

Classifying critical thinking in MOOCs

Tim O’Riordan, 26 November 2021

Thesis: tinyurl.com/tjorphd

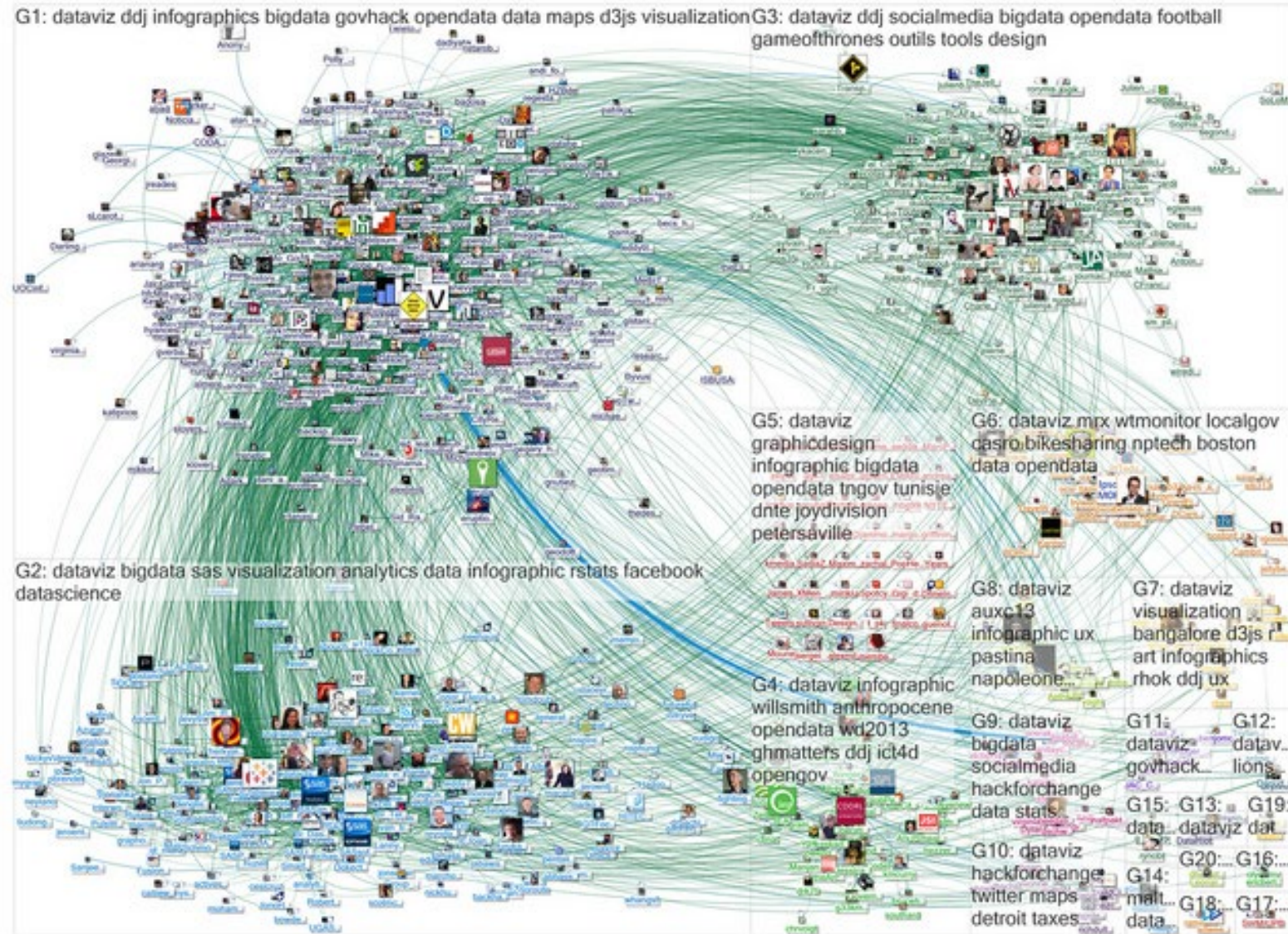
Paper: tinyurl.com/caee2020



1. León-Urrutia, M., White, S., Dickens, K., White, S. (2015). Mentoring the Masses : MOOC Mentor Interventions Towards a Connected Learning Community. EMOOCs 2015 European MOOC Stakeholders Summit, 1–3

