# Chapter 9
# Instructional Design of an Advanced Interactive Discovery Environment:
## Exploring Team Communication and Technology Use in Virtual Collaborative Engineering Problem Solving

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## ABSTRACT

*This chapter examines the instructional design of, and reports on research conducted within, a multiuser virtual environment created for a distributed Collaborative Engineering Design (CED) course. The course's Advanced Interactive Discovery Environment (AIDE) provided a variety of synchronous online tools and communication devices to support SameTime virtual team collaboration and problem-solving within the course. The research helped to unpack (1) which tools team members engaged with during collaborative learning activities, (2) how and why they used or did not use provided online features to support their individual learning and enhance team productivity, collaboration, and communication, and (3) how team members communicated socially. The research also describes how different team social communication patterns may be related to the patterns of team technology use. Relevant theoretical frameworks including social learning, media stickiness, cognitive imprinting, and recommendations on how different tools can be effectively integrated into multiuser virtual environments to facilitate learning are discussed.*

## INTRODUCTION

Dieterle and Clarke (2005) advocated that the best learning environments for students are those that are authentic, situated, and distributed across internal and external sources. With advances in computational technologies and network connectivity, Multiuser Virtual Learning Environments (MVEs) and Computer-Supported Collaborative Learning (CSCL) have become more integrated into instructional environments to provide learners with the tools to communicate synchronously in virtual ways. Simultaneously, authentic problem-solving experiences incorporating simulations and sharing applications like electronic whiteboards also began to be integrated into these new multiuser virtual learning environments to create a real-world situated learning experience. Educational environments were thus beginning to be designed to engage learners in the complex distributed collaborative activities experienced by practicing engineers and scientists (Shuman et al., 2002). Such environments can provide learners with dynamic, interactive multiuser virtual spaces in which they are able to engage in rich hands-on learning experiences, apply new content knowledge to legitimate problems, collaborate in problem solving, and use the emerging technologies of their practice.

*Geer and Barnes (2006) suggested that with the rapid development of emerging technologies and virtual environments educators face a predicament of deciding which technologies are best suited to support expected learning. Given a lack of knowledge of emerging technologies and lack of pedagogical guidance about integrating technologies for collaboration and communication, educators are often left with mounting dilemmas and confusion about which technology-based resources are most effective for given pedagogies and learning expectations. In addition, the lack of understanding about how students learn in complex distributed collaborative activities and how their cognitive processes operate within synchronous virtual learning environments inhibits the design and*

*implementation of effective and appropriate CSCL environments. As Pellegrino (2006, p.3) stated:*

*…most current approaches to curriculum, instruction, and assessment are based on theories and models that have not kept pace with modern knowledge of how people learn. They have been designed on the basis of implicit and highly limited conceptions of learning. Those conceptions tend to be fragmented, outdated, and poorly delineated for domains of subject matter knowledge.*

*In addition, little research has been provided that clarifies the role of communication in multiuser technology use, learning, and problem solving within synchronous computer-mediated learning environments. Limited research has focused on observations of team members becoming more task-oriented and developing clearer role expectations among themselves in online learning communities, with little focus on content or process learning (Jonassen & Kwon, 2001). Numerous researchers who study such multiuser virtual environments have found no conclusive evidence that these environments work, and when and most importantly why they do or do not work (Kirschner et al., 2004). Therefore, additional theories and confirming research are needed to better inform the instructional design (ID) of multiuser virtual environments that facilitate learning of subject matter and appropriately incorporate emerging technologies in pedagogically sound ways.*

## THEORETICAL FOUNDATON: SOCIAL COMMUNICATION, COGNITIVE IMPRINTING, MEDIA STICKINESS AND THEIR IMPLICATIONS TO ID

### Social Communication to Learning in Multiuser Virtual Environments

From social constructivist perspectives, learning is observed to be a social process by which

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