Analyzing the Organization of Collaborative Math Problem-Solving in Online Chats Using Statistics and Conversation Analysis

Alan Zemel[1], Fatos Xhafa[2], and Gerry Stahl[3]

[1] The Math Forum, Drexel University, 3210 Cherry Street,
Philadelphia, PA, USA
arz26@drexel.edu
[2] The Open University of Catalonia, Barcelona, Spain
fxhafa@uoc.edu
[3] College of Information Science and Technology,
Philadelphia, PA, USA
gerry.stahl@cis.drexel.edu

Abstract. In this paper we describe how a statistical test on a hypothesis regarding collaborative math problem solving using online chats showed an unexpected result, whose understanding required the use of qualitative methods. The phenomenon behind the result is identified using Conversation Analysis. This paper demonstrates the importance of using qualitative methods to describe the perspective of participants as a way of interpreting statistical results, revising hypotheses and developing alternative coding schemes and procedures. The combined approach of quantitative and qualitative methods is applied on real data coming from Virtual Math Teams research project (Drexel University) and is identifying issues not addressed so far in the analysis of online collaborative group activity.

1 Introduction

The analysis of the use of groupware is particularly problematic. Most methods of human-computer interaction were developed for single-user systems and are not applicable to computer mediation of group interaction. A common approach to analyzing the use of groupware is to compare statistical measures of usage across conditions or cases. However, this can be criticized for not investigating and taking into account qualitative differences that may be crucial to understanding the quantitative differences [1]. While there is a widespread feeling that fields like CSCL and CSCW need to take a multidisciplinary approach incorporating a variety of analytic methods, it is difficult to see how quantitative and qualitative approaches built on fundamentally incompatible theoretical foundations can work together. This paper reports a case in which a quantitative discovery led to qualitative analysis that explained the significance of the quantitative results and suggested modifications of the quantitative approach.

H. Fuks, S. Lukosch, and A.C. Salgado (Eds.): CRIWG 2005, LNCS 3706, pp. 271 – 283, 2005.

In the Virtual Math Teams (VMT, [2]) project at Drexel University, we investigate online problem-solving chat interactions from a variety of analytical and methodological perspectives. On the one hand, a coding scheme has been developed and applied to logs of online chats among actors participating in math problem solving. This provides a basis for a quantitative analysis of the chat logs. On the other hand, conversation analytic methods have been applied to these chat logs as a way of describing the procedures participants use to make sense of their ongoing activity.

Conversation analysis (CA) and statistical analysis (SA) are uneasy partners in the analytic enterprise. These two orientations to analysis derive from very different perspectives on the role of the analyst and the kinds of assumptions that can be made with respect to the data and its interpretation. In statistical analysis, hypotheses are put forward and tested. Coding schemes are devised which are designed to facilitate the testing of these hypotheses and statistical methods are applied to coded data. In this approach, it is the analyst's perspective that is privileged. The analyst:

- proposes the hypotheses,
- produces the coding scheme to capture the relevant data from an experiment designed specifically to allow for testing of the hypothesis, and
- assesses and interprets the statistical results [3].

Statistical analysis of data gathered from online collaborative learning experiments plays a central role in many CSCL studies [4], [5], [6], [7]. A whole range of statistical methods, from descriptive statistics to multilevel and other sophisticated methods have been used to analyze the underlying features (variables) of the collaborative activity that takes place in a small group.

Conversation analysis, on the other hand, is an analytical methodology that attempts to describe the actions of participants in terms of the relevances demonstrated by participants in and as their interaction [8], [9]. This methodology privileges the perspective of the participants over the analyst's perspective [10]. Actions are seen as situated within a stream of ongoing action and are sequentially organized. Furthermore, conversation analysts presume that actors design and 'customize' their action for the particular circumstances in which they are accomplished.

The differences between SA and CA are consequential. For statistical analysts, validity and reliability are significant concerns. These are not concerns for conversation analysts. Conversation analysts are concerned with providing adequate descriptions of the sense-making procedures used by participants as they interact. Where statistical analysts would discover what might be 'present' as frequently observed regularities in interactions, conversation analysts are concerned with how specific actions are made relevant by prior actions and how a current action make relevant subsequent actions over the course of a particular sequence of actions. For conversation analysts, it is sufficient that the participants in a particular interaction treat their ongoing actions as sensible. The conversation analyst's task is to describe these sequences of actions as sense-making procedures.

While these two types of analysis, statistical and conversational, may seem incompatible, it turns out there are circumstances in which they can be mutually informative [11]. In this paper, we describe a situation in which a puzzling statistical