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Classifying critical thinking in MOOCs

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TOO MANY
COMMENTS

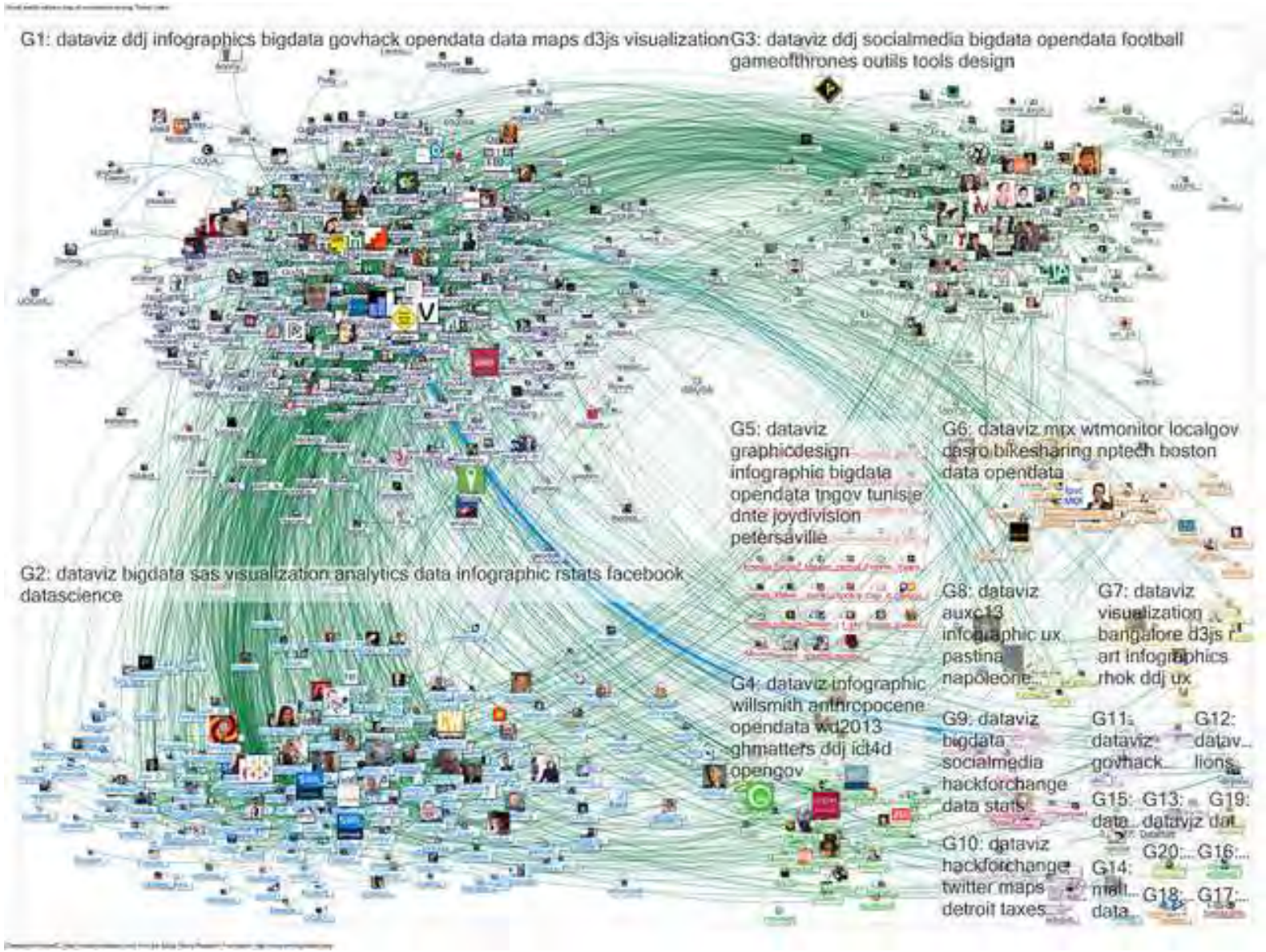

Image: NodeXL Twitter Search #dataviz/ Marc Smith, cc-by, © 2013

Content analysis

Critical thinking

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

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

Coding schemes

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

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

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

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.


