Hemonauts: Initial Implementation of Digital Games to Increase STEM Learning Among Chronically Ill Children

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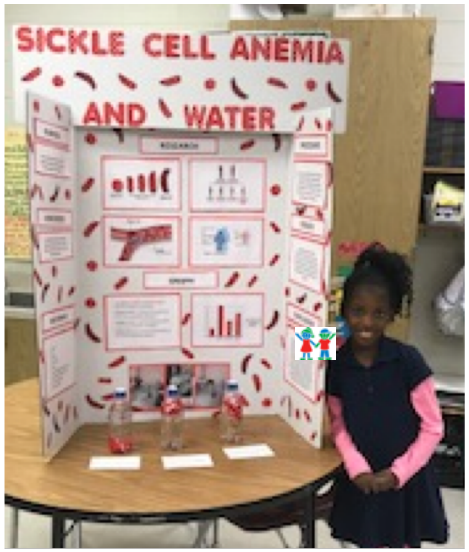
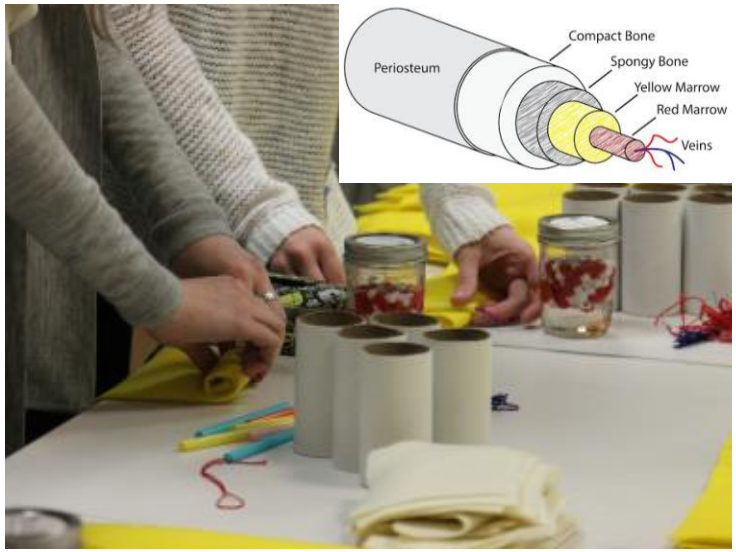
BME healthreach©

AN EDUCATIONAL ENRICHMENT PROGRAM IN COLLABORATION WITH
GEORGIA TECH, EMORY UNIVERSITY, AND CHILDREN'S HEALTHCARE OF ATLANTA

- Interactive science and math educational enrichment outreach program focused on chronically ill hospitalized children
- **Child's own disease is used as the springboard and hook for learning**
- Goal of motivating and sparking an interest in science and math.
- Designed to **augment** classroom teaching and provide educational experiences with interactive hands-on activities





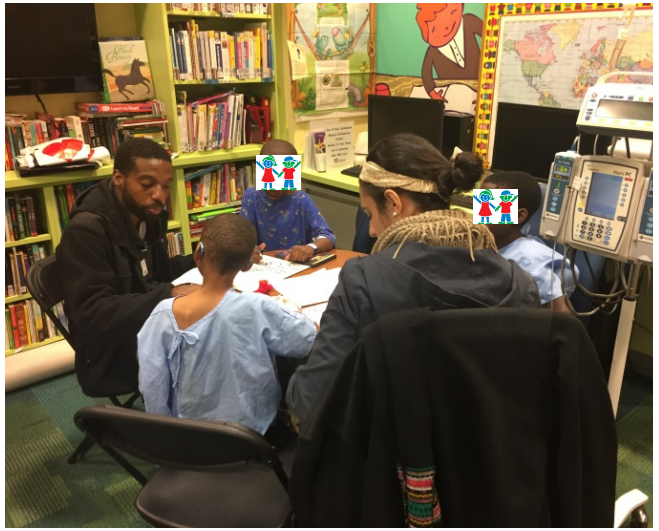
Idea

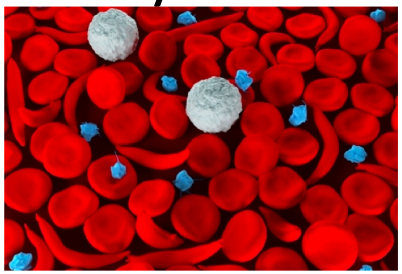
- Could we turn BME HealthReach into a digital gaming platform?
- Chronic illness and human physiology situates STEM learning in a personally meaningful context.

