Chapter 11
Introducing Flowometer: A CyGaMEs Assessment Suite Tool

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ABSTRACT

A CyGaME is an online instructional game designed to make concept learning more intuitive while assessing changes in players' targeted knowledge and self-perceptions of flow. CyGaMEs stands for Cyberlearning through Game-based, Metaphor Enhanced Learning Objects, a research program supporting federal education road maps targeting cyberlearning and assessment as key to 21st-century learner-centered education. The author situates the CyGaMEs approach to instructional game design and assessment within structure mapping, flow, and game design theories. She introduces the CyGaMEs toolset for assessing game-based learning as realized in Selene: A Lunar Construction GaME. Identifying similarities between CyGaMEs and production-oriented approaches, she suggests CyGaMEs' design and assessment generalize across both methods. She presents the CyGaMEs adaptation of the double transfer paradigm as a research design for studying game-based learning. Then she derives the flowometer tool, illustrates a flowometer research implementation, and suggests scholars use the CyGaMEs Selene environment to investigate the relationship between game-based learning and flow.

INTRODUCTION

Successful video games are powerful technologies. The Cyberlearning Through Game-based, Metaphor Enhanced Learning Objects (CyGaMEs) project seeks to harness that power and put it to work for teaching and learning. CyGaMEs derives from the belief that effective game-based technologies are powerful learning tools with the potential to facilitate acquisition of targeted conceptual knowledge if and only if they are well designed. Sound research, measurement, and design require strong methods. CyGaMEs methods derived from established instructional, cognitive, and game design theories.

CyGaMEs is a cyberlearning project. The 2008 National Science Foundation (NSF) Task Force on Cyberlearning recognizes that “cyberlearning offers new learning and educational approaches and the possibility of redistributing learning experiences over time and space, beyond the classroom and...
Introducing Flowometer throughout a lifetime” (Borgman et al., p. 5). The task force recommends:

interoperable resources that support developers so that they can concentrate on their innovation and contribute to the community. Rather than expecting individual projects to take responsibility for all aspects of learning, developers should be able to test their ideas with available tools for such activities as recording student data, designing assessments, acquiring sensor data, or storing data that would be applicable to a wide variety of cyberlearning activities. (Borgman et al., p. 23)

In other words, the task force calls for suites of tools for design, assessment, data collection, data management, data storage, and data reporting. The NSF panel believes “cyberlearning has reached a turning point where learning payoffs can be accelerated” (Borgman et al., p. 5). However, the panel also warns “that this moment could be fleeting because, without deliberate efforts to coordinate cyberlearning approaches, we will miss the opportunity to provide effective support for the convergence of learning and technology” (p. 5). For these reasons NSF funds research programs such as CyGaMEs to design, develop, and evaluate assessment toolsets for use as shared resources within cyberlearning research and implementation.

Many assessment instruments measure change in conceptual or procedural knowledge. Assessments may also measure change in aspects of affect, such as perceived experience. Flow theory defines flow as a state of personally perceived optimal experience (e.g., Csikszentmihalyi & Csikszentmihalyi, 1988). Flow theory provides measures of flow and other states of experience, such as arousal, anxiety, worry, apathy, boredom, and relaxation. Flow is intrinsically rewarding. This means people will attempt to revisit and repeat flow experience. To remain in flow, an individual must meet progressively greater challenge with corresponding greater skill. Flow can derive from positive life choices, but it can also derive from negative choices, such as violent crime. It is imperative to enable humans, especially young people, to experience flow in connection with positive life choices. Academic endeavor is one such positive life choice that could promote flow. Flow and the other states of experience are identified as key aspects of both computer-mediated learner experience (e.g., Craig, Graesser, Sullins, & Gholson, 2004; D’Mello, Taylor, & Graesser, 2007; Kort, Reilly, & Picard, 2001; McQuiggan, Robison, & Lester, 2008; Pearce, Ainley, & Howard, 2005) and videogame experience (e.g., Fullerton, Swain, & Hoffman, 2004; Salen & Zimmerman, 2004; Schell, 2008). Thus it is important to investigate flow with respect to instructional videogames. The CyGaMEs research program has produced a game-based instructional environment and assessment toolset to investigate learner state during optimal learning, identify characteristics and causes of learning-flow trajectories, and refine the learning environments to optimize player state. The long-term goal is enhanced achievement through learner experience involving flow and the states of experience that accompany successful patterns of learning.

This chapter introduces the CyGaMEs suite of assessment tools with a focus on the flowometer. The flowometer measures flow and the other states of experience. Within the background section, I contextualize the suite by summarizing the CyGaMEs approach to instructional video game design, research, and assessment as derived from cognitive science analogical reasoning theory, video game design theory, flow theory, and the preparation for future learning paradigm. Next, I define the CyGaMEs assessment toolset, describe the CyGaMEs research environment, and illustrate flowometer application and potential. I conclude by proposing the research community use the CyGaMEs game, methods, tools, and research environment to investigate the relationship between CyGaMEs learning and CyGaMEs flow.
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