- 500 comments each MOOC
- Rated according to 2 methods by 7 raters
- Linguistic Inquiry and Word Count (LIWC 2015)

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

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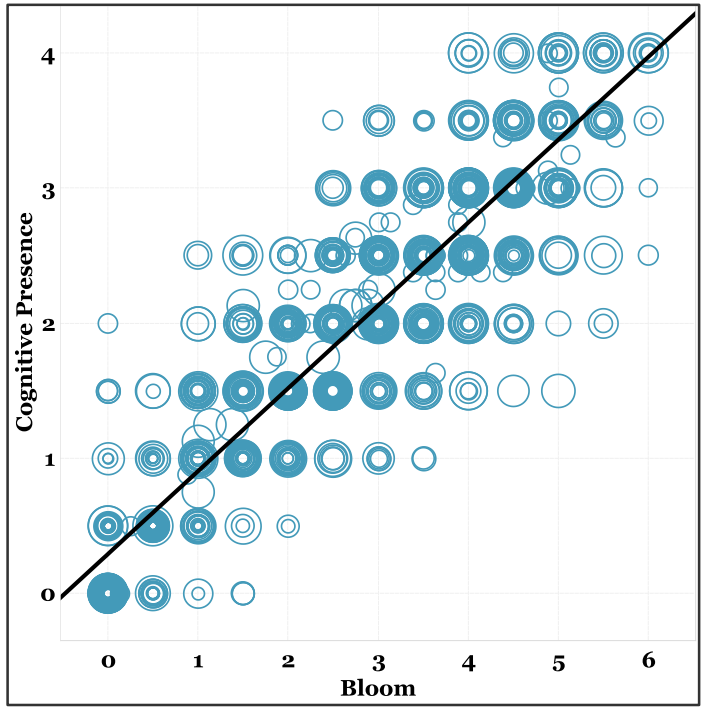
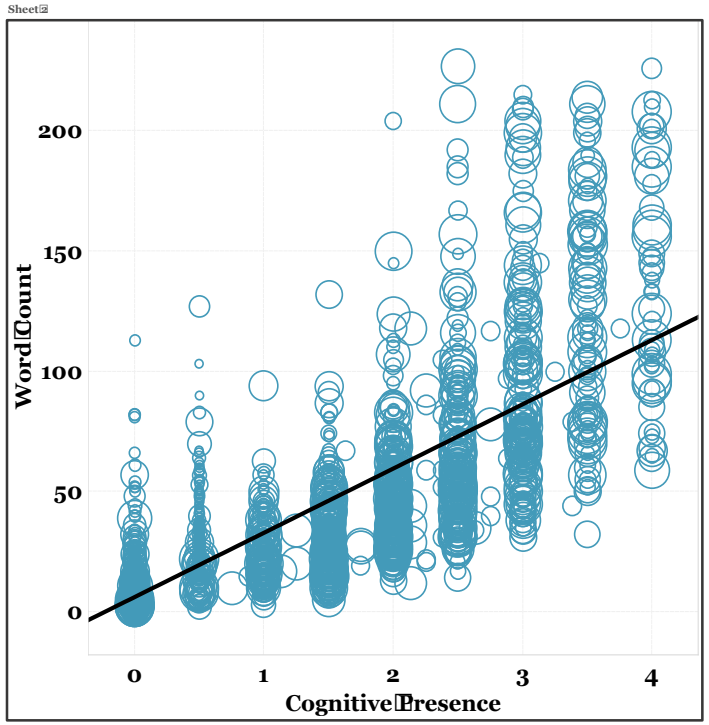
Results



