# Untapping Potential:
## Virtual Reality Circuitry Learning in Rural Midwest Communities

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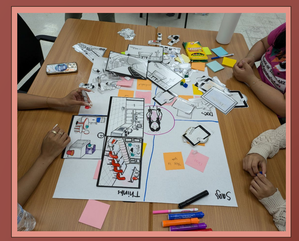
## Background in STEM and VR

- Some rural high school students lack exposure to STEM curriculum
- Educational gaps can lead to underrepresentation in future careers
- VR can enhance engagement especially in STEM education [1].
- Exposure to STEM curriculum through gamification could lead to:
  - Pursuit of higher education
  - Apprenticeships
  - Agency in their future careers & adult life

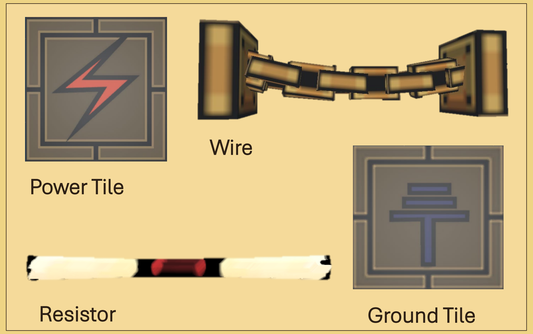
## Co-Design Method



*Co-Design:* A design approach in which developers work alongside students to involve them in the art of creation to better envision the final product [2].

- Implemented with both local teachers & students
- Helped identify:
  - Local community culture & pop-culture
  - Recognizable game tropes
  - Popular art styles

## Volt of the Pharaoh

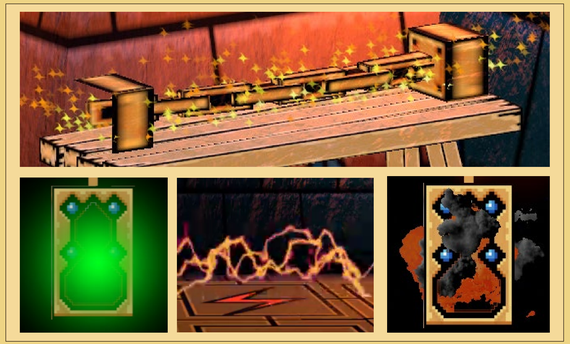


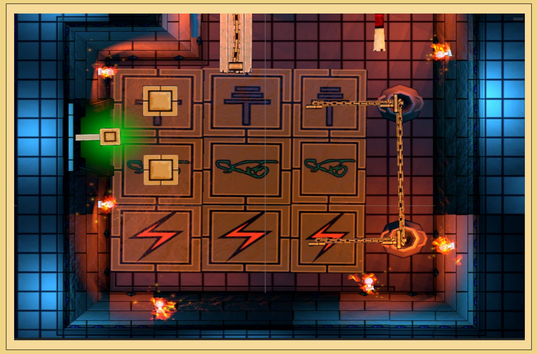

### Game Overview

Set in ancient Egypt. Currently there is a single level in which the player is introduced to the mechanics of the game and learns how to interact with wires, resistors, and circuits.

### Key Feature: Visual Feed Back

- Green lamp light vs fire and smoke
- Particle systems appear around objects to interact with
- Current flow is shown on the ground with lightning bolts
- Floor tile designs show grid connections like a bread board





### Key Feature: Gameplay

- Escape room style play area
- Only vital objects can be moved and interacted with
- Each room teaches additional circuitry principles, building on each other
- Completing the circuit is the puzzle to enter the next room

## Co-Design Results and Effects on Game Design Choices

- Large number of ESL students identified
  - Result: symbology, limited text in game
- Current curriculum shift to Problem-Based Learning
  - Result: puzzle-based game style
- Limited number of technology courses in local schools
  - Result: focus on circuitry, simple introductory level

## Future Work

- Additional co-design sessions
  - Larger focus on game design
  - Iterative game testing & design
- User testing
  - Measure engagement
  - Meets education standards
- Full game development
  - Additional levels
  - Add story to game play
  - New gameplay mechanics

## References

[1] Maheshwari, Ishan, and Piyush Maheshwari. "Effectiveness of Immersive VR in STEM Education." In *2020 Seventh International Conference on Information Technology Trends (ITT)*. Abu Dhabi, United Arab Emirates: IEEE, 2020. https://doi.org/10.1109/ITT51279.2020.9320779.

[2] Alex Renner, Eliot Winer, Kimberly Zarecor, Evrim Baran, Ezequiel Aleman, and Kareen Salazar Morales. "Advancing Career Aspirations in STEM Fields through Co-Design and XR-Enabled Educational Delivery Models." In *Interservice/Industry Training, Simulation, and Education Conference (I/ITSEC)*. Orlando, FL, 2023. https://www.xcdsystem.com/itsec/proceedings/index.cfm?Year=2023&AbID=121273&CID=1001#View.

VRAC Visualize • Analyze • Reason • Collaborate

Iowa State University
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Acknowledgments/Funding Sources
This material is based upon work supported by the National Science Foundation under Grant No. (2244586)