

Presenters:

Jody S. Underwood jody@pr-sol.com, Pragmatic Solutions, Westlake Village, CA

Stacy Kruse stacy@pr-sol.com, Pragmatic Solutions, Westlake Village, CA

Assessing 21st Century Skills to Adapt Educational Games

Jody S. Underwood & Stacy Kruse

Research Goals and Theoretical Framework

Games, when designed appropriately, can be ideal environments in which to learn (Reiber, 1996) as well as to assess what is being learned. “Games” include such things as environments that simulate authentic situations or immersive fantasy spaces, as well as more the casual genres of puzzles and drills. What they all have in common is that there is an element of play involved. Educational games can be created in any of these genres, where the primary goal is to learn.

Embedded assessment is the process of measuring knowledge and ability as *part* of a learning activity rather than after the fact, when it is only an approximation of learner behavior (Shute et al., 2008). Embedded assessment allows student actions to be evaluated within context while interacting in an educational gaming environment. Student actions can be collected, viewed, and analyzed either immediately or after the session.

The kinds of things that can be learned and assessed in these types of environments include content knowledge, procedural skills, and such 21st century meta-cognitive (e.g., critical thinking, decision-making, and problem solving) and behavioral skills (e.g., leadership, preferred learning styles) (Underwood, Kruse, & Jakl, in preparation). For games that lend themselves to learning by drill, content knowledge, speed, and accuracy can be readily assessed through embedded assessment. More interestingly, embedded assessments can be used in simulations and immersive environments to gauge how people respond to situations, and these 21st century skills can be assessed directly.

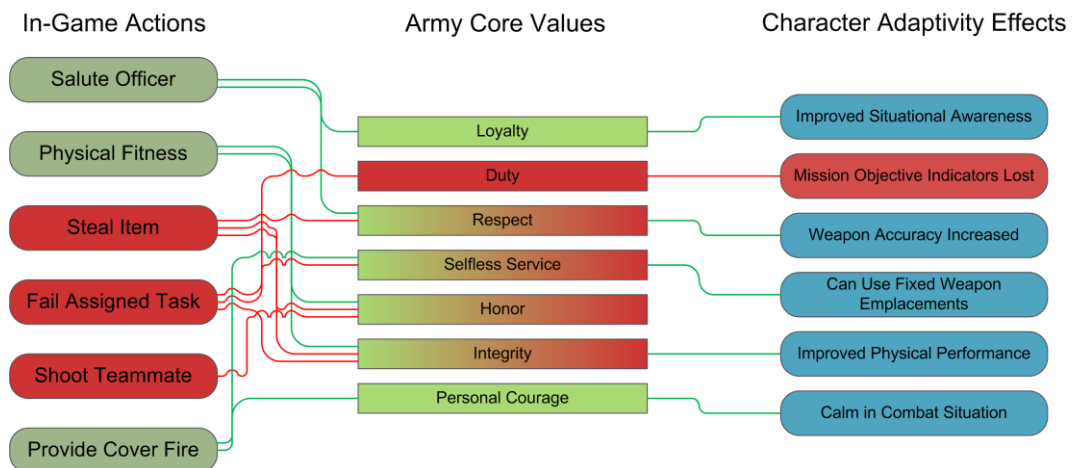


Figure 1. *America’s Army* in-game actions related to Army core values and player adaptivity effects.

Game Context and Methods

We are in the exploratory stages of assessing 21st century skills and paths toward solutions in educational games. In our presentation, we will examine how we assess Army Core Values (e.g., leadership, respect) in the *America’s Army* first-person shooter multi-player immersive game (see Figure 1). One of the goals of *America’s Army* is to educate the public about what Army life is really like; toward this end, the game is designed to be as authentic as possible. We use a mix of rule-based and genetic algorithms to infer 21st century skills from gameplay. Rules are used where experts can determine how a certain set of actions

impact each of the skills; genetic algorithms are used to mine patterns of gameplay that are more implicit. We will also present other educational game projects to exemplify a model of how to assess paths taken to a solution, including efficiency and unexpected but correct paths.

Significance

Educational games should be designed as constructivist learning environments with a focus on both learning outcomes and process. Our goal is to use the outcomes of embedded assessments to adapt gaming environments in real-time to meet the needs of individual learners. This approach is key to fostering both engagement and learning, where the challenge must be neither too easy (promoting boredom) nor too hard (discouraging continued play).

References

- Rieber, L. P. (1996). Seriously considering play: Designing interactive learning environments based on the blending of microworlds, simulations, and games, *ETR&D*, 44(2), 43-58.
- Shute, V. J., Ventura, M., Bauer, M. I., & Zapata-Rivera, D. (2008). Melding the power of serious games and embedded assessment to monitor and foster learning: Flow and grow. In U. Ritterfeld, M.J. Cody, & P. Vorderer (Eds.), *The Social Science of Serious Games: Theories and Applications*. Philadelphia, PA: Routledge/LEA.
- Underwood, J.S., Kruse, S., & Jakl P. (in preparation). Moving to the next level: Designing embedded assessments into educational games. In P. Zemliansky & D. Wilcox (Eds.) *Design and implementation of educational games: Theoretical and practical perspectives*, Hershey, PA: IGI Global.