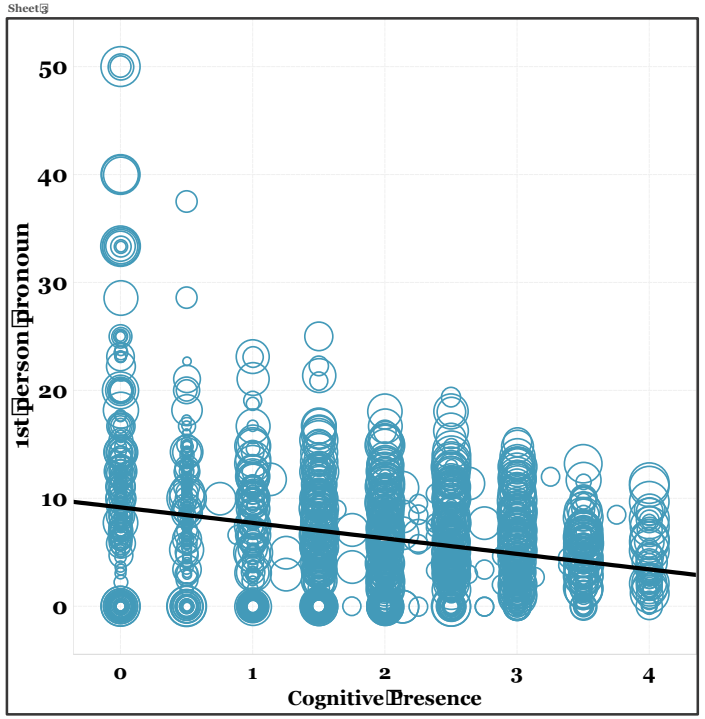
Correlation between Bloom and Cognitive Presence

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

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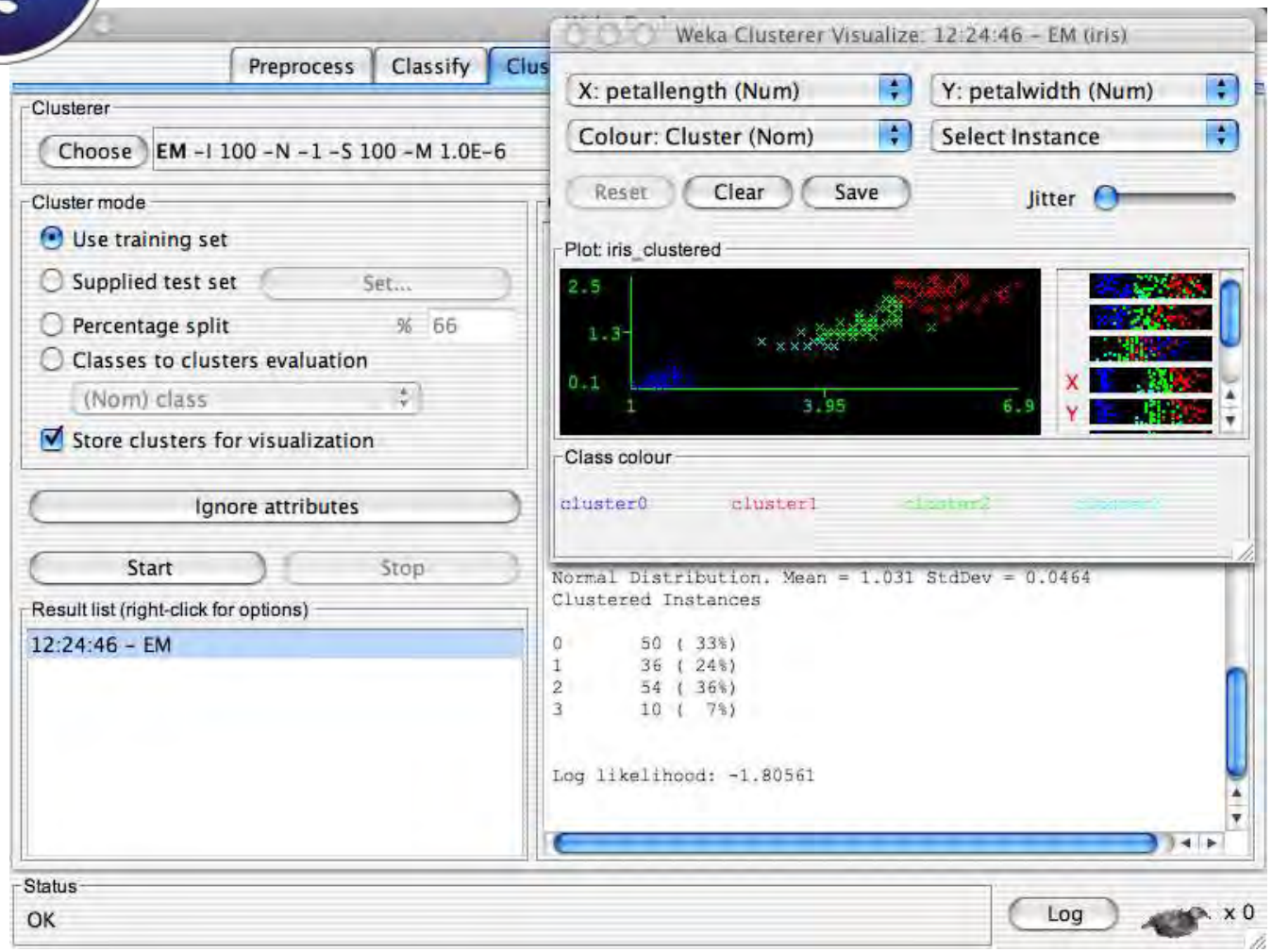