Classifying critical thinking in MOOCs

Small media network map of connections among Twitter users



Created with NodeXL (<http://nodexl.codeplex.com/>) from the Social Media Research Foundation (<http://www.smfoundation.org/>)

Image: NodeXL Twitter Search #dataviz/ Marc Smith, cc-by, © 2013

Content analysis



Image: ALTC2015, Association for Learning Technology ©2015, CC BY-NC-SA 2.0

Critical thinking

”...reasonable and reflective thinking that is focused upon deciding what to do or believe.“²

2. S. P. Norris & R. H. Ennis, *Evaluating Critical Thinking. The Practitioners' Guide to Teaching Thinking Series*. Pacific Grove, CA: Midwest Publications, 1989.

Coding schemes

	0	1	2	3	4	5	6
Bloom's Taxonomy ³	Off-topic	Remember	Understand	Apply	Analyse	Evaluate	Create

	0	1	2	3	4
Cognitive Presence (CoI) ⁴	Off-topic	Triggering	Exploration	Integration	Resolution

3. D. R. Krathwohl, "A Revision of Bloom's Taxonomy: An Overview," *Theory Pract.*, vol. 41, no. 4, pp. 212–218, 2002.

4. D. R. Garrison, T. Anderson, and W. Archer, "Critical thinking, cognitive presence, and computer conferencing in distance education," *Am. J. Distance Educ.*, vol. 15, no. 1, pp. 7–23, 2001.

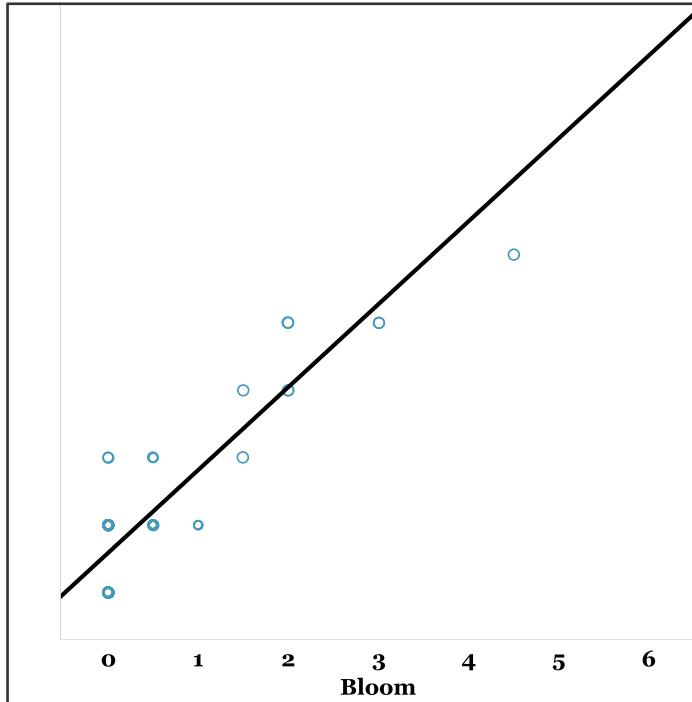
Method



- 1500 comments (500 from each MOOC)
- Rated according to 2 methods by 7 raters
- Inter-rater reliability ≈ 0.8
- Linguistic Inquiry and Word Count (LIWC 2015)

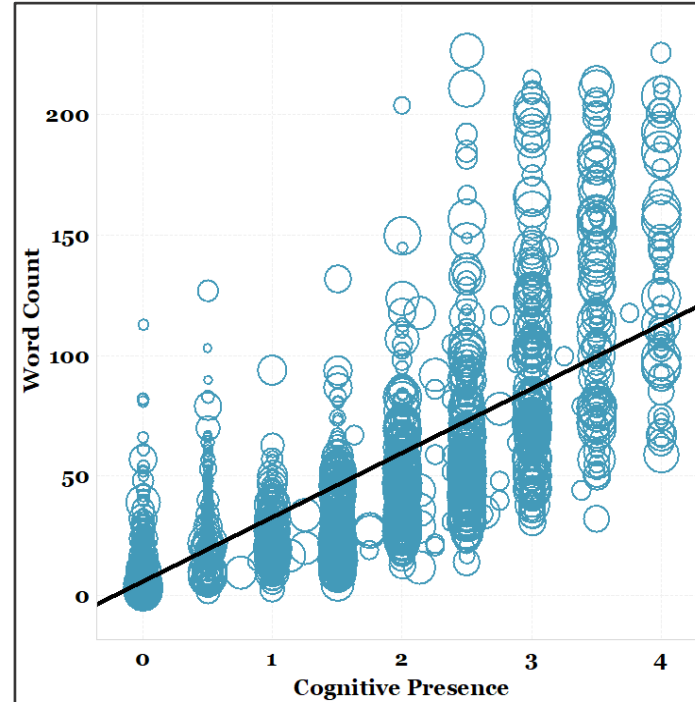
Image: University of Southampton, Understanding Language, Exploring Oceans and Contract Management MOOCs. FutureLearn Ltd 2015.

