Measuring Collaboration in Online Communication

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INTRODUCTION

Collaboration has become a key concept in the workplace, in research laboratories, and in educational settings. Companies want members of different departments located far apart to work together. Various government agencies try to establish collaborative relationships with private organizations. Academics and corporate researchers collaborate with far-flung colleagues to produce new knowledge. Students at all levels of our educational system are increasingly being asked to learn collaboratively. In addition, more work is being done online. Businesses communicate over the Internet, and increasing numbers of educational experiences are being delivered at a distance. Virtual high schools, traditional and for-profit distance education institutions, and colleges and universities are all among the current users of the Internet in education.

In all of these situations—educational and non-educational, face-to-face, and online—several questions need to be addressed. First, what is collaboration? The word is sometimes used as if everyone already understands what it means, but we can find a variety of different definitions in the literature. Second, when we form groups to collaborate, how do we know when they have done so? Is it possible to measure the extent to which collaboration has occurred in a given group and setting? Third, what actions and conditions enhance the collaboration that does take place? And finally, does collaboration work? That is, do groups that are more collaborative produce better results or learning than groups that are less collaborative?

This brief article will not attempt to answer all these questions, but it will concentrate on a specific issue: What methods can be used to determine whether, and how much, collaboration has occurred in online groups in various settings? We will explain our preferred definition of collaboration, based on previous research, and then discuss some of the implications of these ideas for online collaboration and for research into that issue.

BACKGROUND

Collaboration can be generally described in a variety of ways, but perhaps a typical definition is "working in a group of two or more to achieve a common goal" (McInnerney & Roberts, 2004, p. 205). Such a general definition, however, does not tell us how reliably to identify when collaboration has taken place or, assuming that there can be degrees of collaboration, how much of it is going on. To make such measurements, we need an operational definition of collaboration. Recently, Hathorn and Ingram (2002) proposed such a definition. They maintained that collaboration consists of at least three key ingredients: interdependence (Johnson, Johnson & Smith, 1998), a product that is achieved through genuine synthesis of information and contributions from all members (Kaye, 1992), and independence from a single leader (Laffey, Tupper, Musser & Wedman, 1998). In education, this would likely be independence from the class instructor. In other settings, it would mean relative independence from supervisors or others who might otherwise control the process too tightly.

Under this definition, collaboration contrasts sharply with what can be called a *cooperative* way of working. In this characterization, cooperation occurs when a group agrees to divide the work among them, with each taking part of the project. The final product, then, is the sum of separate contributions from each member, rather than being a true synthesis as in a good collaborative effort (Hathorn & Ingram, 2002; Ingram & Hathorn, 2004; Dillenbourg, Baker, Blaye & O'Malley, 1996).

Hathorn and Ingram (2002) operationalized their definition by looking at ways of measuring each of the three components of collaboration. Positive interdependence occurs when group members share information and test their ideas on one another. When individuals in a collaborative group work toward their common goal, they often achieve things that would not have been possible individually (Henri, 1992; Kaye, 1992). Synthesis occurs as the group attains new insights as a result of working together (Henri, 1992; Kaye, 1992). Finally, independence requires that the group function on its own without too much centralized direction (Laffey et al., 1998). Otherwise, it is a directed project, not a collaboration among equals.

MEASURING COLLABORATION

In the literature we can find a variety of ways to measure collaboration that have been used by teachers and researchers. In general, these break down into a few major categories: teacher or leader observations, student and participant self-ratings and self-reports, and quantitative analysis of discussion transcripts. Here we look briefly at each of these in turn.

Teacher/Leader Observations

Sometimes an instructor or a team leader can have a very good "feel" for how well a group is collaborating. By scrutinizing the team in action and examining the products that result from the group work, these observers can often tell who is participating fully and contributing to the results, and who is not. Frequently, however, teachers and others may assume that simply putting people into groups automatically results in high-quality collaborative work. This assumption is false: good collaboration requires many factors, and casual observations may not reveal what is really going on. In many cases, online collaborative groups can be easier to observe than face-to-face groups, because all the conversations may be recorded automatically, depending on the software and systems used.

Student and Participant Self-Ratings and Self-Reports

In many instances, members of groups may know how well they are working together. For instance, a frequent complaint of students doing group work for classes is the uneven distribution of the workload. Finding ways to get clear and reliable self-reports from students and other participants in collaborative groups can lead to better understanding of how the groups operate. There is a danger in this, however, because group members may not have a clear understanding of what it means to collaborate effectively. This is especially true if they have never experienced high-quality collaboration themselves. Many groups, especially in education, seem to prefer a "divide-and-conquer" cooperative strategy that appears to them to be collaborative. In fact, it lacks both the interactions and synthesis necessary for good collaboration, because each member of the group works on just part of the whole project. Therefore, in order both to increase the actual collaboration among group members and to improve the reliability and validity of the self-reporting, it is necessary to teach people the characteristics of good collaboration, how to recognize those characteristics, and how to produce them.

Quantitative Measures

Finally, we look at quantitative measurements of whether collaboration has occurred and of its extent. One approach was taken by Wilczenski, Bontrager, Ventrone, and Correra (2001). They measured the behaviors in a group that facilitated and detracted from the collaboration, under the assumption that groups with more facilitative behaviors would be more collaborative. The study showed that groups exhibiting more facilitative behaviors did better on several measures.

Hathorn and Ingram (2002; Ingram & Hathorn, 2004) also took a quantitative approach. Based on the definition of collaboration cited above, they developed measures of its three main components: interdependence, synthesis of contributions, and independence. Specifically, they applied these concepts to asynchronous threaded discussions, although the same ideas could be useful in other contexts as well (e.g., synchronous online chats). They relied on close and detailed content analysis of the discussions themselves (Silverman, 1993). Rourke, Anderson, Garrison, and Archer (2001) noted that a key step is to develop a way of coding the discussions to illuminate the questions one wants to answer. Hathorn and Ingram (2002; Ingram & Hathorn, 2004) developed such a system for the construct of collaboration, noting the inadequacy of many previous schemes for analyzing online collaboration specifically.

In order to use these measures, one needs complete transcripts of the discussions. Online textual discussions are especially useful in this regard since the transcripts are usually kept automatically in both synchronous and asynchronous discussions. Conceivably, the actual medium of communication could be instant messaging/chat, e-mail (including listservs), threaded discussion boards, or other text-based systems, as long as the technology can keep complete logs of the discussions. In Hathorn and Ingram's (2002) system, coding is based on "statements" made in the discussions. Statements are sentences or complete ideas within sentences that represent individual idea units. A single message can contain just one statement or numerous statements on a variety of topics. Indeed, a single sentence can contain multiple statements.

Interdependence is identified using several criteria. First, it requires roughly equal participation among all members. Without that, it is difficult to see how the members can be meaningfully interdependent. Participation is measured primarily by the number of messages and/or statements contributed by each group member. The count of statements is probably a more accurate measure of actual participation than number of messages, sentences, or words would be. It is unlikely in any group that the members participate exactly equally by any measure, so the requirement for good collaboration is that there be at least roughly equal participation. A simple test for this is a chi-square analysis on the participation of the group members. If the test shows significance,