Images: Weka Logo/Weka interface, University of Waikato ©2015

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

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Machine learning

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

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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

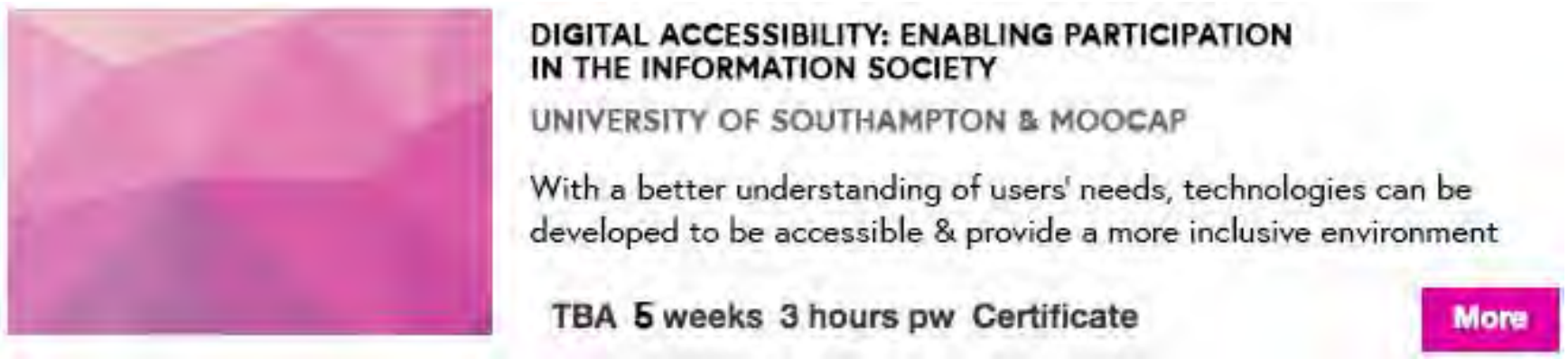

Image: University of Southampton and MOOCAP, Digital Accessibility MOOC. FutureLearn Ltd 2017