Results



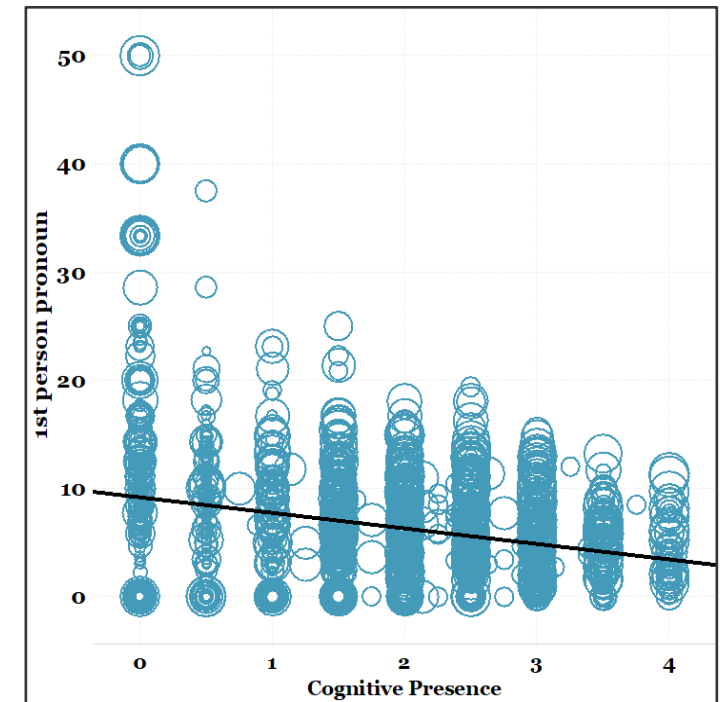
Correlation between Bloom
and Cognitive Presence

