

Learning Analytics as an Intelligent Personal Assistant for Lifelong Learners

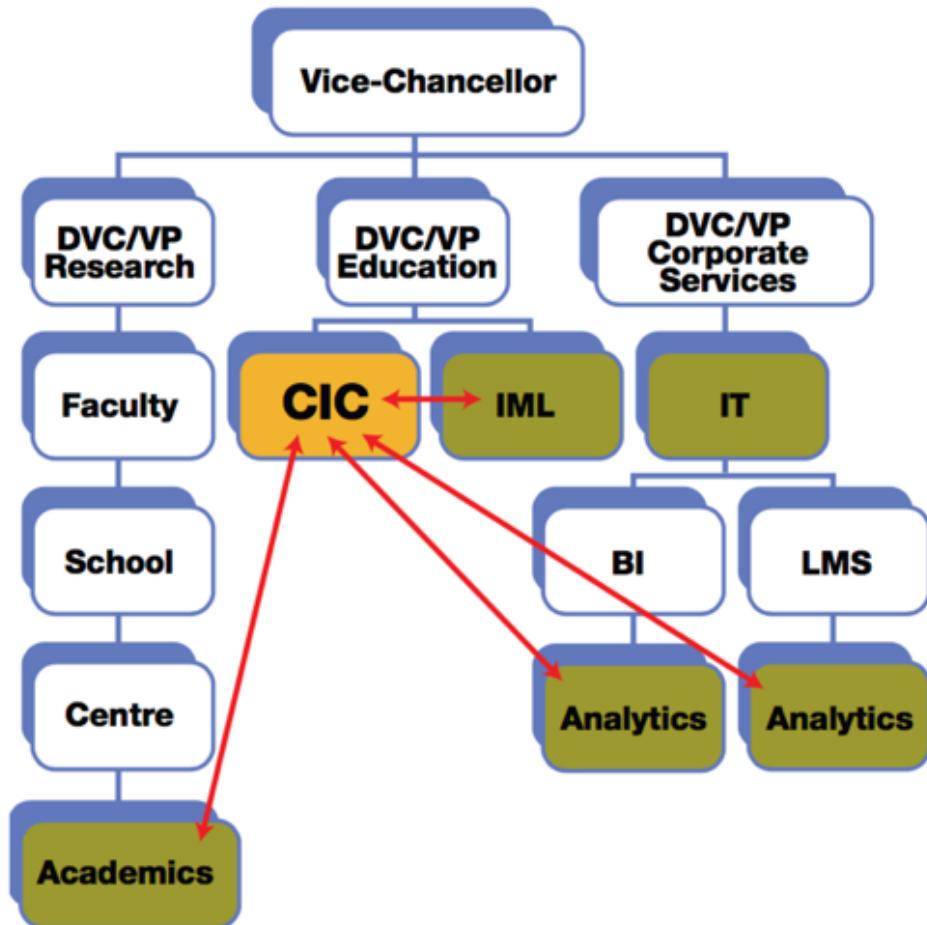
Kirsty Kitto

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what is UTS:CIC?

University of Technology Sydney - Connected Intelligence Centre

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



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





Term 2018

Home

Modules

Announcements

Assignments

View Progress

Export Course Content

+ Module

+ Get started

Welcome to 36103 - Statistical Thinking for Data Science!



traditionally EdTech has focused upon providing analytics within the confines of specific systems built by vendors...

(e.g. LMSs, eBooks, SIS)

Search

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Don't plagiarise!

Resources, texts, and good online courses

Module 0: Preparing for statistical thinking

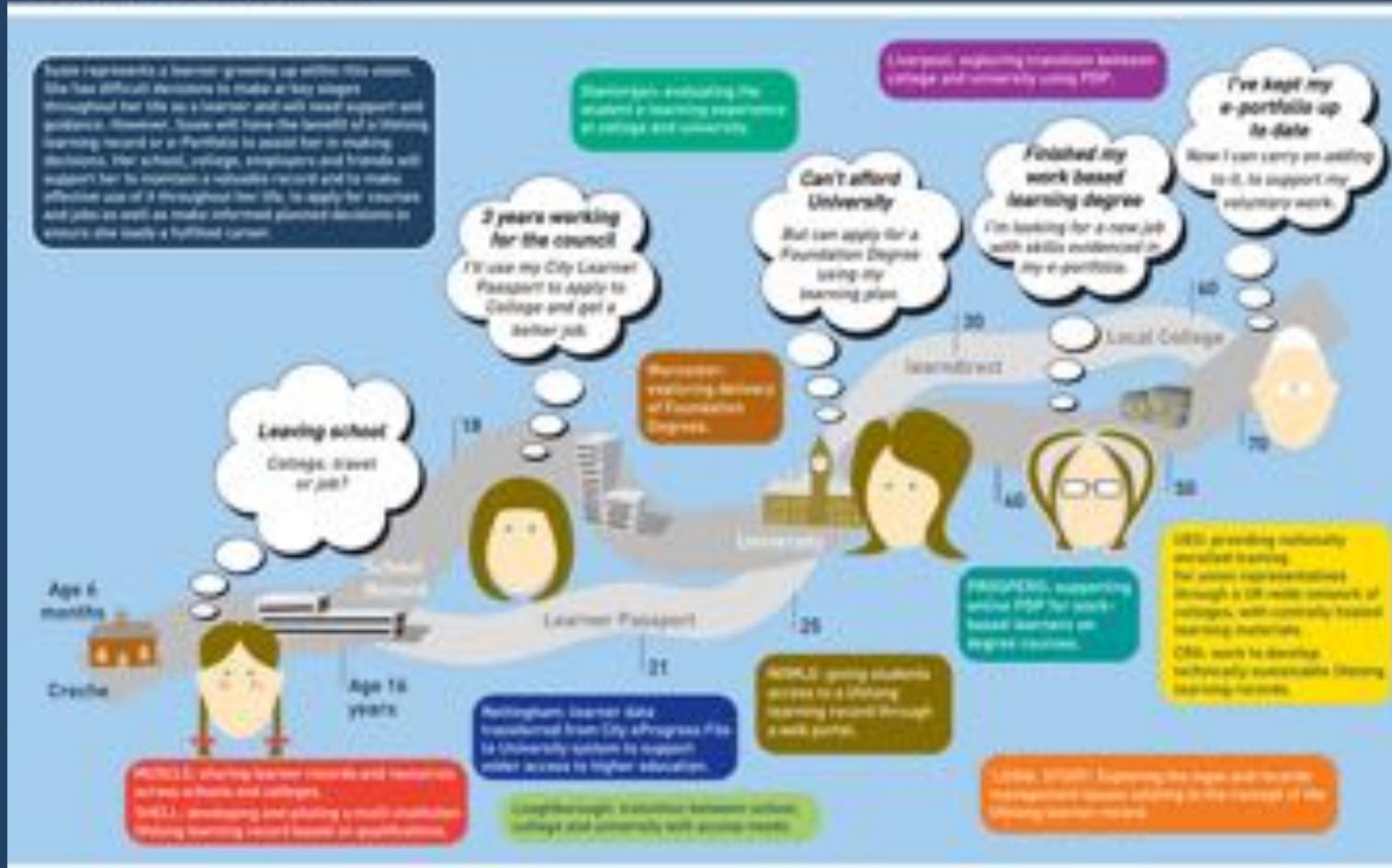
Am I ready for statistical thinking?



