Chapter 3.7

Design Principles for Interactive Learning Environments with Embedded Formative Assessments

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ABSTRACT

The new technology-enhanced conception of assessment stands in contrast to the traditional view of assessments as tests of a learner's ability to recall facts. Because technology mediates learning in new ways, it engenders new forms of knowledge as well as possibilities for documentation and analysis. Many have noted that games, simulations, and cases are engaging for learners and thus warrant further development for their expanded use. Research on learning and assessment suggests design principles that developers should follow when investing such effort in order to capitalize on how the interactive aspects of these tools can serve as assessments about what,

how, and when learning is occurring. The ETIPS application described here serves as an example of how such principles can be used to guide priorities and decisions for developers as well as applied as criteria for determining the quality of such digital tools as learning environments and assessment tools.

INTRODUCTION

Educators are increasingly interested in how to leverage the interactive environments of digital tools such as games, simulations, and case studies for learning and assessment purposes. The research on learning and assessment provides much guidance for developers seeking to create effective learning environments with interactive

media, especially those that provide formative assessment (i.e., feedback) for the learner. Developers of educational materials can draw upon this research and related conceptual frameworks to design effective interactive learning environments with embedded assessments.

This chapter provides an overview of these points, and then describes how one tool, Educational Theory into Practice Software (ETIPS) embodies these ideas as an interactive learning environment. While the learner does interact with a realistic situation in an ETIPS case, the cases are not ongoing and dynamic like a simulation, nor do they embody competition or rules, the key functions of a game (Ellington, 2000). ETIPS is best described as a case study platform that allows in-depth study and reflection.

GUIDING DESIGN PRINCIPLES

Effective Learning Environments

Bransford, Brown and Cocking (2000) synthesize research on educational and cognitive neuroscience and suggest the following four key dimensions of effective learning environments. First, that they are knowledge-centered and focus on developing knowledge of the field or discipline and of strategies to develop expertise; thus, they should incorporate the language, artifacts, and essential principles on which learning in the discipline is based and model how experts work with those principles to gain increased understanding. Second, that they are learner-centered and focus on learners, building on their strengths, interests and needs, and they take individual learning styles and prior knowledge into account. Third, that they are community-centered and evolve a community of practice among like-minded learners so as to develop common goals and facilitate individual and collective work toward achieving them. The community-centered environment also provides opportunities for active participation and the de-

velopment of a shared knowledge base. Finally, that they are assessment-centered and support learners' testing of ideas by promoting ongoing reflection and feedback on practice. Such environments enable opportunities for metacognition in a sustained, coherent context.

The four dimensions outlined here can be visualized as interdependent and overlapping spheres; therefore, we might expect all of these dimensions to be present and functioning in a game, simulation or case study that is to serve as a high-quality learning environment. In the following sections I outline particular considerations for the assessment attributes of a learning environment, and then explain how a digital, interactive tool like a game, simulation, or case study is particularly well suited to help produce these attributes.

Effective Assessments

Well-designed assessments allow teachers to get information about students' knowledge and the depth of their understanding of subject matter. Of particular note are formative assessments, which Black and Wiliam (1998) identified in a review of the literature as one of the most effective teaching interventions possible. Formative assessment should be for learning, generating artifacts that make visible to a teacher and student the student's knowledge, skills, and understanding during the learning process and thereby support instructional interventions. In contrast, summative assessments are about learning, measuring the results of student learning at the end of a period.

Formative assessments produce knowledge that allow teachers to provide feedback to students about the depth and breadth as well as the accuracy and precision of their knowledge and to direct their instruction to address students' misunderstandings or lack of pertinent knowledge. Formative assessments provide a practice opportunity for students about the key ideas of instruction by catalyzing students' active response and usually supply feedback that can direct students' attention

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