$r = 0.909$, $p = <0.001$



Correlation between CP
and Word Count

$r = 0.704$, $p = <0.001$

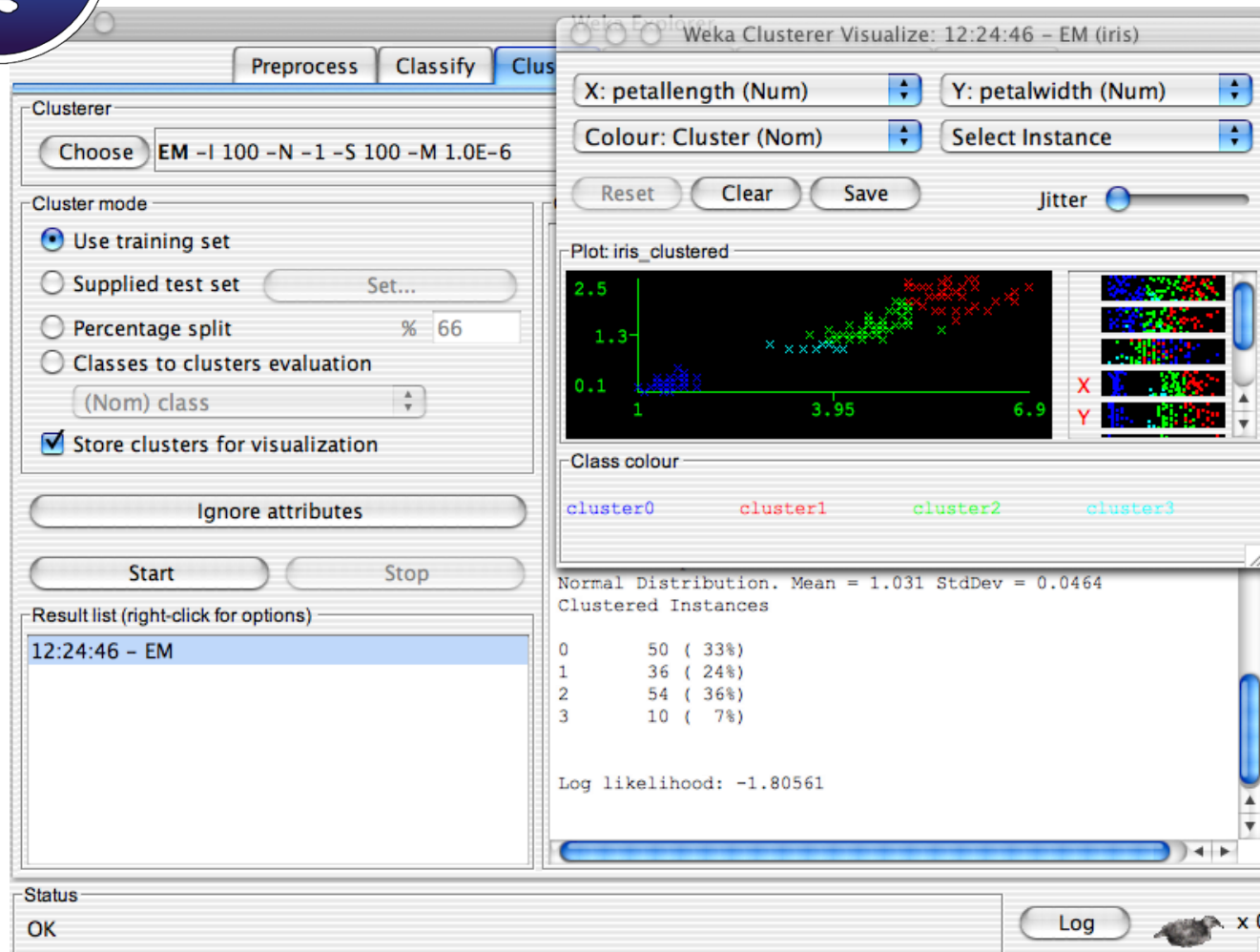


Correlation between CP
and 1st person singular

$r = -0.317$, $p = <0.001$

Critical thinking value

	0	1	2	3	4
Critical thinking value	Low	Modest	Average	Good	High



Images: Weka Logo/Weka interface, University of Waikato ©2015

Machine learning

- Classifiers: Naive Bayes, J48, ZeroR, **Random Forest**
- Intraclass Correlation Coefficient: 0.695

Attributes
Likes
Word count
Causation
Differentiation
Negation
Cognitive process
Words per sentence
Auxiliary verbs
Power words
Six letters or more
Conjunctions
Negative emotion
Prepositions
Pronouns
First person singular
Affiliation words
Positive emotion

Machine learning

	Predicted				
Actual	Low	Modest	Average	Good	High
Low	9	14	26	9	2
Modest	6	21	20	9	4
Average	2	10	25	16	7
Good	0	4	14	19	23
High	0	1	9	14	36

Confusion matrix for best model

User study



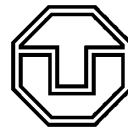
DIGITAL ACCESSIBILITY: ENABLING PARTICIPATION IN THE INFORMATION SOCIETY

UNIVERSITY OF SOUTHAMPTON & MOOCAP

With a better understanding of users' needs, technologies can be developed to be accessible & provide a more inclusive environment

