

# Integrating Learning Analytics to Measure Message Quality in Large Online Conversations

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# Who are we?



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# Overview

- Motivation and problem identification
- Objective of our software
- Design and development
- Research questions
- Experimental study
- Evaluation
- Conclusion
- Comments & questions



# Motivation

- Collaboration provides synergistic learning opportunities for students in order to go beyond what they can achieve alone
- Asynchronous online discussions (AODs) can afford a genuinely conversational mode of learning



# Problem Identification

In large AODs, students..

- produce many navigational uncertainty markers related to what they have read, have not read, and where to find the relevant information (Eryilmaz et al., 2019)
- rarely are aware of other group members' ideas hindering the synthesis of diverse ideas that could be brought to solve problems or perform the task at hand (Vogler et al., 2017)

Eryilmaz, E., Thoms, B., Ahmed, Z., & Lee, K. H. (2019). Affordances of Recommender Systems for Disorientation in Large Online Conversations. *Journal of Computer Information Systems*, 1-11.

Vogler, J. S., Schallert, D. L., Jordan, M. E., Song, K., Sanders, A. J., Te Chiang, Lee, J., Park, J. H., & Yu, L. T. (2017). Life history of a topic in an online discussion: a complex systems theory perspective on how one message attracts class members to create meaning collaboratively. *International Journal of Computer-Supported Collaborative Learning*, 12(2), 173-194.

Eryilmaz et al., 2020 CSUS-3



# Objective of Our Software

Help students to find useful messages, which they may not have found themselves, from a potentially overwhelming number of messages based on their interests



# Design and Development

The recommender system employs

- the constrained Pearson correlation coefficient similarity metric to compute similarity scores among users
- the K-nearest-neighbor classification method to discard poor correlations in order to decrease noise and improve the quality of recommendations
- the weighted averaging equation to calculate a user's preference score for each item based on the best neighbors' preferences

Eryilmaz, E., Thoms, B., Ahmed, Z., & Lee, K. H. (2019). Affordances of Recommender Systems for Disorientation in Large Online Conversations. *Journal of Computer Information Systems*, 1-11.

Eryilmaz et al., 2020 CSUS-5



# CSCL Environment

Course ▶ Spring 2019 (CS161)

4/8

Annotate



## Online Learning Conversations

Annotation Recommendations ▼



highlighted:

Scrum process provides three artifacts namely the Product Backlog, the Sprint Backlog, and the Burndown Chart.



highlighted:

The Daily Scrum Meeting (TDSM) is a 15-minute status meeting to talk about what has been accomplished since the last meeting, what items will be done before the next meeting, and what obstacles developers have.



highlighted:

The idea behind reducing documents in the agile methods is to keep every team members equal by sharing skills and knowledge on the systems. In that way, if one person leaves, there is still a lot of shared knowledge that has gone around among other team members, so it is not a big deal.

Development methods (ADMI), in the early 1990s. The latter developed many of the initial thoughts and practices for Scrum when he was at Easel Corporation as a vice president of Object Technology in 1994. By a joint effort of both Schwaber and Sutherland, the Scrum process was first introduced to public at the conference of Object-Oriented Programming, Systems, Languages and Applications (OOPSLA) in 1996 [13].

## Empirical Process Control

The co-founder of the Scrum process, Schwaber argues that the Scrum process employs an empirical process control which has three legs underlying all of its implementations: transparency (visibility), inspection, and adaptation<sup>38</sup>[14, 25]. Transparency or visibility means that any aspects of the process that affect the outcome must be visible and known to everybody involved in the process<sup>70</sup>. Inspection requires that various aspects of the process be inspected frequently enough so that unacceptable variances in the process can be detected.<sup>76</sup> Adaptation requires that the inspector should adjust the process if one or more aspects of the process are in an unacceptable range.

A code review can be analyzed with the empirical

also tries to remove any impediments imposed on developers.

There are several ceremonies in the Scrum process including the Daily Scrum Meeting, the Daily Scrum of Scrums Meeting, the Sprint Review Meeting and the Sprint Planning Meeting. The Daily Scrum Meeting (TDSM) is a 15-minute status meeting to talk about what has been accomplished since the last meeting, what items will be done before the next meeting, and what obstacles developers have.<sup>718</sup> TDSMs facilitate communications, identify and remove impediments to development, highlight and promote quick decision-making, and improve transparency (visibility) as explained in the previous section.<sup>34</sup> The Daily Scrum of Scrums Meeting (TDSSM) is another short daily meeting and follows the same format as a regular TDSM. The main reason for having TDSSM is to synchronize the work between multiple Scrum teams. The Sprint Planning Meeting (TSPM) is a monthly meeting, where the Product Owner and Team get together to discuss what will be done for the next Sprint which lasts usually for 30 days. In TSPM, team members break a project into a set of small and manageable tasks so that all the tasks can be completed in one Sprint.<sup>84</sup> The Sprint Review Meeting (TSRM) is another monthly meeting which is held at the end of the Sprint. TSRM

