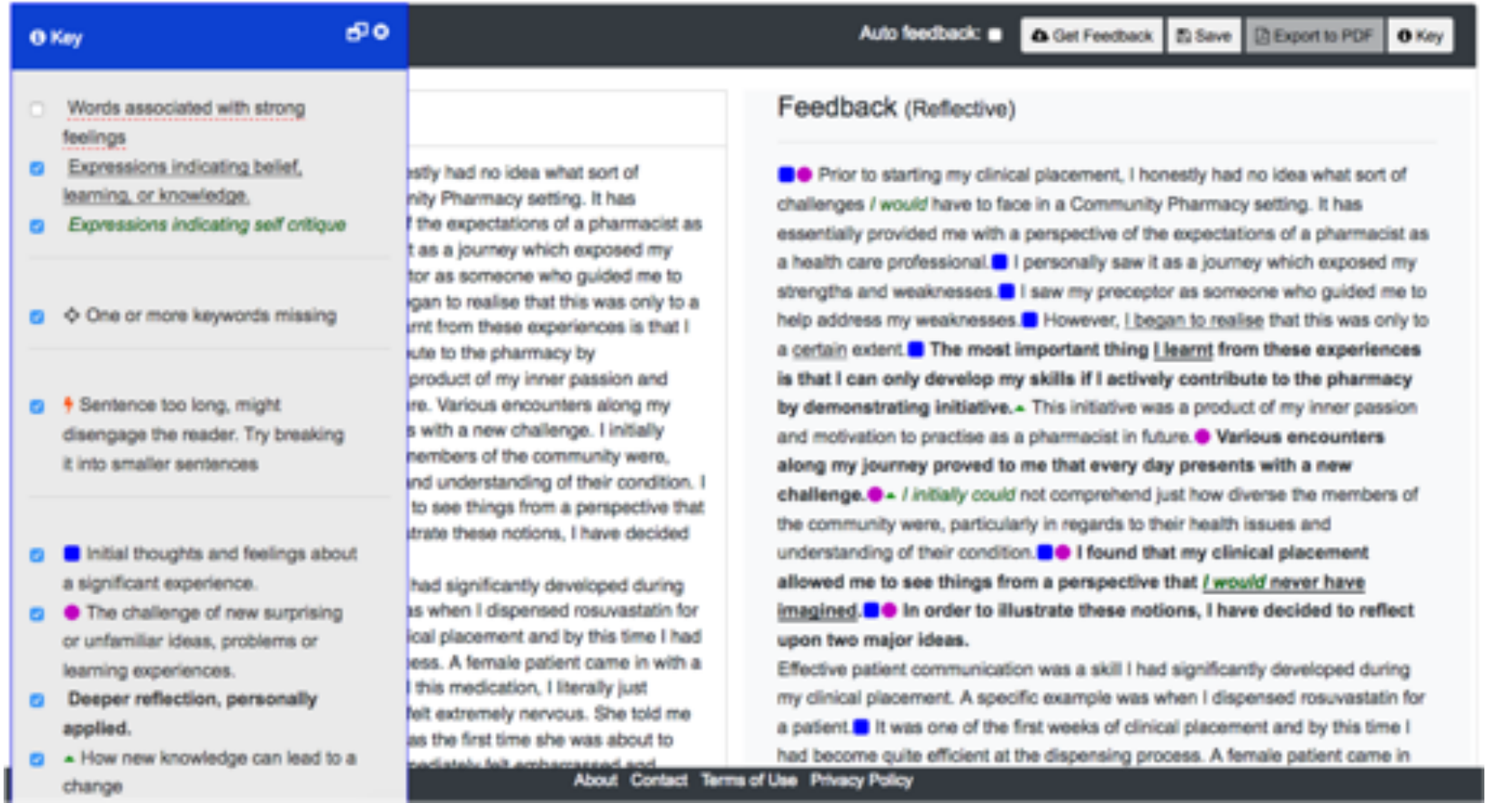
Move 3 – Occupying the niche

- **N** – Novelty and value of your research
- **S** – Summary of the authors goal, nature of the research or structure of the paper