but learning happens everywhere!

Susie's journey

and learning occurs over a lifetime!



so how can we
help our learners
to succeed?

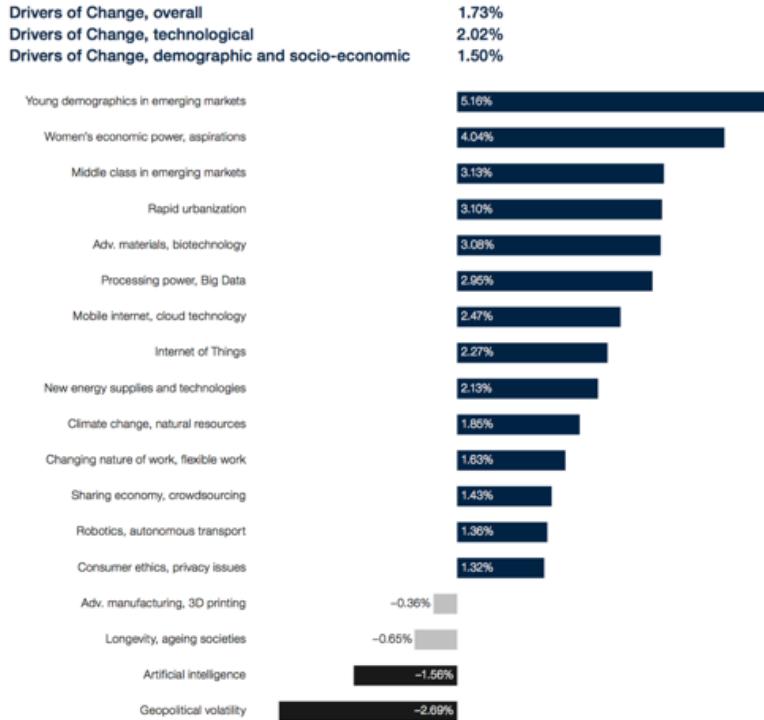


especially in the light of the fourth industrial revolution!



