

Initial Development and Implementation of a Pedagogical Model for Learning Analytics in Online Discussions

Alyssa Friend Wise

Simon Fraser University

250 - 13450 102nd Avenue

Surrey, BC, V3T0A3 Canada

1-778-782-8046

alyssa_wise@sfu.ca

ABSTRACT

This paper describes an application of learning analytics that builds on an existing research program investigating how students contribute and attend to the messages of others in online discussions. A pedagogical model that translates the concepts and findings of the research program into guidelines for practice is presented based on the principles of (1) Diverse Metrics (2) Active and Negotiated Interpretation (3) Integration with Learning Activity and (4) Explicit Time and Space for Reflection. An initial implementation in which analytics are reviewed and interpreted as part of a weekly reflective goal-setting activity is described. Finally, plans for evaluation are outlined. The objective is to assess the effects of using these analytics (as part of reflective practice) on students' discussion participation.

Categories and Subject Descriptors

K.3.1 Computer uses in education

General Terms

Measurement, Design, Human Factors.

Keywords

Online learning, Computer mediated communication, Learning analytics, Asynchronous discussion groups, Student participation.

1. INTRODUCTION

1.1 Prior Research on Online Discussions

Early research into online discussions suggested that the common problems of disconnected comments, weak attention to others' posts, and generally incoherent dialogue were global across students and thus systemic products of the online discussion environment [1, 2]. These findings spurred previous efforts to innovate and improve discussion environments generally. However, more recent work disaggregating data across individuals has revealed that students in fact engage in very different kinds of behaviors in online discussions [3, 4, 5]. This suggests that discussion participation can also be improved with more targeted efforts to provide guidance to students individually. As distributed participation in an asynchronous system is difficult for humans, but relatively easy for computers to track, this is an area in which learning analytics can be useful to education.

1.2 Theoretical Framework for Discussion Participation

From a social-constructivist perspective, online discussions are conceptualized as a space for learners to build individual and collective understandings through dialogue [6]. Using face-to-face

conversations as an analogy, the process of making contributions in an online discussion can be thought of as "speaking" (externalizing one's ideas) and the process of attending to the comments of others can be considered as "listening" (taking in the externalizations of others) [3]. Specifically, speaking involves making original posts and responses, while listening involves accessing the posts of others.

Given the above-described goal of using dialogue to build individual and collective understandings, particular speaking and listening behaviors can be characterized as more or less productive. For example, in terms of *speaking quantity*, multiple posts are needed to respond to others' ideas and questions, elaborate on the points made, and negotiate with others [7]. These posts should be distributed throughout the discussion (rather than clumped at the start or end), relating to the *temporal distribution* of participation. In addition posts of moderate length best support rich dialogue since very short posts tend to be shallow in their presentation of ideas [8] but long posts are often perceived as overwhelming and thus not read [9]. In terms of *speaking quality* posts that are clear, critical and connected to the existing conversation support the generation of insight and understanding of the topic [10]. Posts whose arguments are based on evidence and/or theory can also trigger others to productively build on or contest the points [11]. Finally responses that clarify points, elaborate or question existing ideas, or synthesize different ideas together help deep the exploration of ideas and move the discussion forward [7].

Considering *listening breadth*, viewing a greater proportion of others' posts exposes students to more diversity of ideas and is associated with richer responses [5]. *Listening reflectivity* (revisiting one's own and others' posts from earlier in the discussion) is also important to provide context for interpreting recent posts and examine how thinking has changed. Revisiting others posts has also been shown to be associated with a higher quality of response to ideas [12]. Finally *temporal distribution* is again important as engaging in multiple sessions during a discussion and integrating listening and posting in the same session can support making connections between ideas and contributing posts which productively build on previous ones [3].

2. LEARNING ANALYTICS METRICS FOR DISCUSSION PARTICIPATION

Several metrics easily calculable from online discussion log-file data have been created to give students feedback on their listening and speaking behaviors (see Table 1). Each metric is calculated by for each student for each discussion; for rationale and calculation details see [3, 4, 5, 12]. Speaking quality is not directly assessable from log-file data; future analytics using computational linguistic approaches [e.g. 13] are planned.

Table 1. Summary of discussion participation metrics

Metric	Definition	Particip. Criteria
Range	Span of days a student logged in to the discussion	<i>Temporal Distribution</i>
Number of sessions	Number of times a student logged in to the discussion	<i>Temporal Distribution</i>
Average session length	Total time a student spent in the discussions divided by his / her number of sessions	<i>Temporal Distribution</i>
Percent of sessions with posts	Number of sessions in which a student made a post, divided by his/her total of number sessions	<i>Temporal Distribution</i>
Posts	Total number of posts a student contributed to the discussion	<i>Speaking quantity</i>
Average post length	Total number of words posted by a student divided by the number of posts he/she made to the discussion	<i>Speaking quantity</i>
Percent of posts viewed	Number of unique posts that a student viewed divided by the total number of posts made by others to the discussion	<i>Listening breadth</i>
Number of reviews of own posts	Number of times a student revisited posts that he/she had made previously in the discussion	<i>Listening reflectivity</i>
Number of reviews of others posts	Number of times a student revisited others' posts that he/she had viewed previously in the discussion	<i>Listening reflectivity</i>

