CSI web adventures: A forensics virtual apprenticeship for teaching science and inspiring STEM careers

by Leslie Miller, Ching-I Chang, and Daniel Hoyt

CSI: The Experience, a traveling museum exhibit and a companion web adventure, was created through a grant from the National Science Foundation as a potential model for informal learning; however, the response from teachers who incorporate a forensics unit into their science curriculum or teach a forensics class has indicated a place for this website in the classroom setting. The website was designed to enrich and complement the exhibit by modeling the forensic process. Both the website and the physical exhibit leverage the popularity of the *CSI* (Crime Scene Investigation) television shows to "create interesting, realistic contexts that encourage the active construction of knowledge by learners" (CTGV 1993, p. 52). Forensic professionals, museum personnel, and educators collaborated to produce these informal learning environments. The popular CBS television series provided the hook for engagement and many of the realistic art assets, such as short video clips and photos of the TV characters and lab equipment.

The website, *http://forensics.rice.edu*, available in both Spanish and English, serves a heterogeneous audience—game players of all ages, students, teachers, families, and CSI fans. (See Figure 1 for the home page.) Observation of one of three crime scenes and analysis of evidence is part of the museum exhibit. The web adventure mimics this scenario by offering additional cases to solve, but through the virtual world. As a player, you collect evidence from a crime scene, question suspects, analyze each piece of evidence, and present your findings. As the designers, we integrated substantive science, real-world lab techniques, and higher-level thinking skills to create a forensic virtual apprenticeship that would inspire science careers. The result is a website that is used by thousands of informal learners around the world and by many science classrooms. By way of supporting material, there is a guide for at-home activities titled Family Forensics, that can be downloaded from the website (*http://forensics.rice.edu/html/famguide.html*) (Figure 2) and a set of online short interactives, called Fun Stuff, that test powers of observation and other forensic skills *(http://forensics.rice.edu/html/funstuff.html*).

FIGURE 1 CSI: The Experience *http://forensics.rice.edu*

Three science instructional goals guided the design of *CSI: The Experience Web Adventures*. The first goal was to present substantive and engaging science. We wanted to ensure that players not only learn strategies for solving the mystery, but also fully appreciate the underlying science of different forensic disciplines such as DNA analysis, toxicology, firearms and toolmark identification, and postmortem medical examination. The player explores these forensic specialties in the first case, Rookie Training. As players complete training segments, they earn tools (swabs, magnifying glass, tweezers, and pipette) as part of their field kit.

With the target audience of adolescents in mind, the cases are scaffolded in terms of complexity and application of science knowledge. In other words, we did not feel it wise to ask players to do a toxicology test when they had no concept of what that analysis required or even what the field of toxicology involved. Therefore, the total e-learning environment starts with training (see Figure 3). This purposely precedes Case Two: Canine Caper and Case Three: Burning Star. These

FIGURE 2 Sample page from the Family Forensics booklet

cases are more open ended and exploratory. They require the player to make strategic decisions such as what location to visit, which tools to use, and what evidence should be collected and from whom.

Feedback from some players indicated that they appreciated the game order of training followed by application. In each of the games, when a player is confused or in need of assistance, the player can elect to have a dialogue with one of the characters, who then provides advice and recommendations for future actions. There is also an optional "walkthrough" available for those who need further hints.

The second instructional goal focused on correcting forensic misconceptions. Collaboration with members of the American Academy of Forensic Sciences reinforced the importance of the message that forensic science is not exactly like it appears on television. One example of a misconception that needed to be addressed was the actual time it takes professionals to perform certain forensic analyses. On the *CSI* TV shows, it only takes seconds to obtain a ballistics or

FIGURE 3 Introduction to Rookie Training

DNA analysis. The online materials contain clocks that simulate the real time needed to complete a test, or require the player to return later for the results to emphasize the time usually needed for these tests.

Additional points of misconceptions are the actual duties of forensic professionals. By assigning one character to be the "expert" in each lab setting, we hoped to convey the idea of specialization in contrast to the inaccurate portrayal on television of crime scene investigators as generalists. In Rookie Training, a short quiz about career preferences helps players understand that postbaccalaureate degrees and personal affinities play a part in forensic specializations.

The third instructional goal was to inspire careers in science. As others have noted in designing goal-based learning, "an interest is a terrible thing to waste" (Schrank et al. 1994). By designing a game where players can learn by doing authentic tasks, we can capitalize on innate interest. The similar pedagogical strategies of situated learning (Brown, Collins, and Duguid 1989) and anchored instruction (CTVG 1993) were also part of the underlying approach to the web adventure. These strategies involve "situating" the learner in a context that simulates a real-world learning opportunity. In this case, the situation is a whodunit with tools, evidence, and clues.

The four careers covered in Rookie Training include DNA analyst, medical examiner, toxicologist, and firearms and toolmark specialist. A segment on ethics concludes the training and emphasizes the need for ethical conduct throughout all forensic work.

Case Two: Canine Caper and Case Three: Burning Star require skills of application and synthesis, and are incrementally more challenging. These start with a crime scene and call for players to apply what they learned in Rookie Training in addition to exploring new areas of forensic science such as forensic odontology, digital forensics, and facial reconstruction.

"Canine Caper: A dog handler is found dead at the Las Vegas Dog Show. Was this an accident or foul play?" "Burning Star: A burned-out car with an unrecognizable body is found in the desert. Who is it and how did this happen?" So begin the scenarios requiring the players' application of skills learned in Rookie Training. Figure 4 diagrams the variety of paths that can be followed to gather evidence and sort through the derived clues.

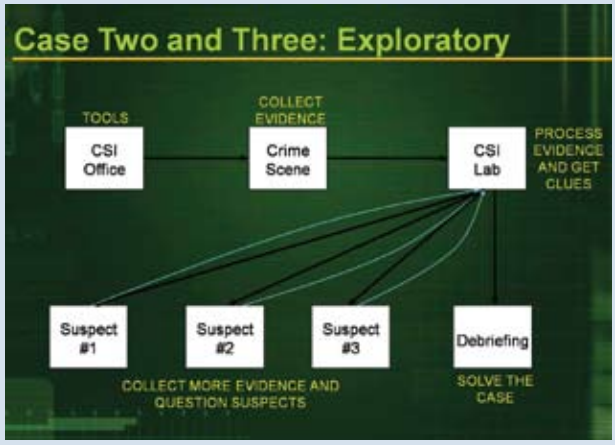
As a virtual apprentice, the player is mentored by a forensic expert, yet also has the freedom to learn from mistakes and exploration. Although people who play CSI web adventures are likely to be positively predisposed toward forensics, some players have indicated that the game helped enrich their knowledge and interest in science. The feedback from players suggests that many become more motivated to study science careers.

The power of online experiences to change self-actualization or sense of self has been suggested by others (Foster 2008; Dodge, Barab, and Stuckey 2008). When a player succeeds in science by performing the appropriate test or making correct deductions from the evidence, this can be a transformational opportunity. This learning environment exposes students to the breadth of careers in science and the work of experts in different fields.

The potential for teaching science and stimulating STEM careers

Could e-learning environments that place students in virtual roles encourage students to pursue science, technology, engineering, and mathematics (STEM) fields? Could online games that allow students to discover careers such as a toxicologist, a DNA analyst, or a microbiologist be just as much fun and more challenging than fantasy games involving elves, warriors, or vampires? Our next step is a long-term study to respond to these questions, but in the meantime, try *http://forensics.rice.edu* and make your own judgment. Better yet, let your students decide.

FIGURE 4 Pathway options in cases two and three



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