User study

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

User study

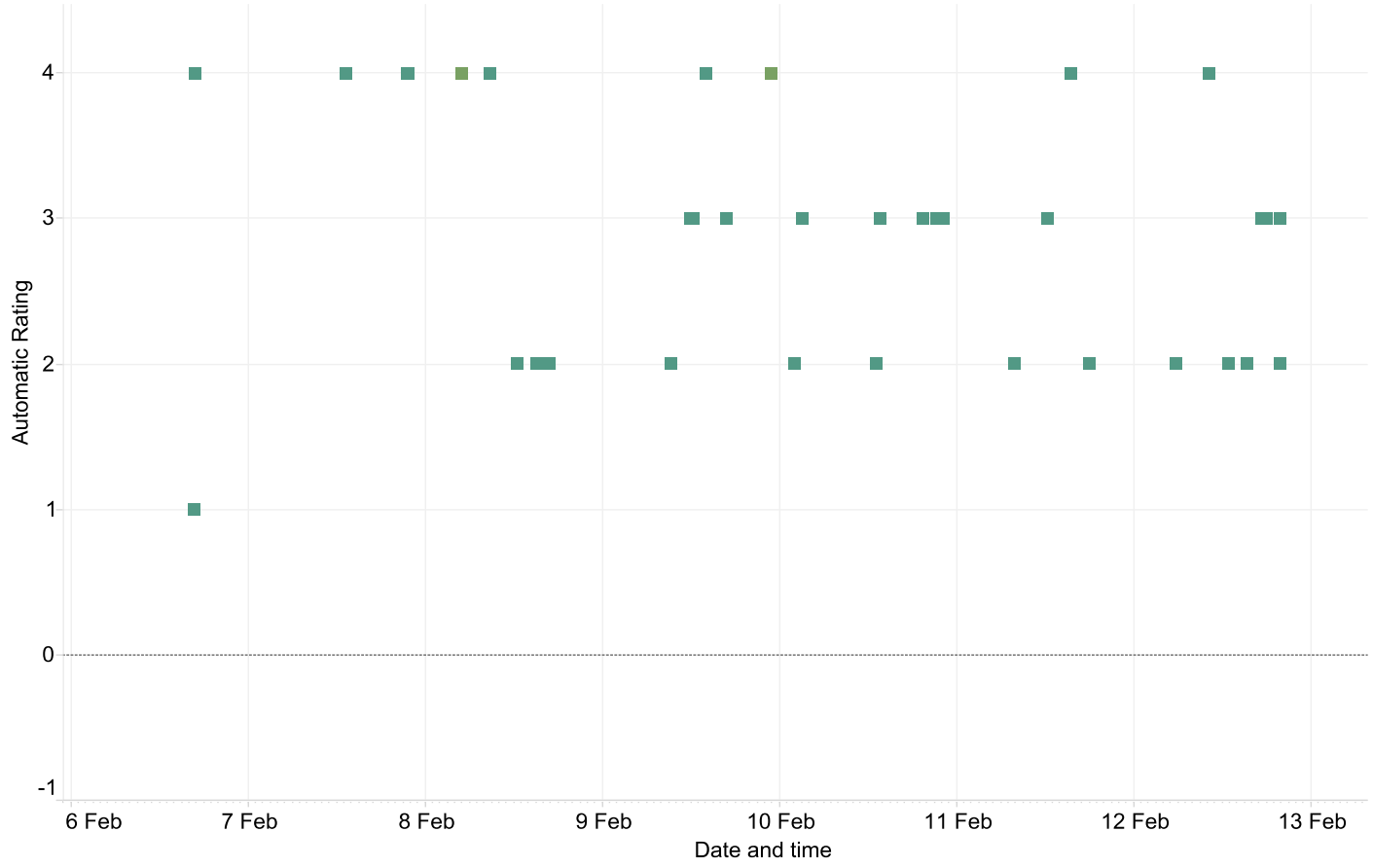

Image: Automatic rating of all comments in all steps for Week 1.18, DA MOOC, 2017.

