Video Games For Equitable and Effective Education Outreach at Scale

FIELD DAY LEARNING GAMES

Background

NSF and other scientific funding agencies have long supported the notion of educational outreach as an critical objective of the scientific enterprise, though many would admit that efforts are expensive, inequitable and have little measurable impact. Meanwhile, research into educational video games has matured rapidly and demonstrated efficacy for both teaching and assessment. Since COVID, an unprecedented investment into digital infrastructure for schools has taken place. Combined with the adoption of standards that prioritize learning science practices as well as content, a unique opportunity exists for practice-based learning games in classrooms.

Method

Field Day Lab at the University of Wisconsin - Madison develops learning games and has established distribution and data infrastructure to conduct research with large audiences. The lab has begun partnering with a variety of researchers to use games to disseminate their work to large public audiences, ranging in topics from science journalism to astrophysics. This poster provides seven example projects and early insights into the results of this approach for educational outreach.
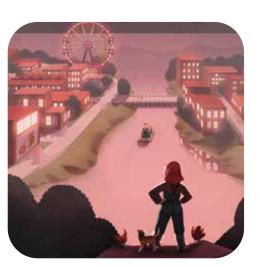

| Jo Wilder and the Capital Case | Lost at the Forever Mine | Wake: Tales From The Aqualab | The Legend of The Lost Emerald | Headlines and High Water | Lakeland | Ice Cube |

Results

Increasing Access

Most of the public will not attend an in-person science event or engage with a complex classroom activity that requires significant teacher training. Learning games excel at providing rich experiences that use existing classroom devices. This broadens access, especially for students in underfunded schools.

Assessment and Analytics

Audience size, demographics and learning outcomes are difficult to measure with traditional outreach approaches. When designed correctly, digital games capture detailed descriptions of learner activity which can be used to model learner thinking, affect as well as study designs for different audiences.

Complex Learning Goals

In well designed games, players take on an active role and make discoveries themselves using the discourses and tools of the scientific discipline. They explore complex simulations, engage in cycles of productive failure, and are provided with formative feedback in pursuit of their goals.

Orders of Magnitude more Cost Effective

A game such as Lakeland will be played ~1.5M times over a ten year period with an average engagement of 20 min per play, a total of 40M min of engagement (MoE). With a $150k production cost, this results in $0.005 per MoE. A small outreach staff will spend the same amount yearly, and if focused on events, may only result in 5k engagements of 5 min each (a large science festival) and 500 engagements at 60 min ea. (bi-monthly workshops). This results in $2.72 per MoE.

Selected Research:

Metcalf, S.,M., Gagnon, D., Slater, S. (2023). Shifts in Student Attitudes and Beliefs about Science Through Extended Play in an Immersive Science Game. 2023 9th International Conference of the Immersive Learning Network (iLRN). San Luis Obispo, USA.

Pfotenhauer, J. M., & Gagnon, D. J. (2021), ThermoVR: A Virtual Laboratory to Enhance Learning in Undergraduate Thermodynamics. Paper presented at 2021 ASEE Virtual Annual Conference Content Access, Virtual Conference. https://peer.asee.org/37908

Tredinnick, R., Cors, R., Madsen, J., Gagnon, D., Bravo-Gallart, S., Sprecher, B., & Ponto, K. (2020). Exploring the Universe from Antarctica–An Informal STEM Polar Research Exhibit. Journal of STEM Outreach, 1–13.https://doi.org/10.15695/jstem/v3i1.03

View more at fielddaylab.wisc.edu/research

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