Population - Sickle Cell Disease

Game testers

- 10 - 13 year olds, in 5th - 7th grade
- Sickle cell disease anemia patient
  - Suffers from acute and chronic pain
- Misses school on average 1 day a week



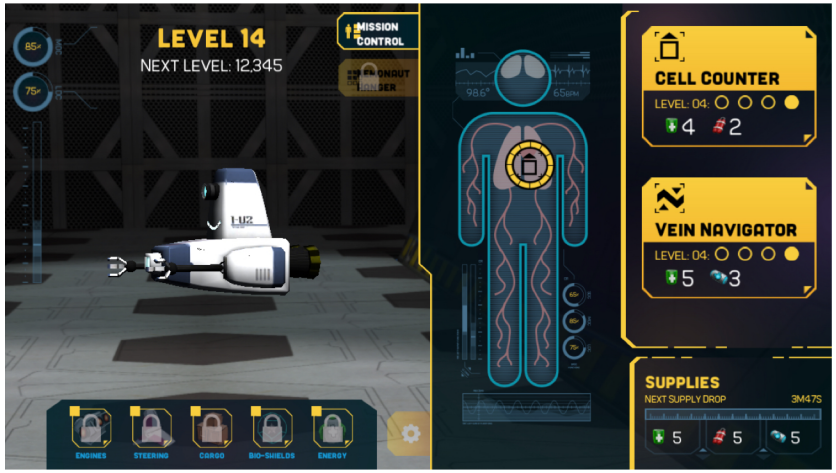


Concerns

- Missed school, falling behind in STEM areas
- Unable to talk about their disease with classmates or friends
- Transition into adulthood will also mean more responsibility for medical care

Game Goals

- Created a suite of games with Thrust Interactive
- Research questions: Can gameplay lead to:
  - Increase STEM content knowledge?
  - Increase knowledge of and intent to persist in STEM careers?
  - Increase disease literacy to improve patient self-advocacy, treatment compliance, promote healthy lifestyle choices?



