Cross-Disciplinary Virtual Design Teams

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INTRODUCTION

Software development teams that work together well, particularly those that can operate virtually, are an enormous competitive advantage for organizations (Cohen & Gibson, 2003). One challenge for software development or new product development teams in a global marketplace is managing and developing individuals from different disciplines who are remotely located. Such teams often encounter communication, environmental and philosophical barriers related to completing design tasks that threaten the success of projects (Warkenton, Sayeed & Hightower, 1997).

For students at the university level, virtual cross-disciplinary learning experiences are key to their success in the competitive marketplace. The authors are currently in the second phase of an ongoing project designed to explore pedagogical, communications and logistical issues related to development of a sense of community between graduate students in the United Kingdom (UK) and United States (U.S.) (Schaffer et.al., 2005). One of the main goals of the current phase is to learn more about how virtual cross-disciplinary teams communicate and learn the concepts, models and discipline-specific language used by one another, as well as to identify key barriers and supports to such learning.

CROSS-DISCIPLINARY KNOWLEDGE AND PERFORMANCE

The productivity of global or virtual, cross-disciplinary software development teams is dependent on a complex array of conditions and factors that have begun to receive attention by researchers (Townsend, DeMarie, & Hendrickson, 1998; Wilson, 2003). Challenges for such teams are logistical: meeting when team members are located in Shanghai, Baltimore and New Delhi; psychological: putting forth the effort to engage in an online community requires readiness and motivation; and technical: accessing and effectively using Web-based content management systems, authoring tools, project management tools, knowledge bases and more. A key success factor for such teams appears to be much more fundamental, and relates to their ability to understand the language, models, frameworks and rationales of team members from other disciplines. As part of their research examining how to assess cross-disciplinary teams in the architecture, construction and engineering fields, Fruchter and Emery (1999) identified four dimensions useful in measuring the evolution of learning within such teams. These dimensions are:

- **Islands of knowledge:** The student 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.

In theory, cross-disciplinary knowledge sharing promotes innovation and cross-fertilization of ideas. As a case in point, Kuehn (1994) found that instructional designers working on software development projects sought to assimilate software design processes into their own design thinking. Likewise, new instructional design models are increasingly reflecting software design concepts such as rapid prototyping and agile methods.

The performance or accomplishment of goals by cross-disciplinary teams can be hindered or enhanced by many factors, one of which is the degree to which they share knowledge. A major focus of the current research was to assess the level of performance support teams felt they received while completing projects. The presence of performance support was measured by assessing several conditions and factors in the performance system, including:

- Clarity of project expectations
- Feedback regarding performance
- Availability of tools and processes necessary to complete tasks
- Rewards and incentives
- Motivation, desire or willingness to put forth effort
- Mental, physical, emotional capacity to complete the project
- Knowledge and skills to complete the project.

These elements are based on the performance pyramid, shown in Figure 1, proposed by Wedman and Graham (1998). The pyramid was specifically designed to identify barriers and supports for accomplishment of goals in the work environment. The absence, lack of related resources or misalignment of one or more of the pyramid elements will have negative impacts on a team's performance.

PROJECTS AND TEAMS

To learn more about cross-disciplinary learning on virtual design teams, 10 groups of students from two university "classrooms" were studied. Fifteen students in the Introduction to E-Learning class at Purdue University and 17 students in the Technological Innovations class at Staffordshire University participated. The Purdue class is typically one of the first classes that students take in the Educational Technology graduate program. The majority of the students enrolled in this class were from the Educational Technology program, although some students were from other fields, such as Computer Science, Chemistry Education, Special Education and Computer Graphics Technology. Technological Innovations is the first class students take for the MA in Interactive Multimedia program at Staffordshire University. It is also offered to students enrolled in the MA E-Business program and students studying Media and Culture. Students were mainly from the Interactive Multimedia program with a few from other fields such as Media Futures and E-Business.

Instructor guidelines for team formation ensured that there was at least one Purdue student and one Staffordshire student from a different discipline on each team. The students were first given the opportunity to self-form as long as they met the stated requirement. One team took advantage of that opportunity; the instructors assigned the remaining nine teams. All teams were comprised of individuals from at least two different countries.

In the first phase of this project, the original group of students was not expected to complete a concrete product. Instead, they were only required to provide feedback on one another's design projects. This assignment did not lead to the level of involvement desired by the research team (Schaffer et al., 2005). Therefore, students in the second phase were assigned the task of creating an informational Web site about a technology-related topic,

Figure 1. Performance pyramid (Wedman & Graham, 2004)