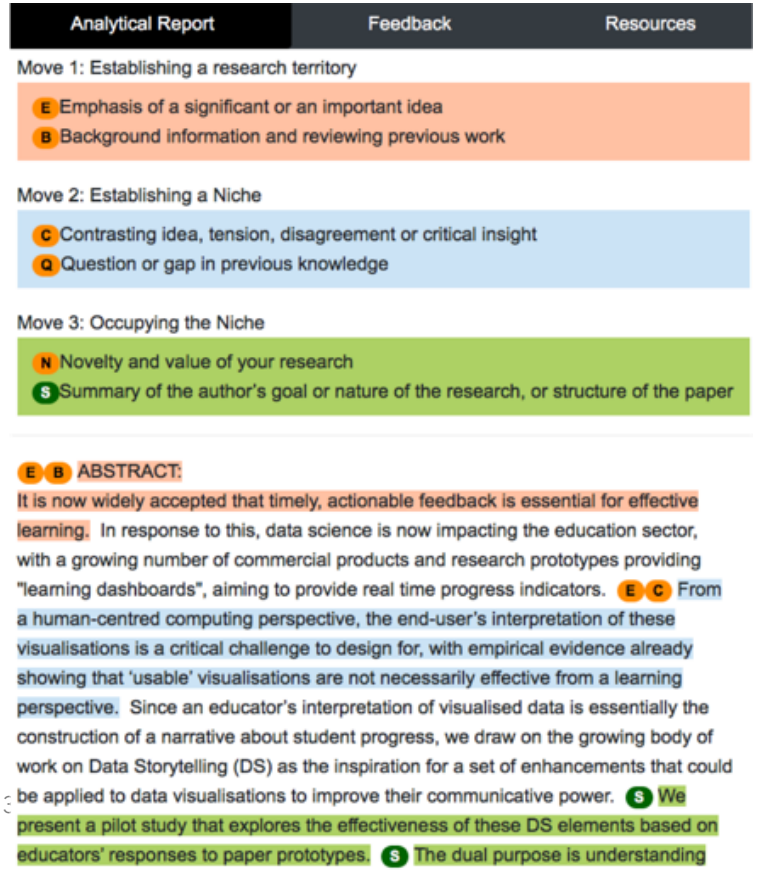
Abel, S., Kitto, K., Knight, S., Buckingham Shum, S. (2018). Designing personalised, automated feedback to develop students' research writing skills. In Proceedings ASCILITE 2018. In Press.