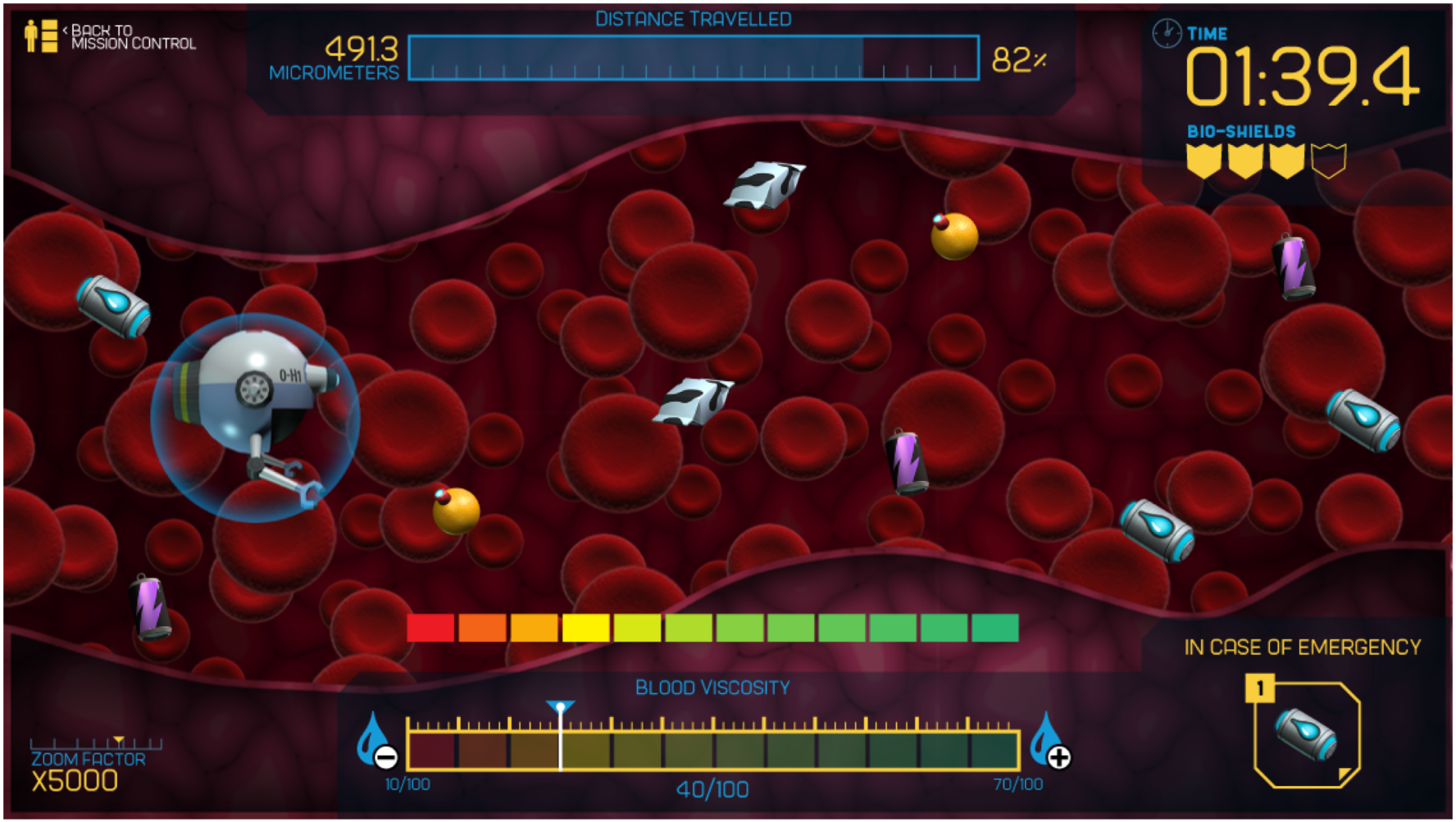
Mini Game – Cell Counter

- Navigate a nanobot through the veins to count red blood cells.

Cell Counter Feedback

- Described as a game focused on “counting” or “scanning” blood
- Game moved too fast
- Had to restart the game to understand how to play
- STEM content missed primarily because it was integrated into the directions.
- Unable to make the connection between counting the number of cells repeatedly for the purpose of finding an average.

