Cross-Disciplinary Learning in Virtual Teams

Scott P. Schaffer
Purdue University, USA

Therese M. Schmidt
Purdue University, USA

GLOBAL VIRTUAL TEAMS

The prevalence of global software development and new product development teams is on the increase, and such teams face unique challenges (McDonough, Kahnb, & Barczaka, 2001). First, these teams often are comprised of individuals from different disciplines (software engineering, graphic design, instructional design/educational technology). Second, these teams often are required to communicate and share information virtually, since they are geographically dispersed. These challenges make management of such teams difficult, and very little is known about the conditions and factors that impact virtual team performance. While the task of overcoming these challenges is daunting, the benefits that an effective virtual and cross-disciplinary software development team can have are large. Cohen and Gibson (2003) state, "when organizations compose virtual teams with people from different perspectives and knowledge bases, innovation is more likely to occur" (p.8). In addition, the possibility of creating teams that are virtual allows an organization the opportunity to have the best people for a project actually work on the project, regardless of geographic location.

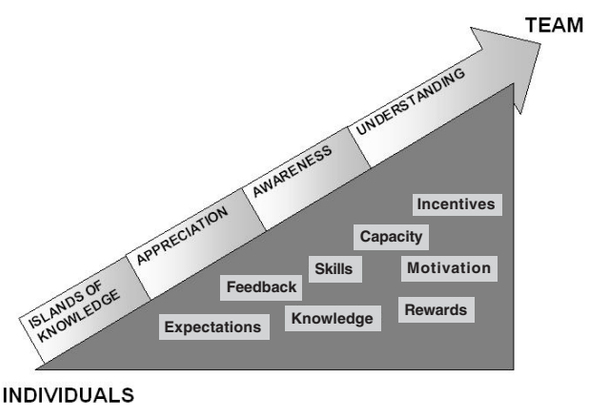
Major questions related to the study of such teams include: Do virtual teams perform better, worse or the same as face-to-face teams? What makes one virtual team better than another? Are group dynamics fundamentally different in a virtual group than in a face-to-face group? Warkenton, Sayeed and Hightower (1997) found that face-to-face teams outperformed virtual teams, and the latter were less satisfied with the experience. Advances in asynchronous communication tools since this study may have improved the situation for virtual teams, but the question of what makes one virtual team better than another is intriguing. Ocker and Fjermestad (2000) investigated factors that distinguish high- vs. low-performing virtual teams. High-performing teams communicated more and more widely related to design decisions than did low-performing teams. Such teams summarized and reflected more often on processes and deliverables, and essentially mirrored face-to-face teams. Similar findings were reported by Baker (2002) in a study of the effects of technology on decision-making in such teams.

Another key driver of virtual team development and success is the level of cross-disciplinary learning that occurs during the completion of a project. Fruchter and Emery (1999) define cross-disciplinary learning as the individual's progression from a state dominated by discipline-centric thought to a state in which the individual understands the terminology and processes of another discipline. It is important to investigate how this learning can be supported and assessed.

Cross-Disciplinary Knowledge, Learning and Performance Framework

While much previous research with virtual teams has used a communications-based framework for studying team processes, another approach is to focus on cross-disciplinary learning. A knowledge, learning and performance support framework for cross-disciplinary teams is shown in Figure 1. This framework incorporates a metric for assessing the evolution of cross-disciplinary knowledge within virtual teams, as well as factors and conditions that support team learning and performance.

Figure 1. Cross-disciplinary learning research framework



As part of their work on assessing cross-disciplinary teams in architecture, construction and engineering, Fruchter and Emery (1999) defined four dimensions to measure the evolution of team knowledge development. The dimensions range from teams consisting of individuals dominated by discipline-centric thought to teams made up of individuals who share an understanding of the language and goals of each team member's discipline. These dimensions, represented on a diagonal continuum in the framework, are:

- **Islands of knowledge:** The individual has mastered his or her discipline but has little experience in other disciplines
- **Awareness:** The student is aware of other disciplines' goals and constraints
- **Appreciation:** The student begins to build a conceptual framework of the other disciplines, and understand enough about them to ask good questions
- **Understanding:** The student develops a conceptual understanding of the other disciplines, can negotiate, is proactive in discussions with participants from other disciplines, provides input when requested and begins to use the language of the other disciplines.

Assessment of cross-disciplinary learning of teams may be accomplished through the use of multiple methods. A pre-post project questionnaire allows team members to report knowledge of their own discipline and their knowledge of the disciplines of their team members (see Figure 2). In addition to these questionnaires, individual reflections and team interactions may be coded and analyzed.

Supporting Cross-Disciplinary Learning and Performance in Virtual Teams

While individual team members gain knowledge of teammates' models, terminology and processes, a major role of managers of cross-disciplinary teams is to provide performance support. Wedman and Graham (1998, 2004) have developed a model for performance support called the performance pyramid that helps identify potential barriers and enhancers within a performance system. In a complex performance system such as a virtual cross-disciplinary team, individual and team performance is dependent upon several factors, such as skills and knowledge, expectations and feedback, rewards and incentives, motivation, capacity and available tools (see Figure 1). The alignment of these factors with vision and resources is required for exceptional performance. These factors are quite similar to those identified in the change management literature as influencing the adoption and adaptation of technology innovations (Ely, 1999). Conditions and factors that impact the use of technology by virtual teams have also been addressed on several levels by a number of researchers (Lipnack & Stamps, 1997; Rockett, 1998; Townsend, DeMarie & Hendrickson, 1998; Wilson, 2003).

The presence and levels of performance support factors on a virtual team project may also be assessed through pre- and post-project questionnaires. On the lpre-project questionnaire, questions are phrased so that they could be answered from an individual's perspective (Figure 3).

On the post-project questionnaire, the questions are phrased to be answered from a team perspective (Figure 4). Phrasing the questions this way allows one to gather more

Figure 2. Sample team member knowledge rating scale

Myself	1	2	3	4
Partner A	1	2	3	4
Partner B	1	2	3	4
	No knowledge or experience Not familiar with any of the terminology Not familiar with goals and constraints of the field No experience in field	**Minimal knowledge and experience** Have heard some of the terminology of the field, but am not sure of the meaning. Aware of some of the goals and constraints of the field Limited experience in the field	**Average knowledge and experience** Understand the terminology of the field Understand the goals and constraints of the field Fair amount of experience in the field	**Above-average knowledge and experience** Very comfortable using the terminology of this field Very aware of the field's goals and constraints Good deal of experience in the field