TBA 5 weeks 3 hours pw Certificate

More



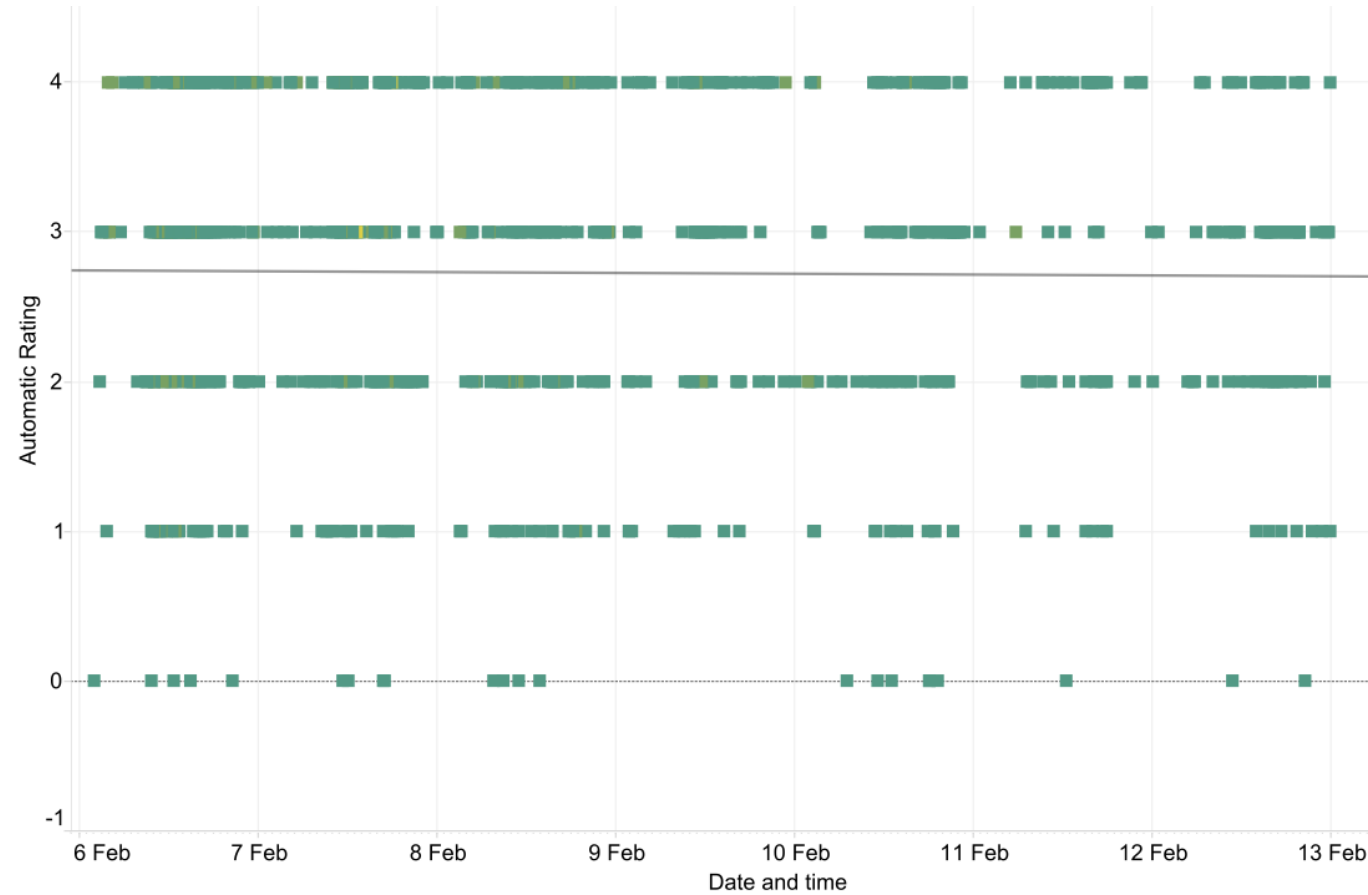
**TECHNISCHE
UNIVERSITÄT
DRESDEN**



UNIVERSITY OF
