

Chapter 13

Cognitive Apprenticeship and Computer Science Education in Cyberspace: Reimagining the Past

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ABSTRACT

The lens of appreciative inquiry, as seen through the eyes of educators, examines ten years of virtual learning at several institutions. The study reflects on the impact of presence, and explores how learning communities develop as students assume roles and learn using cognitive apprenticeship. The examples reinforce the value of deep immersion and identity in situated learning, even as the software design activities illustrate the benefits experienced when students assume ownership and structure their activities. Encouraged by self-reflection, the learners explore their shared values, form into groups, and make personal discoveries. The examples illustrate the power of design thinking during individual and group work. From early work with 400 8th graders through 50 higher education classes taught at two institutions, techniques emerged for applying cognitive apprenticeship and deep immersion that strengthened the experiences and provided insights for developing a sustainable educational program.

INTRODUCTION

How do students learn? How do they apply the knowledge they acquired to address future problems and tasks? This chapter explores several cognitive theories and the use of cognitive apprenticeship through ten years and 50 classes held in a virtual world. The examples begin with middle school and 8th grade students in Suffern, New York and shifts to address every level of higher education in a computer science degree program with a concentration in emerging media as the evolution of Web science. The chapter

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reflects on how design thinking within the technology strengthened teamwork and leadership skills through deep immersion, and presents recommendations for future work.

BACKGROUND

Robert Lockhart and Fergus Craik (1972) turned cognitive models of learning upside down by introducing the concept of levels of processing. Their model featured two categories: shallow processing and deep or semantic processing.

Memories decay under shallow processing, influenced by data related to:

- How an object looks - structural processing;
- How something sounds - phonemic processing;
- How letters are symbols that when grouped together, become words - graphemic processing;
- How the shape of objects appear - orthographic processing.

In contrast, the construct of semantic processing uses deep immersion to reflect on:

- The relationship between objects or experiences;
- The deeper meaning of the experience;
- The importance of the experience.

Lockhart and Craik's deep learning through semantic processing favors deep immersion through context and the relationship between objects or situations, the search for deeper meaning through comparing and contrasting related experiences, and when reflecting on the importance of the experience. In virtual world education, learners gather in synchronous sessions or work with 3D holograms that represent the content through a variety of shapes, symbols, and media presented within a situated learning context.

Deep immersion occurs when the learners apply the principles of design thinking (Brown, 2008) to imagine and reflect on the art of the possible as they apply the course concepts using situated cognition (Glick, 1997), critical thinking and problem-based learning challenges. They imagine a variety of possible scenarios, and create 3D environments that engage the visitors in probing, immersive experiences. The power of creation reinforces the learning experience, and they remember the details as well as the outcome. See Table 1 for a proposed model of how to reflect on the levels of deep immersion and their relationship to identity confusion and safety.

Throughout the process, the deeper levels foster a suspension of disbelief to form relationships that establish the optimal conditions for shaping identity. Interesting questions come to mind, illustrated using the analogy of a scuba diver:

1. "What immersive social and environmental features are sufficient for reaching a suspension of disbelief level as one goes deeper with immersion?"
2. "At what point of deeper levels does it become counter-productive? When does a person lose perspective between virtual and physical aspects of their identity?" The scuba diver wants to go deeper, but there are increased health risks and extraction procedures to follow to avoid the deleterious side effects;

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