Figure 4: Employment effect of drivers of change, all job types

Compound growth rate, 2015-2020, %⁷



Global Challenge Insight Report

The Future of Jobs

Employment, Skills and
Workforce Strategy for the
Fourth Industrial Revolution

January 2016

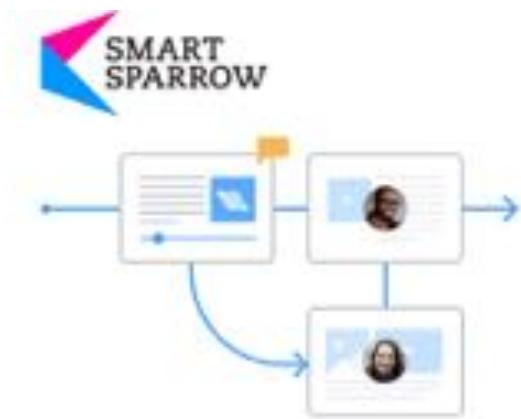


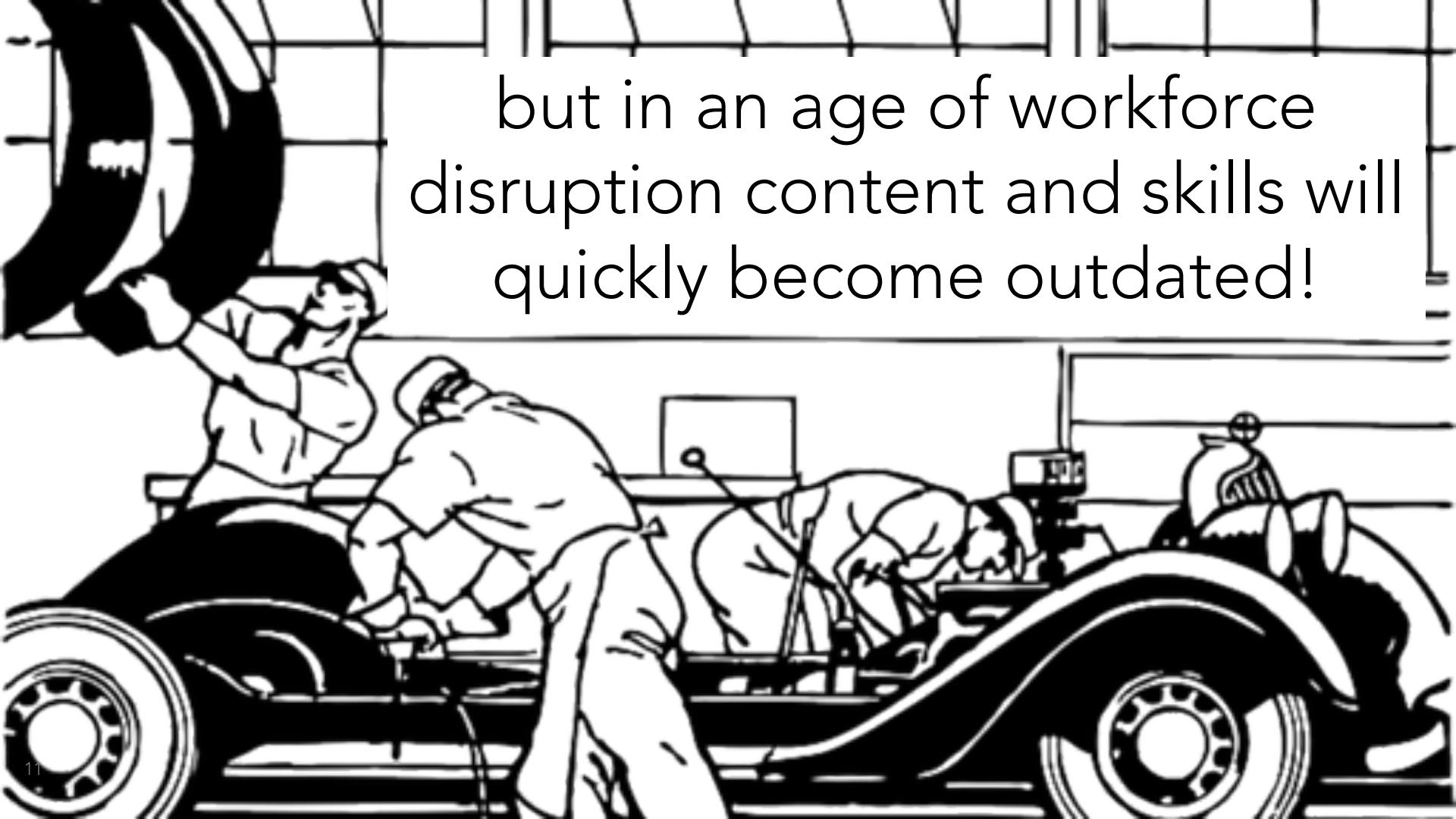
but first!
what type of learning
are we talking about?

are students acquiring:
content and skills?
or
learning to learn?

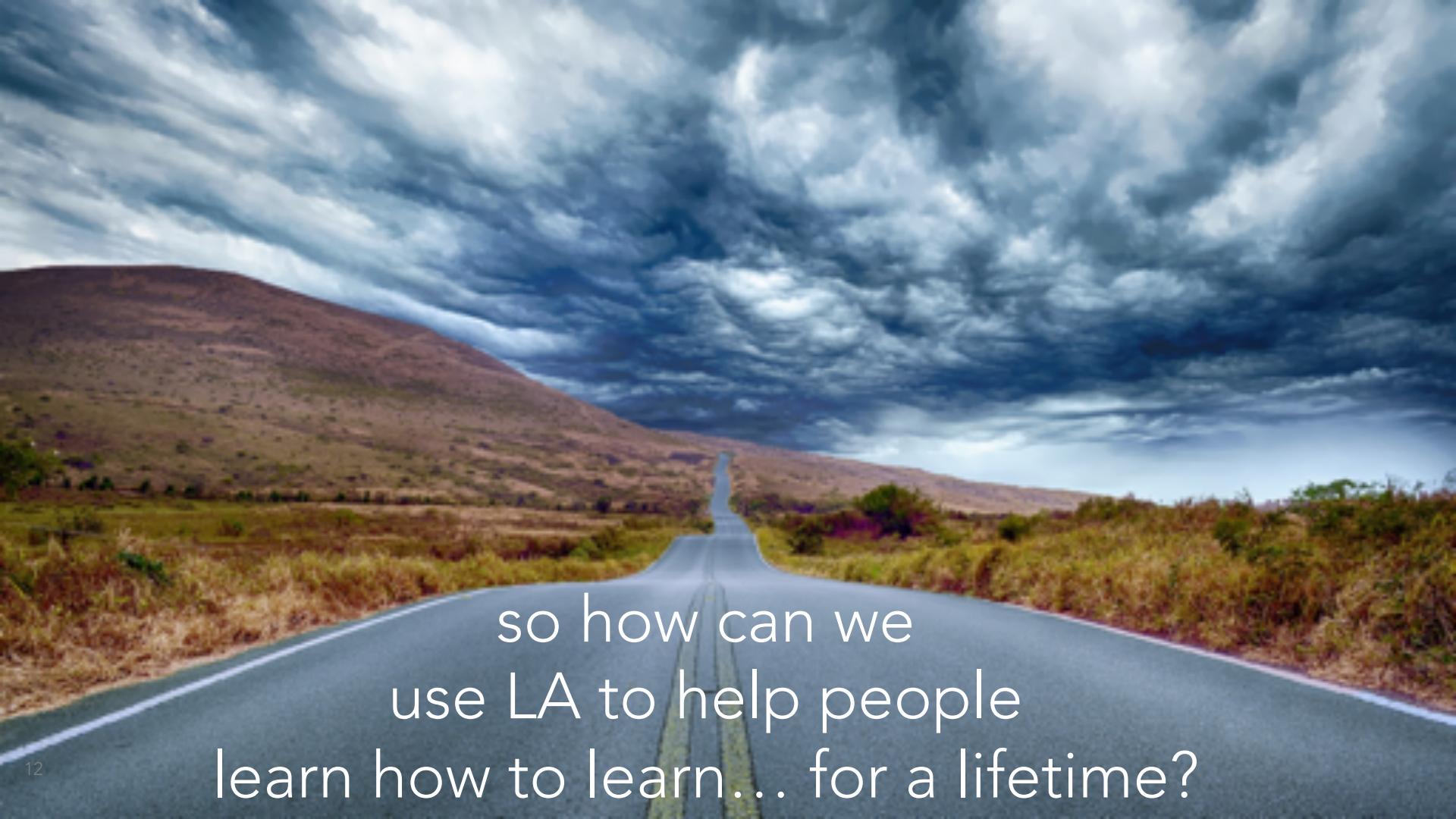


content and skills are well suited to adaptive learning and intelligent tutoring systems





but in an age of workforce
disruption content and skills will
quickly become outdated!