Southampton

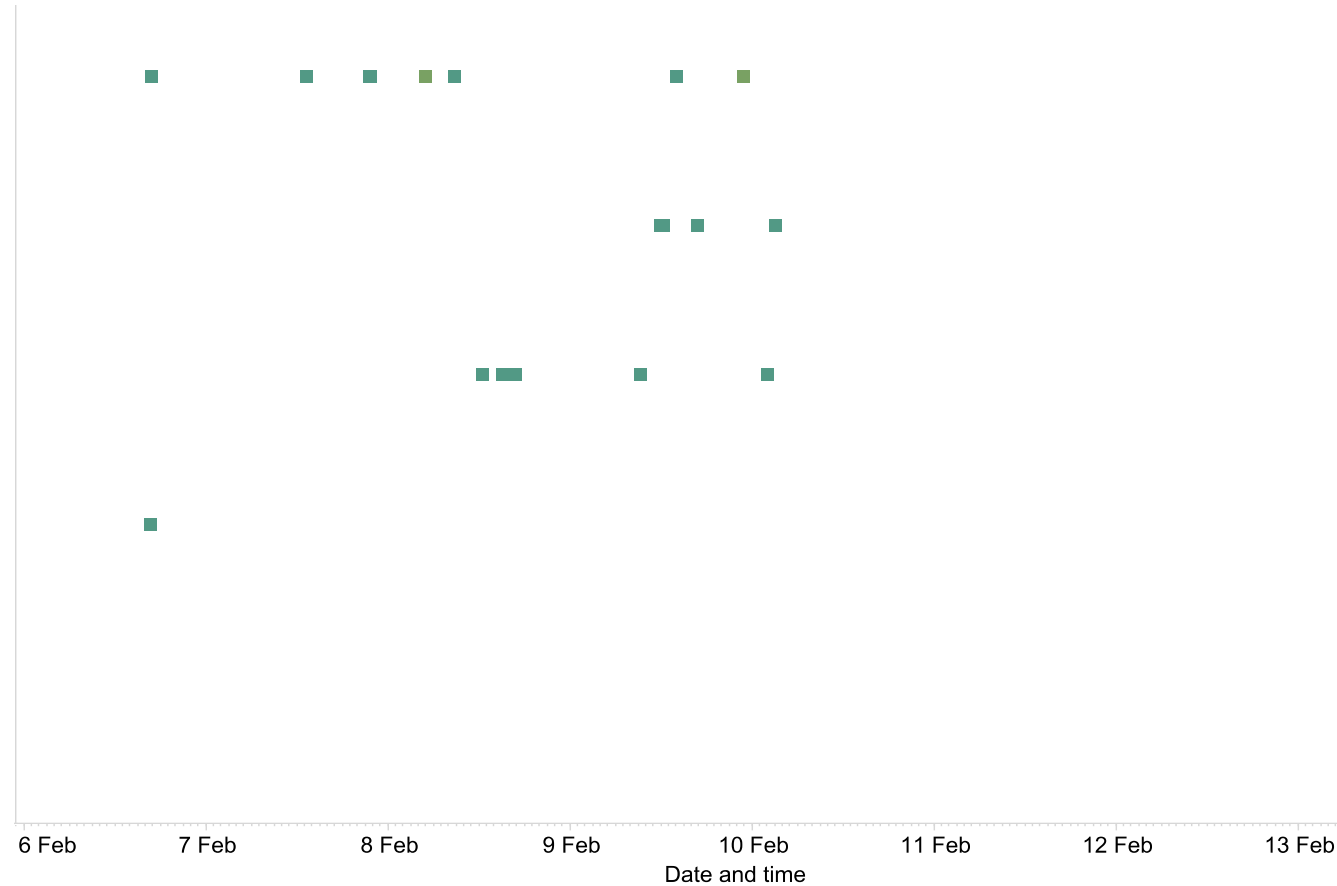
Image: University of Southampton and MOOCAP, Digital Accessibility MOOC.
FutureLearn Ltd 2017