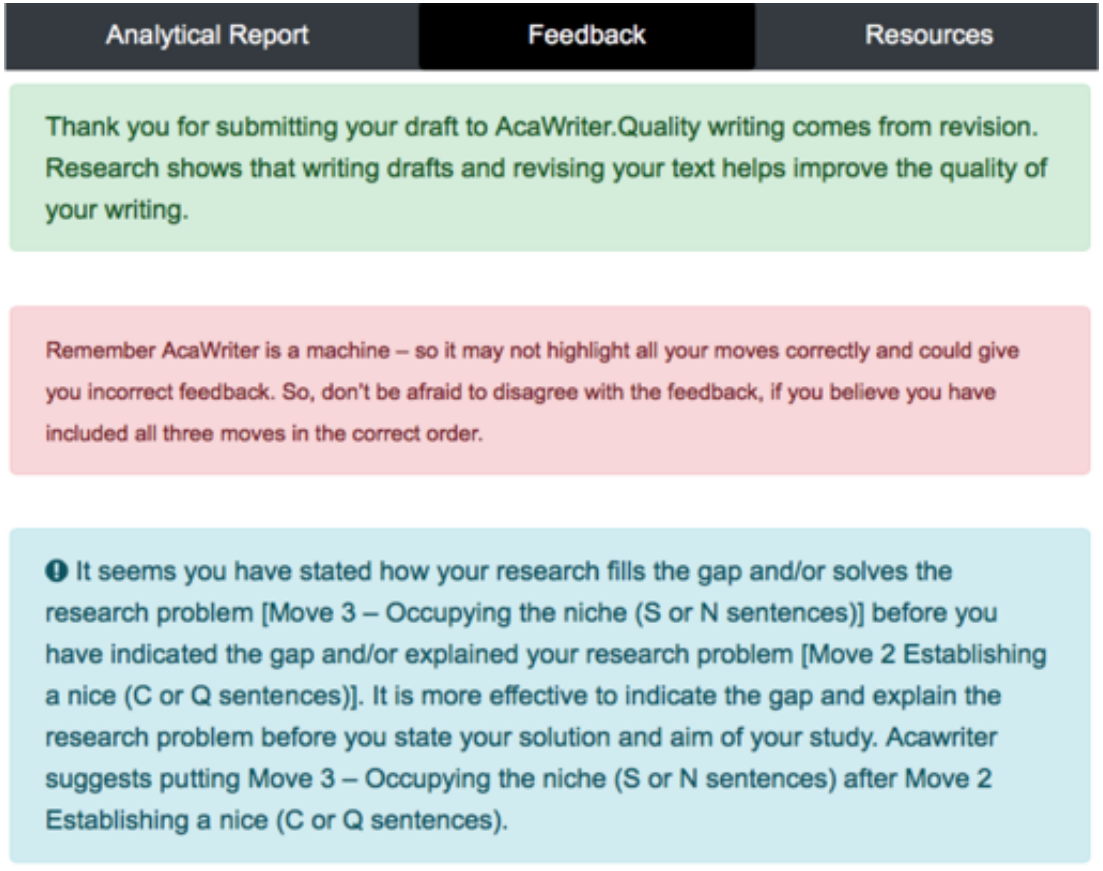
See www.heta.io for more details

feedback – reflective writing



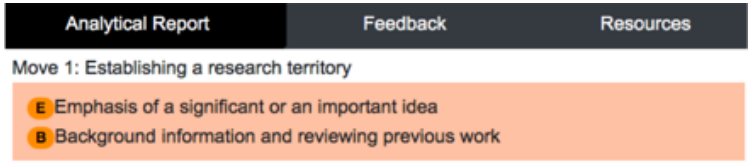
feedback – research writing

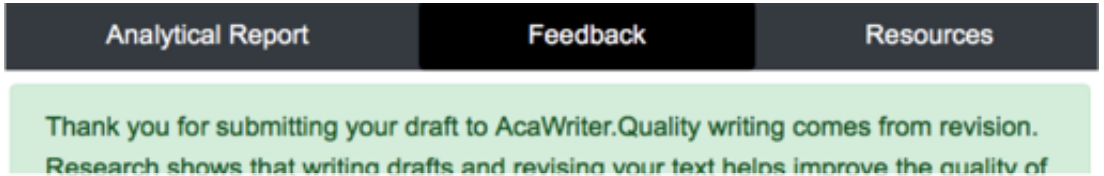




learning outcome 3: data literacy for a lifetime of learning

elaboration: writing analytics





Remember AcaWriter is a machine – so it may not highlight all your moves correctly and could give you incorrect feedback. So, don't be afraid to disagree with the feedback, if you believe you have included all three moves in the correct order.

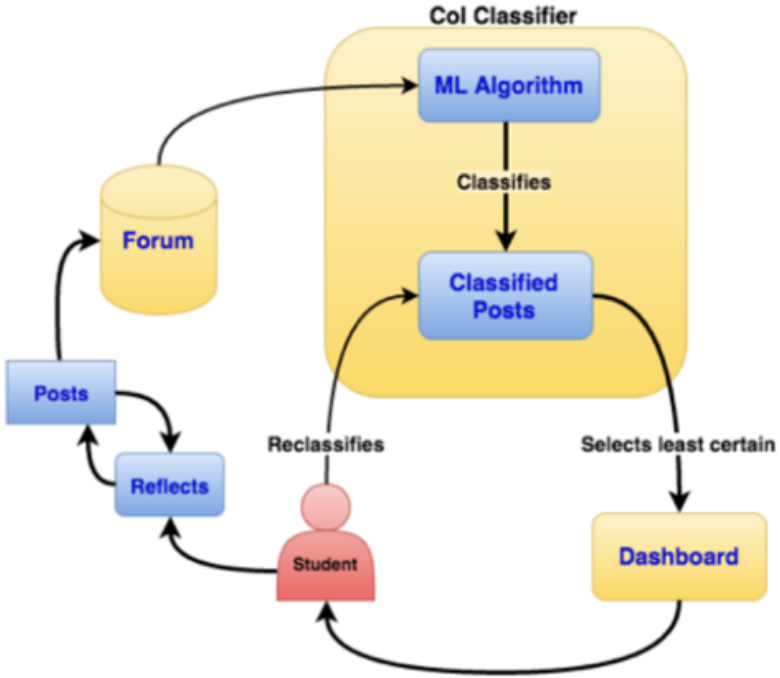
It is now widely accepted that timely, actionable feedback is essential for effective learning. In response to this, data science is now impacting the education sector, with a growing number of commercial products and research prototypes providing "learning dashboards", aiming to provide real time progress indicators. E C From a human-centred computing perspective, the end-user's interpretation of these visualisations is a critical challenge to design for, with empirical evidence already showing that 'usable' visualisations are not necessarily effective from a learning perspective. Since an educator's interpretation of visualised data is essentially the construction of a narrative about student progress, we draw on the growing body of work on Data Storytelling (DS) as the inspiration for a set of enhancements that could be applied to data visualisations to improve their communicative power. S We present a pilot study that explores the effectiveness of these DS elements based on educators' responses to paper prototypes. S The dual purpose is understanding