A photograph of a long, straight asphalt road stretching into the distance. The road is flanked by dry, brownish-yellow grass and low-lying bushes. To the left, there's a larger, more prominent hillside covered in similar vegetation. The sky above is filled with heavy, dark, and light grey clouds, creating a sense of depth and drama.

so how can we
use LA to help people
learn how to learn... for a lifetime?



my approach: student facing LA

CAUTION

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** (Learning Design is essential!)

example 1: learning to write

should b for ple reason a wrong
We shold not make nanobots fore multipul reesuns. As you probibly know in the rong hands thay can be dangerous. So to fined out the rest you are going to have to read the rest of this exsithing artikul. cle an bo

For one a nanobot could have a bug and start eeting enything cardin basck or just not work at all. Another thing is that thay may also eat the rong substins, wich wold onle be bad 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 mean 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 foo. 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.
news

feedback – reflective writing

Key

Get Feedback Save Export to PDF Key

Words associated with strong feelings
 Expressions indicating belief, learning, or knowledge.
 Expressions indicating self critique
 ◇ One or more keywords missing
 ↗ Sentence too long, might disengage the reader. Try breaking it into smaller sentences
 ■ Initial thoughts and feelings about a significant experience.
 ● The challenge of new surprising or unfamiliar ideas, problems or learning experiences.
 ▲ Deeper reflection, personally applied.
 ▲ How new knowledge can lead to a change

Auto feedback:

Feedback (Reflective)

■● Prior to starting my clinical placement, I honestly had no idea what sort of challenges *I would* have to face in a Community Pharmacy setting. It has essentially provided me with a perspective of the expectations of a pharmacist as a health care professional. ■ I personally saw it as a journey which exposed my strengths and weaknesses. ■ I saw my preceptor as someone who guided me to help address my weaknesses. ■ However, *I began to realise* that this was only to a certain extent. ■ The most important thing *I learnt* from these experiences is that I can only develop my skills if I actively contribute to the pharmacy by demonstrating initiative. ▲ This initiative was a product of my inner passion and motivation to practise as a pharmacist in future. ● Various encounters along my journey proved to me that every day presents with a new challenge. ● I initially could not comprehend just how diverse the members of the community were, particularly in regards to their health issues and understanding of their condition. ■● I found that my clinical placement allowed me to see things from a perspective that *I would never have imagined*. ■● In order to illustrate these notions, I have decided to reflect upon two major ideas. Effective patient communication was a skill I had significantly developed during my clinical placement. A specific example was when I dispensed rosuvastatin for a patient. ■ It was one of the first weeks of clinical placement and by this time I had become quite efficient at the dispensing process. A female patient came in

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LA must be linked to the pedagogical purpose!

reflective writing

Depth	Intention	What change is likely to lead to future benefits?				
Integration		What impact on my goals/inspirations?	What other ideas could I use to change myself?	How do others address these challenges?	How can I learn from other perspectives?	
Internalisation		What do these feelings say about me?	How is this a problem that challenges me?	Why do I need to change?	How can I change?	
Interpretation	What does it mean for me?	Why do I feel this way?				
Impression	What do I notice about my situation?					
	Thoughts	Feelings	Challenge	Self critique	Potential solution	Learning opportunity
	CONTEXT		CHALLENGE		CHANGE	
	Narrative					

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

Key

Get Feedback Save Export to PDF Key

Words associated with strong feelings
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feedback – research writing

Analytical Report

Feedback

Resources

Move 1: Establishing a research territory

- E Emphasis of a significant or an 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 author's goal or nature of the research, or structure of the paper

E B ABSTRACT:

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

Analytical Report

Feedback

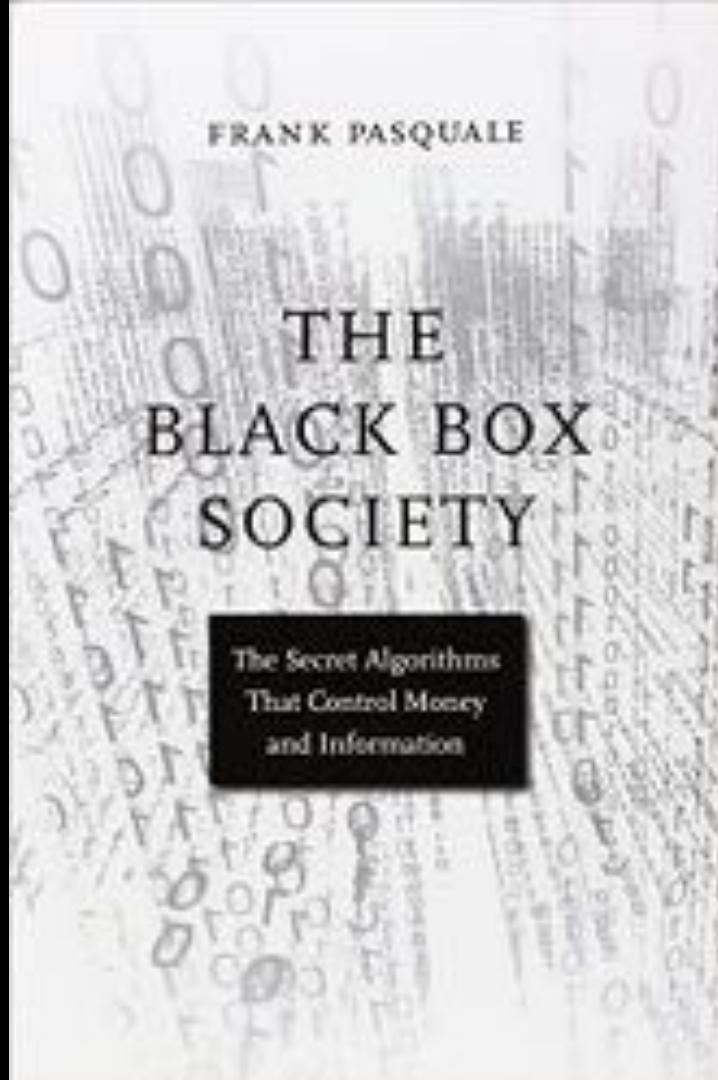
Resources

Thank you for submitting your draft to AcaWriter. Quality writing comes from revision. Research shows that writing drafts and revising your text helps improve the quality of your writing.