User study



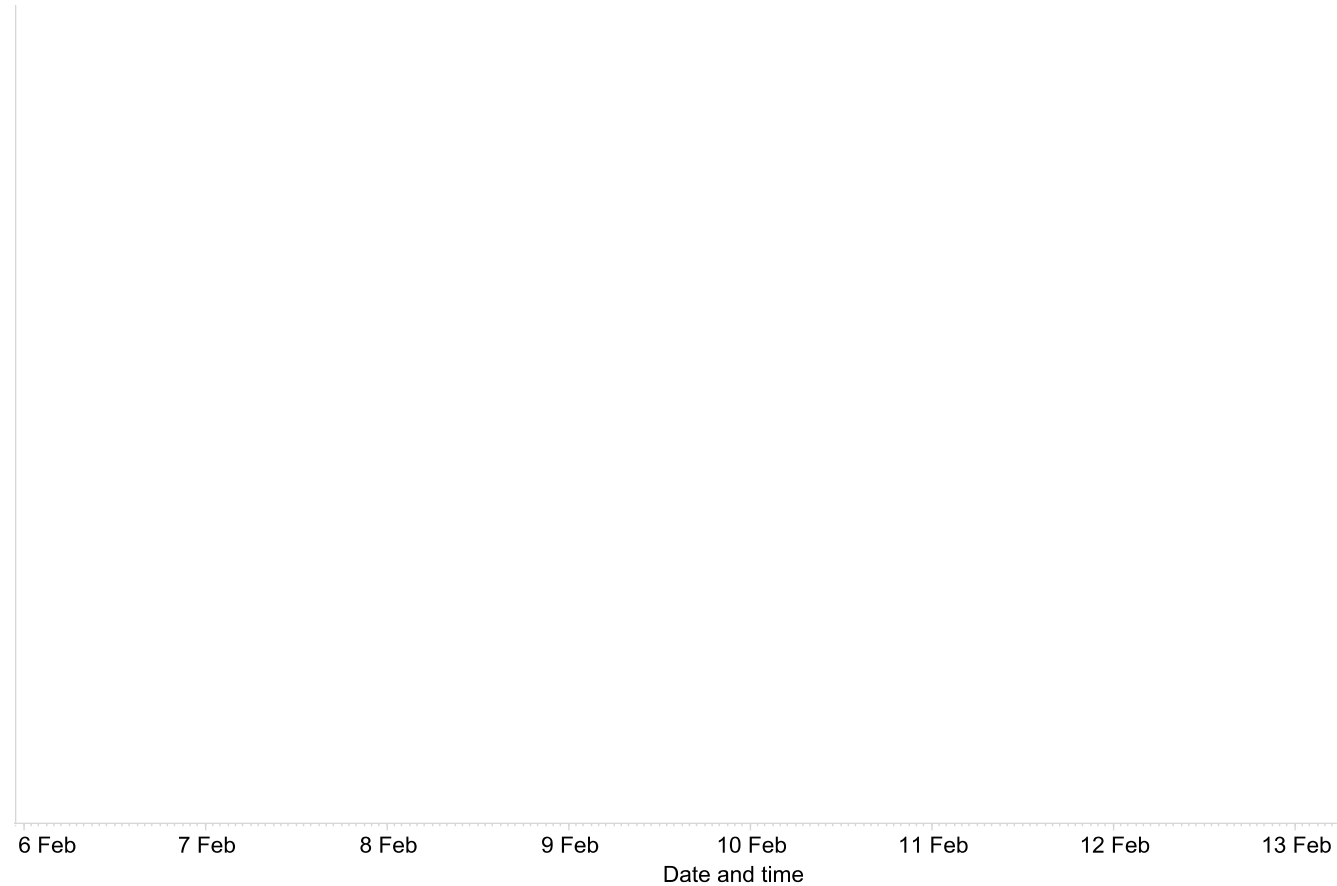
Automatic rating of all comments in all steps for Week 1, DA MOOC, 2017.

User study



Automatic rating of all comments in all steps for Week 1.18, DA MOOC, 2017.

User study



Automatic rating of all comments in all steps for Week 1.17, DA MOOC, 2017.

Results

- Educators sought reflective, high level comments
- Automatic ratings considered reasonably accurate
- Value feedback that facilitates filtering high volumes
- Questioning importance of monitoring critical thinking.

What educators look for

When I read the comment, I look for:

1) they have thought about the issue themselves, and they have their own opinions about things; and

2) they have new thoughts that nobody else has written or commented on.

And sometimes they ... post links ... So that shows that they have done some research themselves.

Accuracy of rating

It was one of those examples where I thought, oh, we are so lucky to find these people in this course, so in my mind it is actually a four.

Usefulness of rating

To me it's kind of a suggestion. I understand what the system gave me it's something that I can consider. But the decision is mine, right?

Usefulness of rating

Particularly in a MOOC, if you ... can give the teacher or educator some possibilities to have a quick overview of how the students are doing ... so that they can actually give feedback to the students. It will be a very, very good addition to the MOOC pedagogy.

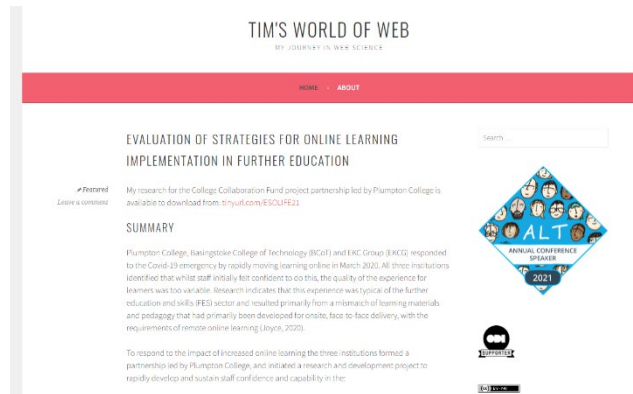
Conclusions

- Facilitation and direction via MOOC forums is a significant challenge.
- Interchangeability of coding schemes.
- Coherent and intelligible method.
- Providing useful, actionable feedback.

Next steps

- Involve stakeholders in developing the classifier
- Practice-centred rather than methods-centred approach
- Operationalise the algorithm

Thank you



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