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# CSCL Environment

The screenshot shows a course interface for 'Spring 2019: CSUS-7'. At the top, there is a navigation bar with 'Course', 'Spring 2019: CSUS-7', a document icon, a download icon, a progress indicator '4/8', an 'Annotate' button, a user profile for 'danrichards', and a 'Logout' button. The main content area is divided into three columns. The left column shows a comment thread with a 'Key Idea' box. The middle column shows a document viewer with a '3' in a box. The right column shows a document viewer with a '5' in a box. The 'Key Idea' box contains the text: 'on what they missed.' followed by a star rating, a comment by 'Eun Young' with a 'Reply' button, and a 'Key Idea' box stating 'This is important.' with a 5-star rating. Below this is a comment by 'Dan Richards' with a 'Reply' button and a 'Statement' box stating 'I agree, short daily meetings on where each team member currently is with their tasks is important in helping keep people focused and also allows the team leader to make timely adjustments and remain flexible. Teams who are able to react quickly and flexibly have a good chance of success.'

Eryilmaz, E., Thoms, B., & Canelon, J. (2018). How Design Science Research Helps Improve Learning Efficiency in Online Conversations. *Communications of the Association for Information Systems*, 42(1), 21.

Eryilmaz et al., 2020 CSUS-7



# Research Questions

- What are the effects of recommendations on the phases of the interaction analysis model developed by Gunawardena et al. (1997)?
- What are the effects of recommendations on message quasi-quality index scores per student?
- Is there a relationship between message quasi-quality index scores and the phases of the interaction analysis model developed by Gunawardena et al. (1997)?



# Study

- Experimental study with 70 undergraduate college students distributed to two sections of a system analysis and design course.
- We randomly assigned each section to a software condition.



# Evaluation-Content Analysis

Phase	Control Software (n=35)		Recommender System (n=35)		Test Statistics	
	M	SD	M	SD	p	Cohen's d
Sharing information	0.43	0.22	0.23	0.18	<0.001	-0.99
Exploring dissonance	0.24	0.13	0.32	0.14	0.02	0.60
Negotiating meaning	0.14	0.13	0.21	0.12	0.03	0.56
Testing proposed synthesis	0.07	0.11	0.10	0.13	0.33	0.25
Agreeing on new knowledge	0.06	0.12	0.08	0.13	0.54	0.16
Off-topic messages	0.07	0.11	0.05	0.09	0.41	-0.20



# Evaluation-Quasi Quality Index Score

$$QQI = \left( \frac{1}{n} \sum_{i=1}^n X_i \right) + \left( \frac{d}{\frac{1}{n} \sum_{i=1}^n d_i} * \frac{u}{\frac{1}{n} \sum_{i=1}^n u_i} \right)$$

$n$ =Total elements

$x$ = Post readability score

$d$ = Post keyword density

$u$ =Total post non-stopwords

$$d = \frac{k}{W-S}$$

$W$ =Total post words

$S$ =Total post stopwords

$k$ =Total post keywords

B. Thoms, E. Eryilmaz, N. Dubin, R. Hernandez, S. Colon-Cerezo, "Real-Time Visualization to Improve Quality in Computer Mediated Communication," *Web Intelligence Journal*, September, 2019.



# Evaluation-Quasi Quality Index Score

	Control Software (n=35)		Recommender System (n=35)		Test Statistics	
	M	SD	M	SD	p	Cohen's d
Quasi-quality index scores	67.84	8.87	73.12	7.97	0.01	0.63



# Evaluation-Relationship between Content Analysis and Quasi Quality Index Score

Quasi-quality index score for phase	Control Software (n=35)		Recommender System (n=26)		Test Statistics	
Sharing information	M	SD	M	SD	p value	Cohen's d
	67.10	11.90	68.83	15.07	0.62	0.13
Exploring dissonance	Control Software (n=30)		Recommender System (n=33)		Test Statistics	
	M	SD	M	SD	p value	Cohen's d
	67.13	12.58	74.35	13.89	0.04	0.55
Negotiating meaning	Control Software (n=21)		Recommender System (n=28)		Test Statistics	
	M	SD	M	SD	p value	Cohen's d
	70.38	12.85	80.27	14.24	0.02	0.72



# Community Formation

	Control Software (n=35)		Recommender System (n=35)		Test Statistics	
	Frequency	Proportion	Frequency	Proportion	z	p
Number of central students	4	0.114	8	0.229	1.27	0.20
Number of intermediate students	12	0.343	17	0.486	1.21	0.23
Number of peripheral students	19	0.543	10	0.286	-2.18	0.03



# Conclusion

Findings advance prior literature on

- learning analytics and content analysis of AOD messages
- the effects of recommendations on AOD message quality



# Mahalo!

Your Comments and Questions are welcomed.

Please address feedback to:

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