It seems you have stated how your research fills the gap and/or solves the research problem [Move 3 – Occupying the niche (S or N sentences)] before you have indicated the gap and/or explained your research problem [Move 2 Establishing a nice (C or Q sentences)]. It is more effective to indicate the gap and explain the research problem before you state your solution and aim of your study. Acawriter suggests putting Move 3 – Occupying the niche (S or N sentences) after Move 2 Establishing a nice (C or Q sentences).

active learning squared (AL^2)

the student trains the classifier...

...while it is training the student…



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cognitive presence

"extent to which the participants in any particular configuration of a community of inquiry are able to construct meaning through sustained communication."

Triggering

↓

Exploration

↓

Integration

↓

Resolution

Garrison, Anderson, Archer (2001) Critical thinking, cognitive presence, and computer conferencing in distance education. American journal of distance education, 15(1):7–23

https://plus.google.com/u/0/+StefanPSchmid/posts/4wrUbFzFwpJ

current state of the art uses machine learning to classify discussion forum text using this construct

Towards Automated Content Analysis of Discussion Transcripts: A Cognitive Presence Case

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ABSTRACT

In this paper, we present the results of an exploratory study that examined the problem of automating content analysis of student online discussion transcripts. We looked at the problem of coding discussion transcripts for the levels of cognitive presence, one of the three main constructs in the Community of Inquiry (CoI) model of distance education. Using CoI Metrix and LIWC features, together with a set of custom features developed to capture discussion content, we developed a random forest classification system that achieved 70.3% classification accuracy and 0.63 Cohen's kappa, which is significantly higher than values reported in the previous studies. Besides improvement in classification accuracy, the developed system is also less sensitive to overfitting as it uses only 205 classification features, which is around 100 times less features than in similar systems based on bag-of-words features. We also provide an overview of the classification features most indicative of the different phases of cognitive presence that gives an additional insights into the nature of cognitive presence learning cycle. Overall, our results show great potential of the proposed approach, with an added benefit of providing further characterization of the cognitive presence coding scheme.

Keywords

Community of Inquiry (CoI) model, content analysis, content analytics, online discussions, text classification

LAK '16, April 25 - 29, 2016, Edinburgh, United Kingdom

ISBN 978-1-4503-4190-5/16/04 ... $15.00

DOI: http://dx.doi.org/10.1145/2883851.2883950

1. INTRODUCTION

Online discussions are commonly used in modern higher education, both for blended and fully online learning [42]. In distance education, given the absence of face to face interactions, online discussions represent an important component of the whole educational experience. This is especially important for the social-constructivist pedagogies which emphasize the value of social construction of knowledge through interactions and discussions among a group of learners [2]. In this regard, the Community of Inquiry (CoI) model [22, 23] represents perhaps one of the best researched and validated models of online and distance education, focused on explaining important dimensions – also known as *presences* – that shape students' online learning experience.

The most commonly used approaches to the analysis of online discussion transcripts are based on the quantitative content analysis (QCA) [12, 34, 51, 15]. According to Krippendorff [37] content analysis is *"a research technique for making replicable and valid inferences from texts (or other meaningful matter) to the contexts of their use"*[p18]. In the case of the study presented in this paper, contexts is online learning environments. QCA is a well defined research technique commonly used in social science research, and it makes use of specifically designed coding schemes to analyse text artifacts with respect to the defined research goals and objectives. For instance, the CoI model defines a set of coding schemes which are used by the educational researchers to assess the levels of three CoI presences.