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 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).

example 2:
learning to open
the black box

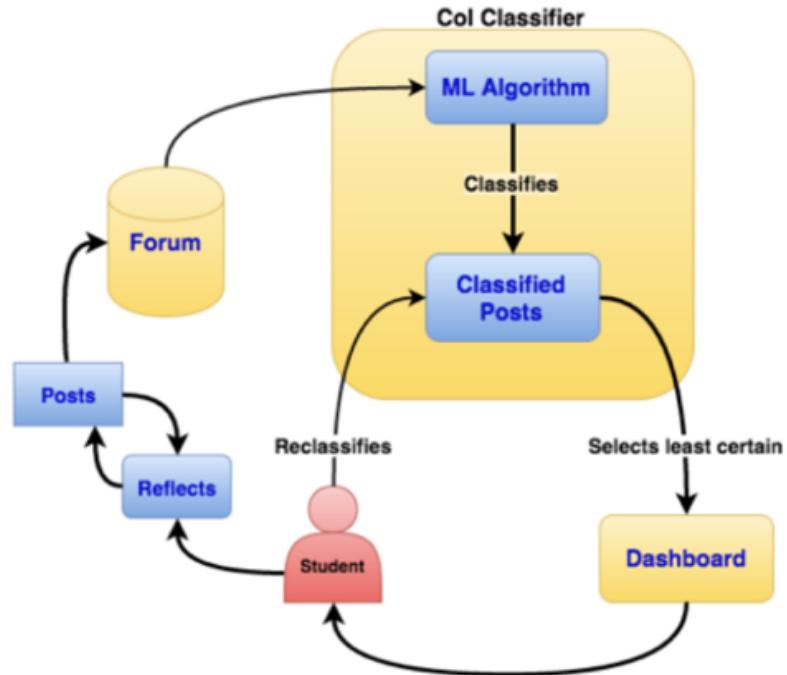


active learning squared (AL^2)

a learning design we are starting to use:

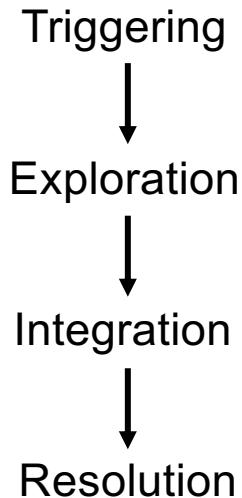
the student trains the classifier...

...while it is training the student...



cognitive presence

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



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

The diagram illustrates the four phases of cognitive presence using a screenshot of a Google+ post. The post is a reply to a tweet from Stefan P. Schmid (@StefanPSchmid) about the "fear of tweeting". The conversation then branches into several comments:

- Triggering phase:** The original post by Stefan P. Schmid and a reply from Rosa Hussin (@RosaHussin) are circled in red, labeled "Problem presentation, Triggering phase" and "Relation to previous post, Triggering phase".
- Exploration phase:** A comment from Laura Gibbs (@LauraGibbs) is circled in blue, labeled "Tagging participants" and "Shared resource, Triggering phase".
- Exploration phase:** A comment from Stefan P. Schmid (@StefanPSchmid) is circled in red, labeled "Insight, Opinion, Triggering phase Exploration phase".
- Exploration phase:** A comment from Stacy Zemke (@StacyZemke) is circled in blue, labeled "Related video, Exploration phase".
- Integration phase:** A comment from Mark Poole (@MarkPoole17) is circled in red, labeled "Reference to previous post, Integration phase".
- Integration phase:** A comment from George Station (@GeorgeStation) is circled in blue, labeled "Related original content, Integration phase".
- Resolution phase:** A comment from George Station (@GeorgeStation) is circled in red, labeled "Insight, opinion, Resolution phase".

The URL of the Google+ post is provided at the bottom: <https://plus.google.com/u/0/+StefanPSchmid/posts/4wrUbFzFwpJ>

we can use machine learning to classify discussion forum text using this construct

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.

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 encoding 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 Cosine Matrix and L2WC features, together with a set of custom features developed to capture discussion contexts, we developed a random forest classification system that achieved 93.5% classification accuracy and 0.63 Cohen's kappa coefficient. Higher than expected kappa value is typical for previous studies. Besides improvement in classification accuracy, the developed system is also less sensitive to encoding 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 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 characterisation of the cognitive presence coding scheme.

Keywords

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

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DOI: <http://dx.doi.org/10.1145/2869851.2869950>

I. 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 [1]. This is particularly true 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, 54, 31, 35]. According to Kruegerhoff [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 analyze 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 retrospective and research after the courses are over without an impact on the courses' learning outcomes [53]. In the field of content analysis [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 McKinn [44] and Corch et al. [11] on automation of the CoI coding schemes, which served

Community of Inquiry Classification

View 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 categorise 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

Community of Inquiry Classification

Community of Inquiry Classifications

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Begin

Community of Inquiry Classification

View Community of Inquiry Classifications

What is this?