3. PEDAGOGICAL MODEL & USE CASE

While the above metrics can be useful to instructors and students in monitoring and improving discussion participation, doing so requires active interpretation with respect to the qualities of productive participation described earlier. To support such activity, we created a pedagogical model for animating these analytics centered on the principles of (1) Diverse Metrics (2) Active and Negotiated Interpretation (3) Integration with Learning Activity and (4) Explicit Time and Space for Reflection. Following these, the use of analytics is set in the frame of a periodic online reflective journal shared between each student and the course instructor. At the start of the term students are given guidelines for productive discussion participation tied to both the indicating research and the relevant analytics and asked to set concrete goals for their participation based on these. Students are then provided with a variety of analytics (as well as class averages as a benchmark) at the end of each discussion segment and given a series of reflective questions to respond to in the online journal (See Figure 1). As needed, the instructor reviews students' analytics and reflections and responds. In this way interpretation of the metrics is active, integrated and negotiated. Storing the analytics, reflections and responses in a digital journal also facilitates longitudinal review of changes and progress over the course of the term by both the student and instructor.

4. IMPLEMENTATION & EVALUATION

The initial implementation of this pedagogical model of learning analytics in online discussions is currently underway, using the Visual Discussion Forum system [14]. This environment presents discussion threads as a hyperbolic (radial) tree, allowing students to easily see the structure of the discussion and the location of their comments within it (thus providing an additional embedded analytic). The pilot work is being conducted in a blended graduate seminar on educational technology. This setting affords willing students and a manageable class size with which to roll out the approach. After the model has been evaluated (and likely revised)

1. What do you think went well in your individual discussion participation in this week's discussion? What could be improved? Tie your reflections to specific analytics if possible.
2. How does your participation in this week's discussion compare to previous weeks?
3. How well did you do in meeting the goal(s) you set for your participation in this week? How do you know?
4. Please set at least one goal for your participation in the coming week and write it below.

Figure 1. Sample reflective journal question prompts.

in this "best case" scenario, it can expanded to further contexts (e.g. larger classes, undergraduate courses, fully online offerings). Ethics board approval has been received to solicit permission from course students to collect their reflective journals for analysis of how the analytics were used. This data source will be complemented with post-course interviews of the students and instructor. The implementation will be evaluated on the degree to which the analytics were used to monitor and reflect on discussion participation and to what extent this resulted in actual improvement of discussion participation across the term.

5. REFERENCES

- [1] Thomas, M. 2002. Learning within incoherent structures: The space of online discussion forums. *JCAL*, 18, 351-366.
- [2] Hewitt, J. 2003. How habitual online practices affect the development of asynchronous discussion threads. *JECR*, 28, 31-45.
- [3] Wise, A. F., Speer, J., Marbouti, F. & Hsiao, Y. 2012. Broadening the notion of participation in online discussions: Examining patterns in learners' online listening behaviors. Advance online publication. *Instructional Science*.
- [4] Wise, A. F., Perera, N., Hsiao, Y., Speer, J. & Marbouti, F. 2012. Microanalytic case studies of individual participation patterns in an asynchronous online discussion in an undergraduate blended course. *IHE*, 15, 108–117.
- [5] Wise, A., Hsiao, Y., Marbouti, F., Speer, J. & Perera, N. 2012. Initial validation of "listening" behavior typologies for online discussions using microanalytic case studies. *Proceedings of ICCLS*, Sydney, AU.
- [6] Boulos, M. N., & Wheeler, S. 2007. The emerging web 2.0 social software: An enabling suite of sociable technologies in health and health care education. *HILJ*, 24, 2-23.
- [7] Pena-Shaff, J.B. & Nicholls, C. 2004. Analyzing student interactions and meaning construction in computer bulletin board discussions. *C&E*, 42, 243-65.
- [8] Dennen, V.P. 2001. The design and facilitation of asynchronous discussion activities in web-based courses: Implications for instructional design theory. *IU-Bloomington*
- [9] Peters, V. & Hewitt, J. 2010. An investigation of student practices in asynchronous computer conferencing courses. *C&E*, 54(4), 951-961.
- [10] Rovai, A. P. 2007. Facilitating online discussions effectively. *IHE*, 10, 77-88.
- [11] Clark, D., Sampson, V., Weinberger, A., & Erkens, G. 2007. Analytic frameworks for assessing dialogic argumentation in online learning environments. *EPR*, 19, 343-374.
- [12] Wise, A. F. Zhao, Y. & Hausknecht, S. 2013. Connecting students' listening and speaking behaviors in asynchronous online discussions. To be presented at *AERA 2013*.
- [13] Ferguson, R. & Buckingham Shum, S. 2011. Learning analytics to identify exploratory dialogue within synchronous text chat. *Proceedings of LAK2011*, Banff, CA.
- [14] Marbouti, F. 2012. Design, implementation and testing of a visual discussion forum to address new post bias. *SFU*.