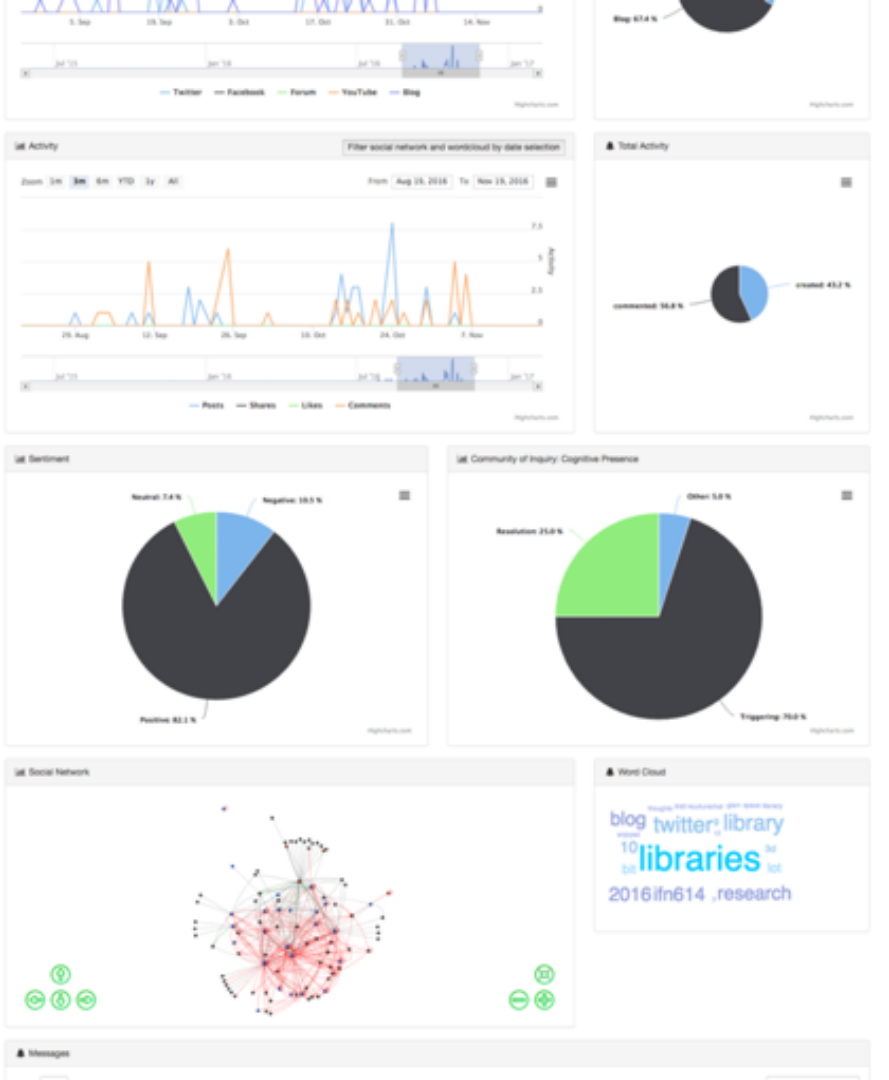
In the domain of educational research, QCA of student discussion data have been mainly used for the retrospection and research after the courses are over without an impact on the courses' learning outcomes [53]. In the field of content analytics [38] – which focuses on building analytical models based on the learning content including student produced content such as online discussion messages – there have been some attempts to automate some of these coding schemes. Most notable are the efforts of McKlin [44] and Corich et al. [11] on automation of the CoI coding schemes, which served

Kovanović, Joksimović, Waters, Gašević, Kitto, Hatala, Siemens (2016). Towards automated content analysis of discussion transcripts: a cognitive presence case. In Proceedings of the Sixth International Conference on Learning Analytics & Knowledge (LAK '16). ACM, New York, NY, USA, 15-24.

but contextuality…

- training data sets are rarely shared in education
- and cohorts change – a lot!
- the CoI report uses (not very) accurate Machine Learning
- it is not robust in new learning scenarios
- need to be able to rapidly train classifiers for new cohorts

- does this provide a new teachable moment?



Connected Learning Analytics Toolkit

Community of Inquiry Classification

Community of Inquiry Classifications

Want to learn about your participation within your learning community?

When you start this activity, you will see one of your posts. We have used machine learning to catgorise your cognitive presence according the Community of Inquiry model.

However, our machine learning tool is still learning and it could be wrong. We would like you to:

1. Think about how your post was classified
2. Choose what category you believe your post belongs to
3. If you like, you may highlight text from your post that you used in making your decision, or add remarks to the text-box about what helped you come to your conclusion
4. You can view your history below

What is Cognitive Presence?

Cognitive presence has four phases: Triggering, Exploration, Integration, and Resolution.

Triggering Phase initiates discussion about a particular issue/topic for inquiry.
Exploration Phase posts explore the issue at hand by exchanging knowledge between members of the community.
Integration Phase interactions build upon the ideas shared and explored in the Exploration phase and begin to construct understanding or a solution about a topic or issue.
Resolution Phase are messages in a discussion that test the solutions or understanding developed in the Integration phase.