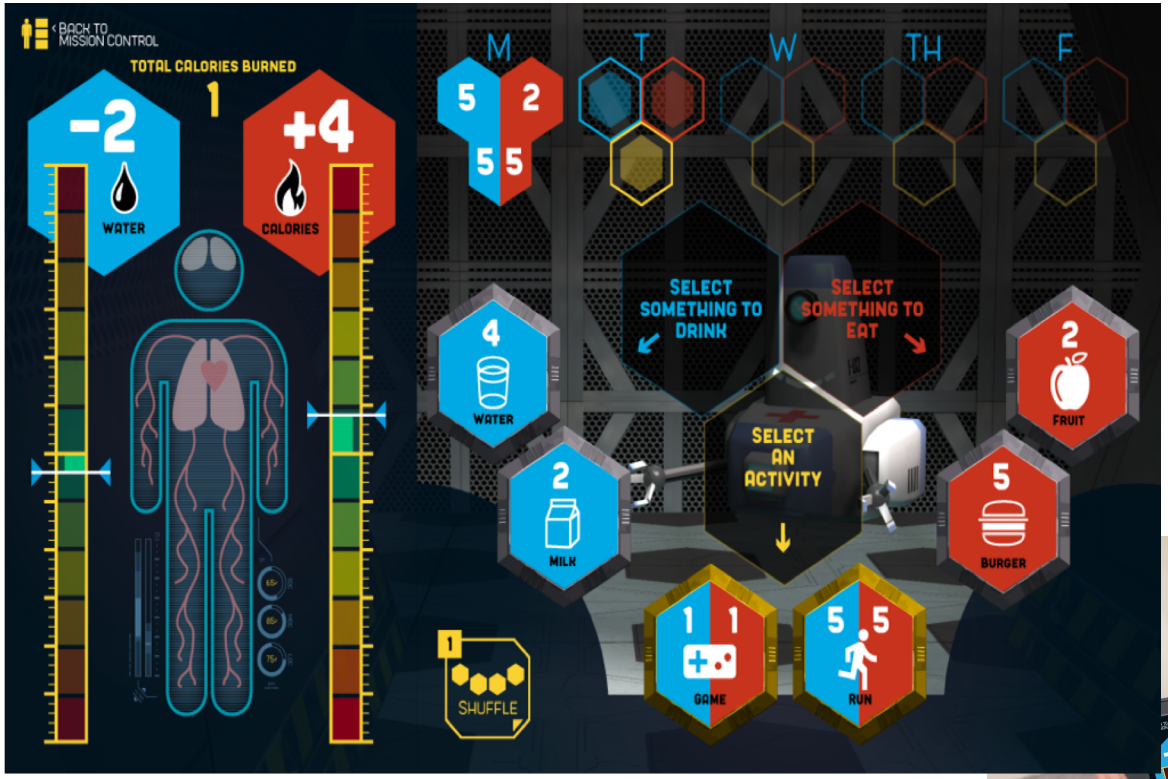
Mini Game – Cell Navigator

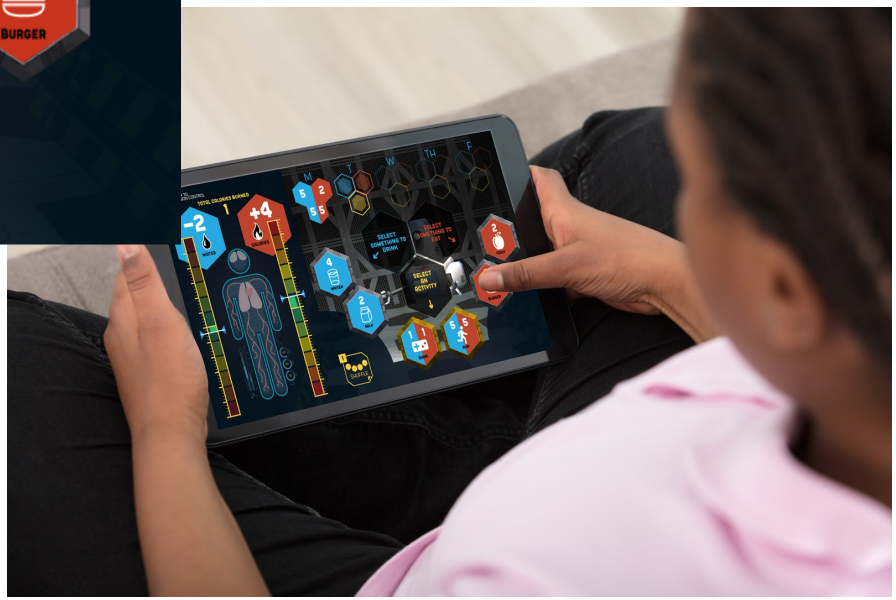


Cell Navigator Feedback

- Enjoyed the side-scroller game action
- For Sickle Cell Disease – hydration used to prevent pain crisis
- Confused about the effects of beverage choices – water vs. milk
- Unable to grasp how the games was contextualized in the body

Mini Game – Body Balance





Body Balance Feedback

- Most popular game
- Players felt they learned something about balancing food and beverage intake and exercise/exertion
- Most successful at delivering health education
- **“Don’t overdo it. Drink more water. And calories you burn, try maintain it. Like keep it balanced… Don’t get dehydrated…”**

Overall Results

- Games were successful at delivering health education
- Patient's thought the game was set in their body
- Limited success in communication higher-level STEM content
- **"Games were fun, intuitive, and easy to manipulate toward an understood goal."**
- Expressed feelings of loneliness and embarrassment, unable to explain their disease.
- Patients showed a strong interest in learning about sickle cell disease and their bodies but,
- Demonstrated a large deficit in knowledge of disease physiology and management

Next Steps

- Received NIH SBIR Phase 2 funding August 2018
- Revising the games with goals:
  - Increase STEM content knowledge through gameplay
  - Increase knowledge of and intent to persist in STEM careers
  - Increase disease literacy to improve patient self-advocacy, treatment compliance, and to promote healthy lifestyle choices
- Include supplemental, mixed media remedial education materials.
- Assessment
- Answer our research question:
  - What is the optimal mode of delivery for STEM educational content within mixed media to promote increases in content knowledge and intent to persist in STEM?

Questions

- Funded by the National Institutes of Health Small Business Innovation Research – Serious STEM Games for Pre-College and Informal Science Education Audiences

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