Was classified as: Triggering

Here's a free definition for your buzzword bingo card:

Conspicuous: 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. Conspicuous 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

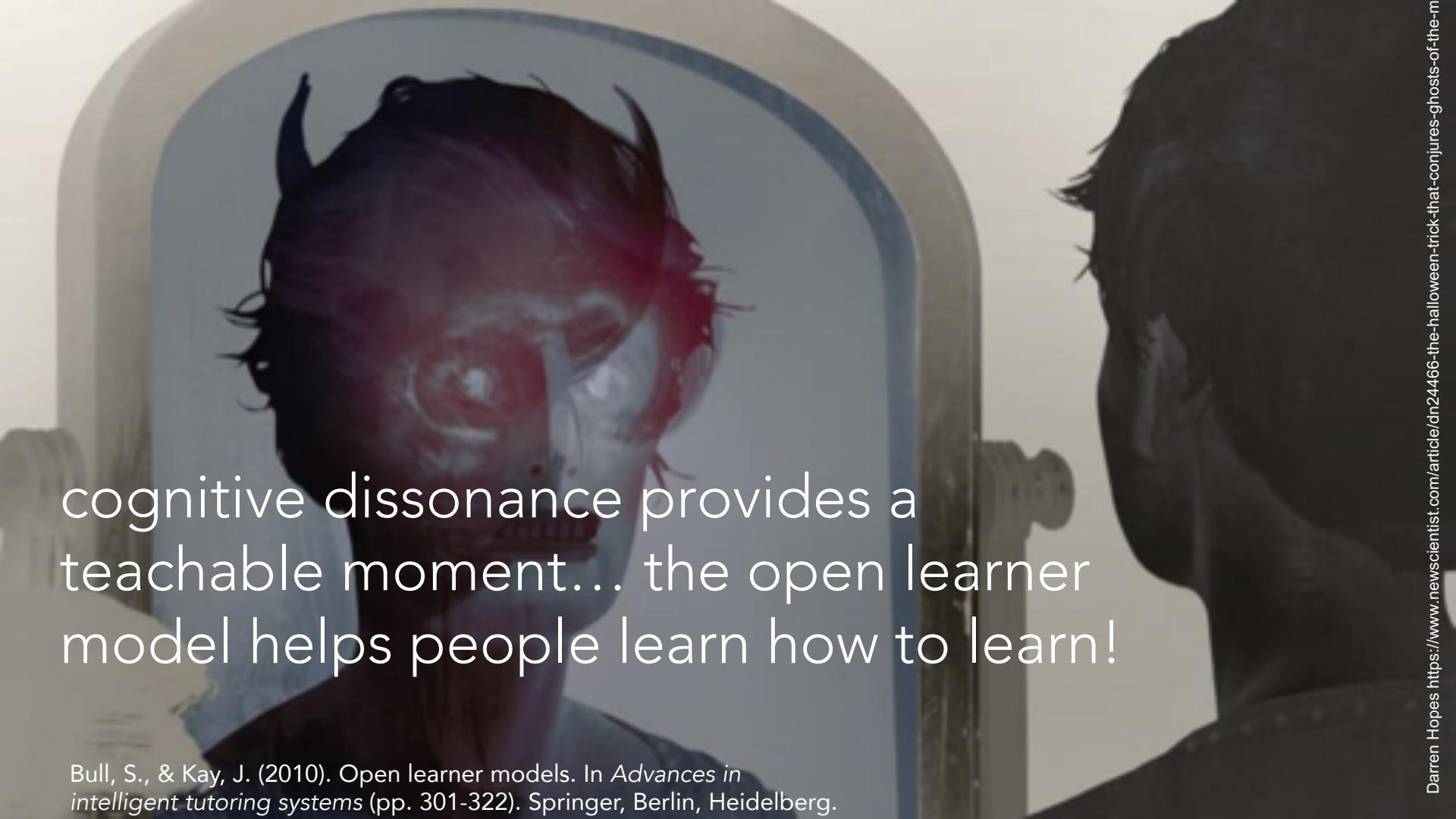


Kate Davis
Keymaster

Here's a free definition for your buzzword bingo card...

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cognitive dissonance provides a teachable moment... the open learner model helps people learn how to learn!

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

example 3:
personalised
messaging
to students
based on
activity in
class



weekly personalised feedback to 800+ students

(Acknowledgement: Jurgen Schulte, UTS Science)



Lecture Response

Attendance
Engagement
Understanding
Workload



Assignments Exams

Participation
Engagement
Solving Skills
Time Management



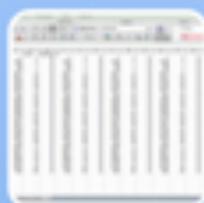
Laboratory

Participation
Time Management
Solving Skills
Reporting Skills



Exams

Selected Material
Comprehension
Solving Skills
Engagement



Dashboard

Engagement
Participation
Working Pattern

rapid, personalised feedback at scale to students

(developed by Jurgen Schulte, UTS Science)