Begin

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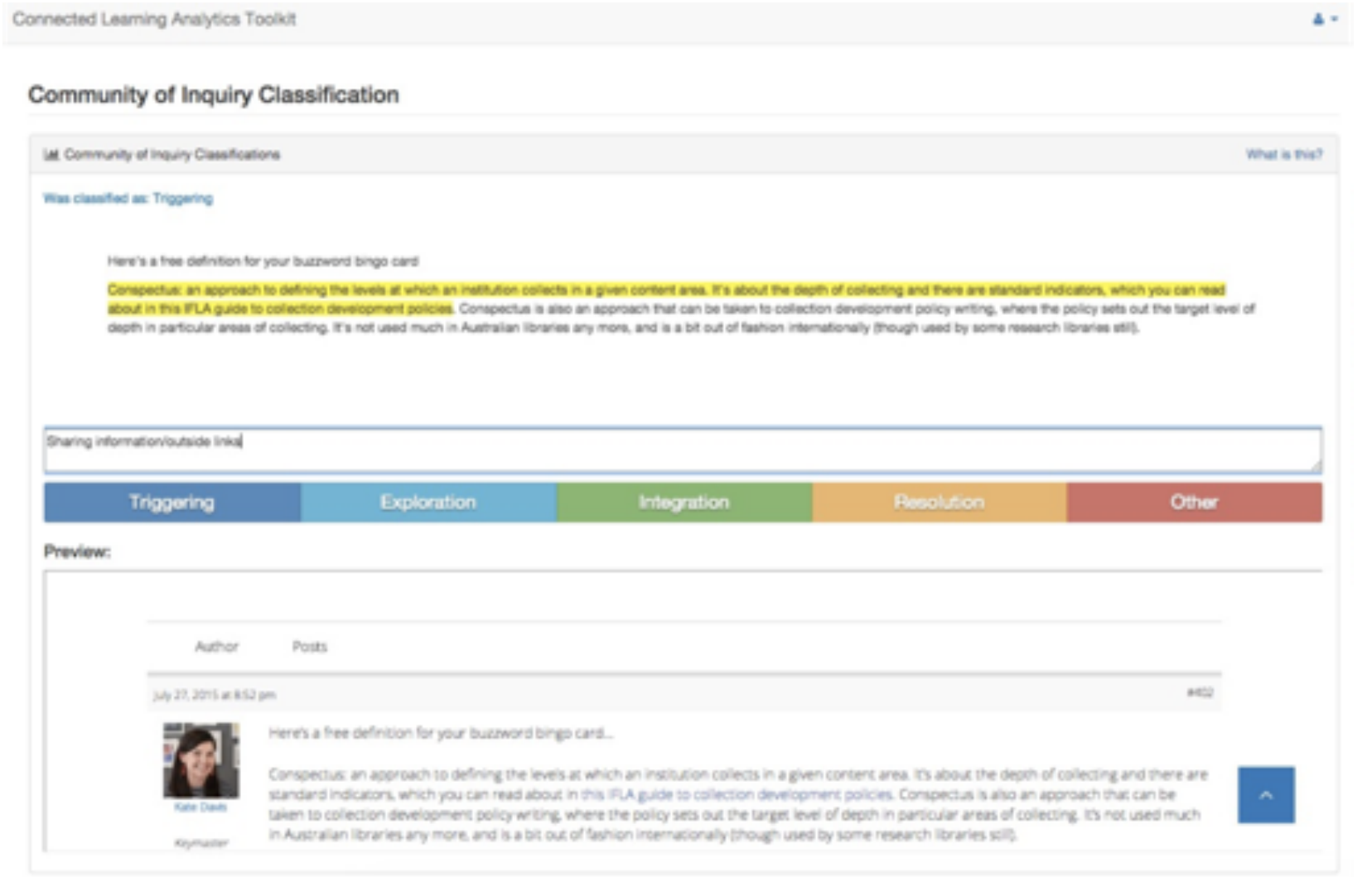
4.


