K20CENTER
THE UNIVERSITY OF OKLAHOMA

perfectstrain

TEACHING EVOLUTION AND NATURAL SELECTION

Theorists suggest that people have natural biases that conflict with an understanding of evolution (Sinatra, Bren, & Evans, 2008). For students to accurately grasp the concepts of evolution and natural selection, they must be shown where incongruities exist between their current understanding and the new conceptual framework (Chi, Slotta, & de Leeuw, 1994).

In Perfect Strain, players take the role of a microbiologist in the far future, cleaning up a toxic Earth by breeding pollution-consuming bacteria. Students discover strategies to breed certain bacterial strains in a virtual world. The bacteria are constantly reproducing and mutating in real time. These mutations are based on real traits exhibited by this kind of organism in nature. Each mission in the game presents new tools and strategies for the player to use. By applying these tools to the bacteria, students can encourage the development of certain traits.

In Perfect Strain, biology students must:

- Describe how natural selection works and what is required for it to take place
- Define mutations, genetic variation, and fitness
- Avoid the common misconceptions of essentialism and teleology

In a formal study involving 172 university students, two versions of Perfect Strain were tested against a video lecture control condition. A significant between-subjects difference emerged between game conditions, $F(1, 135)=3.76$, $p=.054$, partial eta squared=.03, with summative feedback ($M=3.65$, $SE=.18$) supporting knowledge acquisition significantly better than no summative feedback (3.15, $SE=.19$). Summative conditions of the game produced a significant knowledge increase from pre- to post-tests ($t(73) = -2.335$, $p = .022$). The recorded lecture did not produce a knowledge increase ($t(32)$ -.487, $p=.630$).

Games with summative feedback caused participants to feel more temporal dissociation than games with no summative feedback, $F(1, 138)=3.99$, $p=.05$, partial eta squared=.03. Games with summative feedback produced more interest ($p=.021$), focused immersion ($p<.001$), temporal dissociation ($p<.001$), and hedonic enjoyment ($p=.054$) than the recorded lecture.

To access all K20 educational games at no cost to your school, go to k20.ou.edu/getgames

Chi, M., Slotta, J., & de Leeuw, N. (1994). From Things to Processes: A Theory of Conceptual Change for Learning Science Concepts. *Learning and Instruction*, 4, 27-43.
Sinatra, G., Bren, S., & Evans, M. (2008). Changing Minds? Implications of Conceptual Change for Teaching and Learning about Biological Evolution. *Evolution Education Outreach*, 1, 189-195.