End of **week 3** feedback **case 3**

cond 1 Dear Osiri,

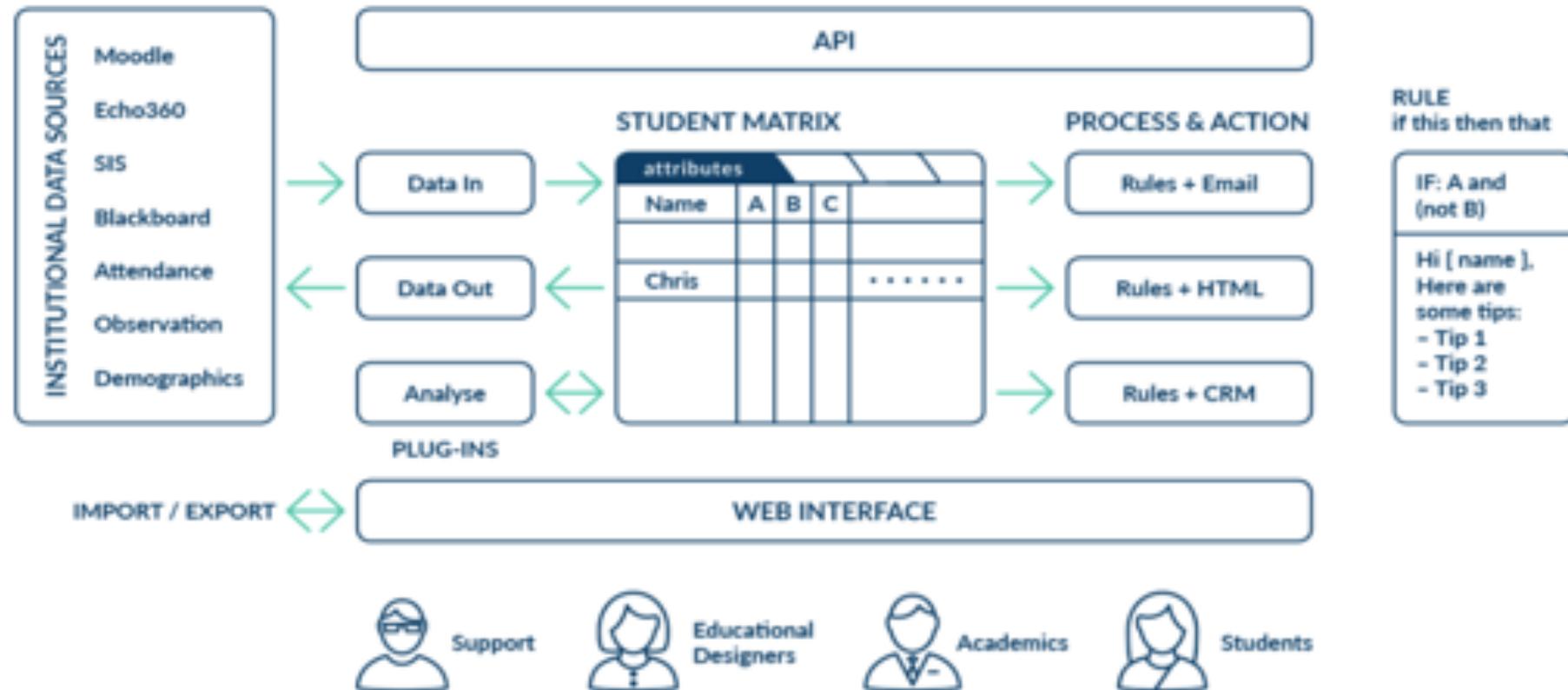
cond 2 Quite a few students had to move lab classes the past two weeks. This is just to confirm that I have you on record that your are now in lab **Group 18** and that your online lab report should be submitted at our **Group 18** pages.

cond 6 You had a good start with Physical Modelling and seem to be well on track.
cond 7 You managed to achieve 9 out of 10 marks in your WileyPLUS assignments.
cond 8 Your lab reports came back with 7 out of 7 marks.
cond 9 I noticed you are a keen participant of our lecture exercises. Did you know that they can be accessed before as well as after the lecture, not just during lecture?
cond 5 You seem to have had problems with one of the forces questions. Please have a look at HRW Chapter 3.2.2 where this case is discussed in more detail.

Please don't forget that the our **third** homework assignment has been released already. This assignment will be due 11.00 pm Friday next week.

Kind regards,
Jurgen Schulte

scaling up via Australian national funding...





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Providing personalised,
timely support actions to
large student cohorts.

LEARN MORE



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example 4: navigating workforce transition



Digital Business

Motivate Employees to Reskill for the Digital Age

qualifications frameworks are too broad

Australian Qualifications Framework

Home AQF ▾ AQF Governance FAQs Contact us ▾

Search site

The AQF is currently undergoing a review. More information can be found on the [Department of Education and Training website](#).

Australian
Qualifications
Framework



datasets exist that provide sophisticated mappings

The screenshot shows the European Skills/Competences, qualifications and Occupations (ESCO) website. At the top, there is a logo for the European Commission and links for Legal notice, Cookies, Contact, Search on Europe, and English (en). Below the header, the ESCO logo and the text "European Skills/Competences, qualifications and Occupations" are displayed. A breadcrumb navigation shows European Commission > ESCO > Occupations. The main navigation bar includes links for ABOUT ESCO, CLASSIFICATION, TOOLS & RESOURCES, and a search icon. Below the navigation, there are three main categories: Occupations, Skills/competences, and Qualifications. The "Occupations" category is currently selected, indicated by a yellow background and a blue border around the link text. On the left, a sidebar lists various occupations under the heading "OCCUPATIONS". The main content area displays the details for the occupation "data scientist". The title "data scientist" is in a large, bold, black font on a yellow header bar. To the right of the title is a link to "English (en)". Below the title, there is a "Description" section containing a detailed paragraph about the role of a data scientist. On the far right of the main content area, there are icons for download, print, and sharing.

Legal notice | Cookies | Contact | Search on Europe English (en)

European Skills/Competences, qualifications and Occupations

European Commission > ESCO > Occupations

ABOUT ESCO CLASSIFICATION TOOLS & RESOURCES

Occupations Skills/competences Qualifications

data scientist English (en)

OCCUPATIONS

data scientist
bioinformatics scientist
sensory scientist
cosmologist
hydrographic surveyor
geoscientist

data scientist

Description

Data scientists find and interpret rich data sources, manage large amounts of data, merge data sources, ensure consistency of data-sets, and create visualisations to aid in understanding data. They build mathematical models using data, present and communicate data insights and findings to specialists and scientists in their team and if required, to a non-expert audience, and

a prototype tool

UTS: Burning Glass

Kirsty ▾

Content Tagger/Similarity

Enter subject number(s) comma separated

Fetch Results

Occupations	
Subject	Potential Skills
Data Scientist	0.449
Data / Data Mining Analyst	0.4
Statistician	0.375
Database Architect	0.354
36100 Data Science for Innovation	0.349
36103 Statistical Thinking for Data Science	0.348
Data Engineer	0.345
IT Project Manager	0.342
Data Warehousing Specialist	0.340
UI / UX Designer / Developer	0.339
Financial Quantitative Analyst	0.339
Chief Information Officer / Director of Information Technology	0.339
36106 Data, Algorithms and Meaning	0.338
36101 Leading Data Science Initiatives	0.338

UTS: Burning Glass

Kirsty ▾

Content Tagger/Similarity

Enter subject number(s) comma separated

Fetch Results

Occupations	
Subject	Potential Skills
UI / UX Designer / Developer	0.448
Marketing Manager	0.407
Data / Data Mining Analyst	0.409
Data Scientist	0.394
Product Manager	0.389
Software Developer / Engineer	0.388
Market Research Analyst	0.387
Database Architect	0.386
Social Science Researcher	0.385
Natural Science Research Manager	0.379
81539 Impossibilities to Possibilities	0.378
81540 Technology, Methods and Creative Practice	0.377
81538 Frame Innovation	0.376
94663 Navigating Entrepreneurial Ecosystems and Initiating Change	0.375

so can we use this to help people identify new opportunities when they are **returning** to university?