Connected Learning Analytics Toolkit
Community of Inquiry Classification
Community of Inquiry Classifications
What is this?
Was classified as: Triggering
Here's a free definition for your buzzword bingo card
Conspectus: an approach to defining the levels at which an institution collects in a given content area. It's about the depth of collecting and there are standard indicators, which you can read about in this IFLA guide to collection development policies. Conspectus is also an approach that can be taken to collection development policy writing, where the policy sets out the target level of depth in particular areas of collecting. It's not used much in Australian libraries any more, and is a bit out of fashion internationally (though used by some research libraries still).
Sharing information/outside links
Triggering
Exploration
Integration
Resolution
Other
Preview:
Author
Posts
July 27, 2015 at 8:52 pm
#402
Here's a free definition for your buzzword bingo card...
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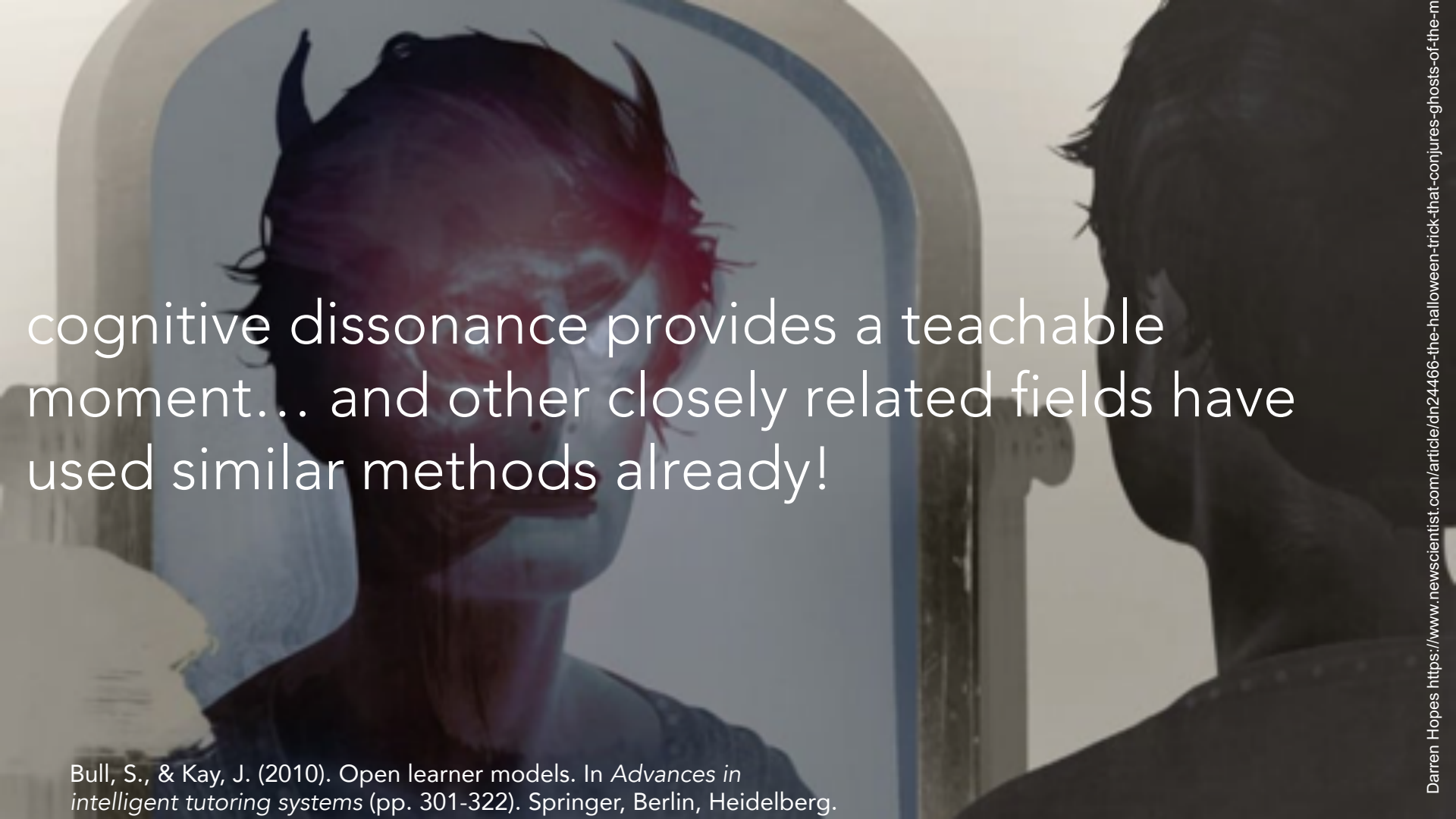
Katie Davis
Keymaster