User study

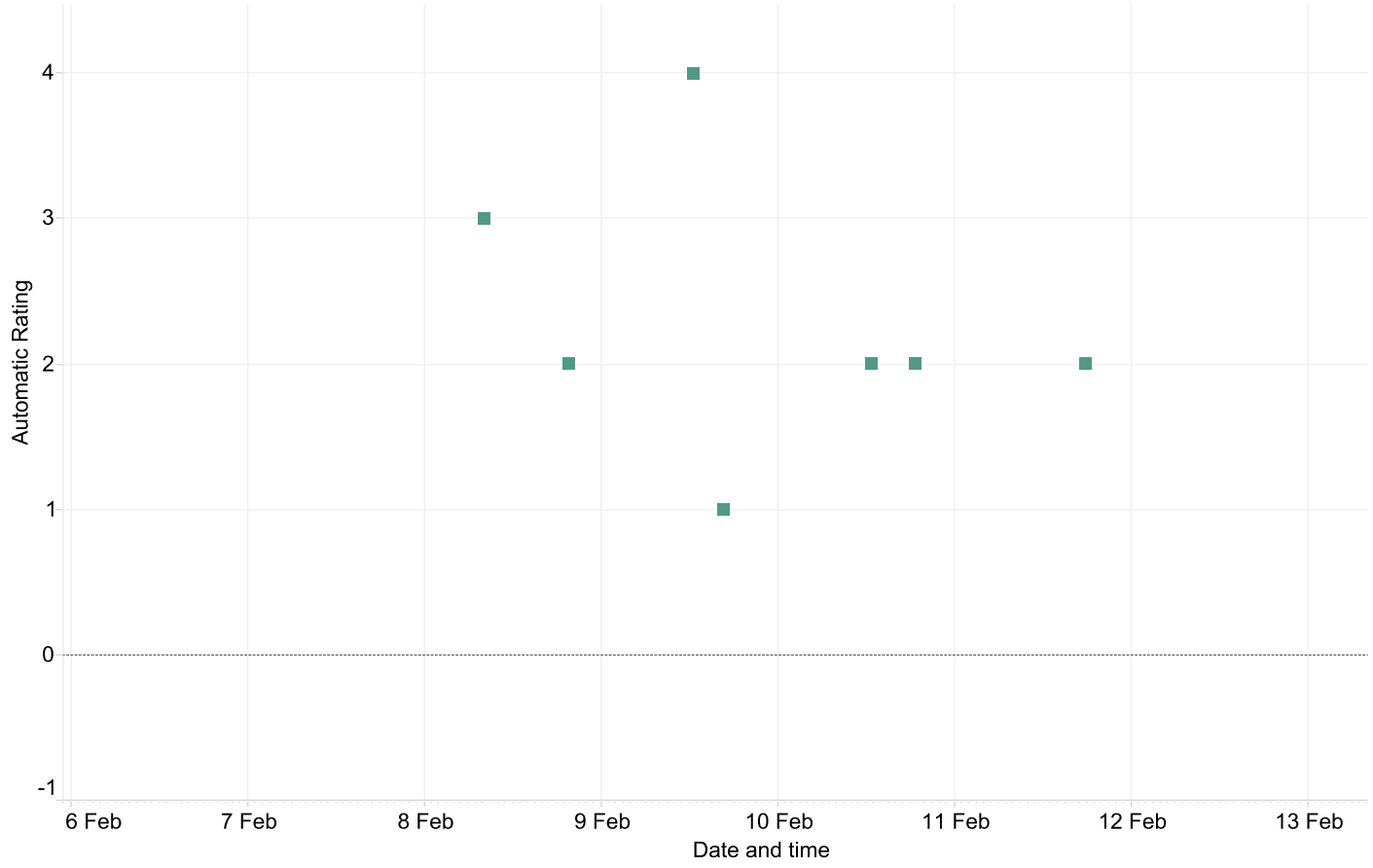

Image: Automatic rating of all comments in all steps for Week 1.17, DA MOOC, 2017.

Results

- Educators sought reflective, high level comments
- Automatic ratings considered reasonably accurate
- Value feedback that facilitates filtering high volumes

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.

What educators look for

...being provocative to some degree. That they are arguing against. That they offering counter argument. That they are looking at it from a different perspective. That they have, I suppose, absorbed the lesson and added something to it would indicate it as well.

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

I found that it kind of focused on critical thinking, which I hadn't really thought about. And what would be interesting would be to – when you're designing the course – to be thinking in those terms.

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 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.

Next steps

- Practice-centred rather than methods-centred approach
- Operationalise the algorithm
- Double-blind study

Thank you

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