The screenshot shows the UTS CareerHub interface. At the top, there's a blue header with the UTS logo, the text "CareerHub", and social media links for Careers (@, f, t). Below the header is a black navigation bar with links for "CareerHub", "Job Opportunities", "Resources", "Dashboard", "Events", "Profile", and a user profile for "Kirsty". The main content area has a light gray background. It features a title "Career Action Plan" above four large blue circles, each containing one of the four stages: "Self-Awareness", "Opportunity Awareness", "Decision-Making", and "Take Action". Below these circles is a text block: "Throughout your career, you'll go through a number of different stages". Underneath this, it says "Self-Awareness, Opportunity Awareness, Decision-Making and Take Action." followed by "Explore these stages through the activities below." and "You have the ability to choose the sections and activities that are most relevant to you or that you are interested in learning more about." At the bottom, it says "Work your way through the Career Action Plan and track your progress with the counters in the top right corner of each section." A large, semi-transparent text "in progress!" is overlaid on the bottom right of the slide.

CareerHub

Careers @ f t

Kirsty

Career Action Plan

Self-Awareness

Opportunity Awareness

Decision-Making

Take Action

Throughout your career, you'll go through a number of different stages

Self-Awareness, Opportunity Awareness, Decision-Making and Take Action.

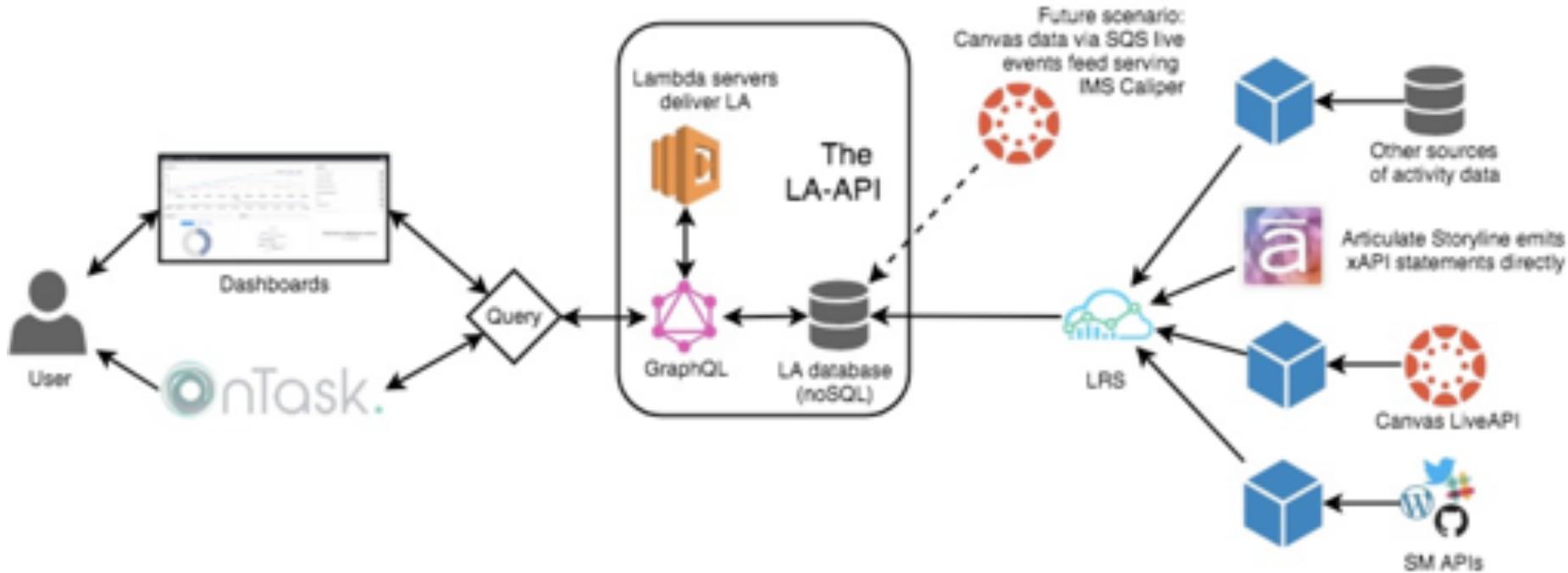
Explore these stages through the activities below.

You have the ability to choose the sections and activities that are most relevant to you or that you are interested in learning more about.

Work your way through the Career Action Plan and track your progress with the counters in the top right corner of each section.

in progress!

but that requires an ecosystem of tools!



data interoperability and portability are
essential in a lifetime of learning!

An aerial photograph of the Great Wall of China, showing its long, winding path across a series of hills. The wall is made of light-colored stone and has several watchtowers. The surrounding terrain is dry and hilly, with sparse vegetation.

learning to
learn is a long
and winding
road

A wide-angle photograph of the Great Wall of China, showing its winding path across a range of mountains. The wall is made of stone and brick, with small watchtowers at intervals. The surrounding terrain is dry and rocky, with sparse vegetation. The sky is clear and blue.

one that is fraught
with peril if we are
too naive!

in summary

what I have learned... and often wish that EdTech would too:

- learning happens everywhere – so we need to *enable* that
- learning happens over a lifetime – so over many systems!
- we must establish the *type* of learning we are hoping to enable
- we must focus on solving actual problems!
- data interoperability and portability are essential!
- technology alone is never enough



Questions?



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