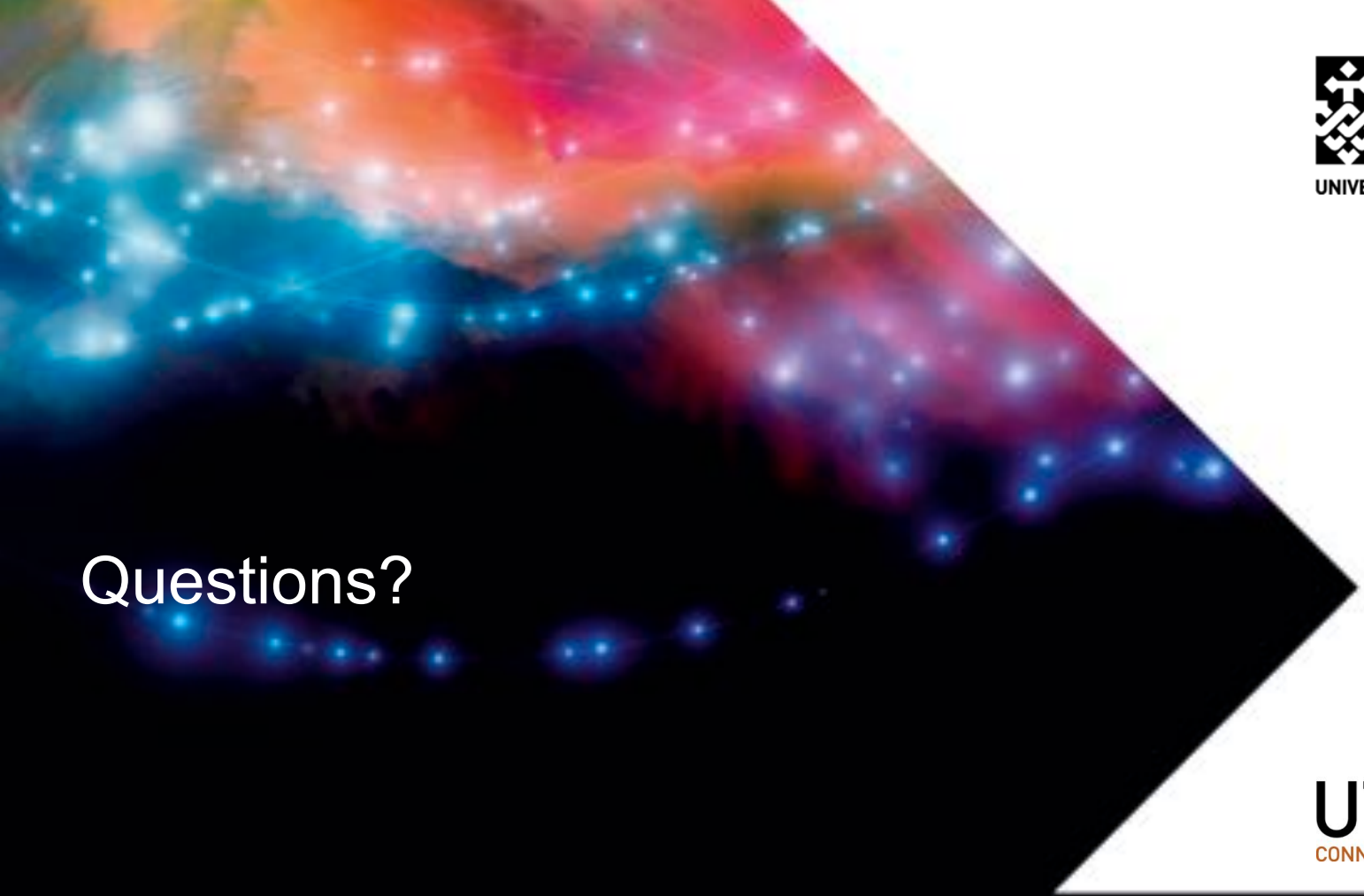
cognitive dissonance provides a teachable moment… and other closely related fields have used similar methods already!

Bull, S., & Kay, J. (2010). Open learner models. In *Advances in intelligent tutoring systems* (pp. 301-322). Springer, Berlin, Heidelberg.

Darren Hopes https://www.newscientist.com/article/dn24466-the-halloween-trick-that-conjures-ghosts-of-the-m

in summary

- learning happens everywhere!
- student facing learning analytics opens up new pedagogical possibilities
- but to do this we need to start from the learning!
- …and then work back to the learning analytics required to help achieve the outcomes we want



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Questions?

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