Chapter 15
3D Modeling in a High School Computer Visualization Class:
Enacting a Productive, Distributed Social Learning Environment

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EXECUTIVE SUMMARY

This semester long case study in a rural high school Introduction to Computer Visualization course focused on a detailed analysis of pedagogical approaches, the learning environment, and students' performance outcomes. Classroom observations, student interviews, and instructor's commentary yielded insights regarding how students learn to create virtual 3D models and what contexts for learning best support the modeling processes students' learned in the course (tool use, tool path patterns, time management, and accuracy of the modeled structure). The social learning environment of this particular classroom, the combination of didactic, guided practice and exploratory modes of inquiry, self-selected work groupings, and peer designations of expertise that supported multiple problem solving approaches were powerful mediators of students' learning resulting in high quality modeling products.

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INTRODUCTION

Recent advances in computer hardware, mostly in the form of low-cost high end graphics cards in personal computers and the availability of software such as 3D visualization tools like Google Sketch-up (freeware) and 3D Studio Max (from Adobe), put more sophisticated visualization tools within reach of classroom teachers and their students. These advanced modeling tools promote 21st Century Learning skills—problem solving, collaboration, critical thinking and creativity, and support recent efforts to promote STEM (Science, Technology, Engineering, and Mathematics) learning. For example, scientific visualization has long been integral to inquiry across many scientific disciplines. 3D design tools can make visible particular dimensions of objects that one simply cannot view using 2D representations. Before we employ these 3D tools as part of specific subject matter content, we need to explore the cognitive and pedagogical implications associated with the use of these sophisticated 3D tools. Educators need to know how students learn to use these tools, what barriers they face, and how to best design instruction to ensure students can use the tools efficiently, understand the qualities of 3D space and develop the capacity to use 3D tools to construct high quality 3D models. Exploring these basic and foundational instructional and contextual issues associated with 3D tool use was the focus of this study.

There are many ways of learning and different views on how people and more specifically, high school students, learn. Learning theories have guided research over the years and assisted in the development of instructional design models. While learning theories tend to be descriptive, explaining how learning occurs and instructional theory tends to be prescriptive, specific to the situation (Morrison, et al., 2004; Reigeluth, 1999). Social learning theories that describe learning as a social process, involving internal (the mind) and external factors (learning contexts) framed the design of this study and provided a lens to support the analysis of the data.

Social Psychology: Grounding Social Learning Perspectives

Investigating learning as a social process using the work of leading social psychologists such as Vytgosky, can aid in answering the research questions of this study. Vytgosky and other psychologists who employ social learning theory frameworks contend that knowledge is constructed through cultural mediation, historical development and practical activity (Vygotsky, 1978). There are two main approaches to social psychology, situated cognition, and distributed cognition. Both situated and distributed cognition approaches focus on activity. The differences lie within the application of activities. Situated cognition focuses on the activity of people in a particular setting as opposed to the knowledge that is distributed across a group of

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