Exploring Gamification in Virtual Reality Training of Bioreactor Operations

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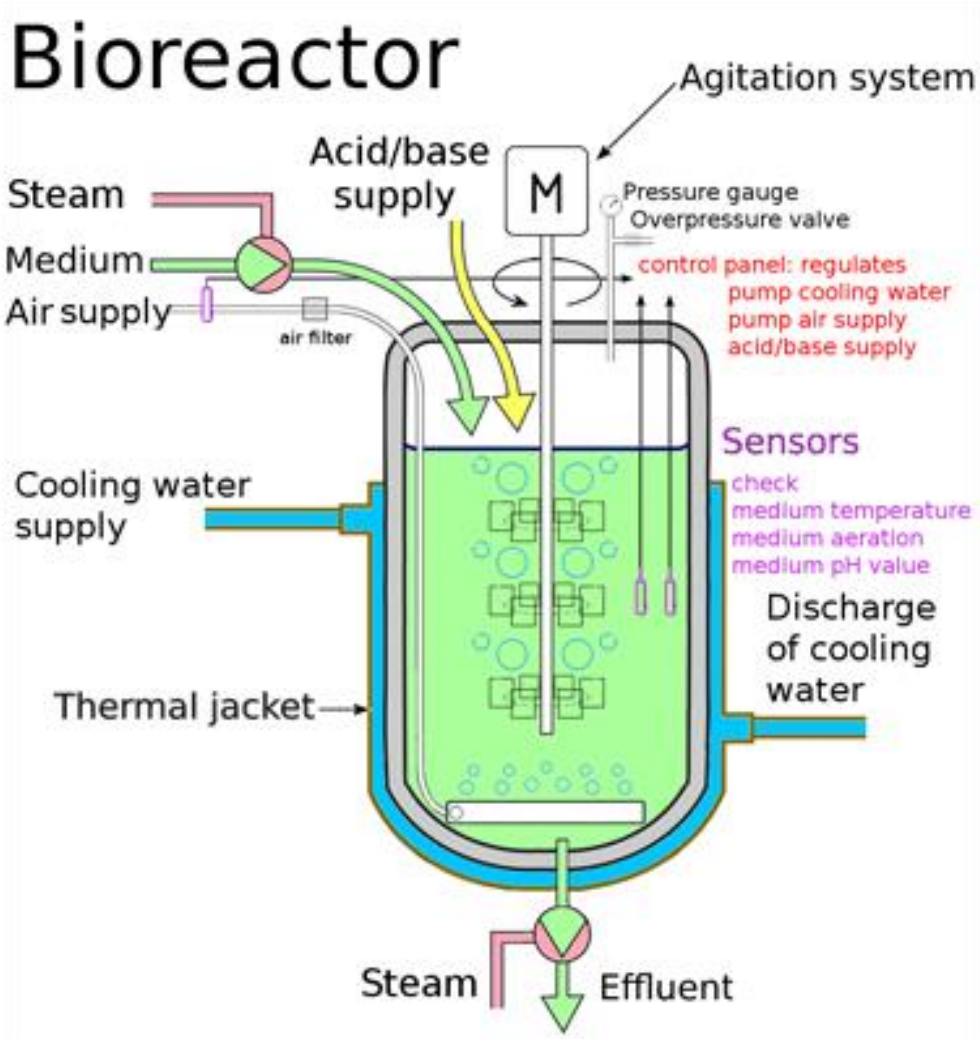
Overview

- Motivation
- Aims & Objectives
- Gamification
- Methodology
- Demo
- User Evaluation
- Conclusion

Motivation

Single-use bioreactor (SUB) in-lab setup



Textbook diagram

Motivation

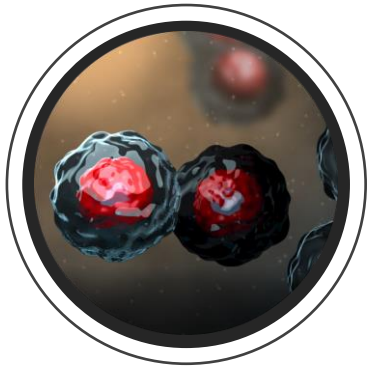
Need presence of specialized personnel as bioreactors are **complex to operate**

Difficult to sustain operations as **consumables are costly**

Students expected to competently apply engineering principles to design processes and operate lab equipment, requiring sessions of practice

Limited access to equipment and hence limited learning opportunities

VR as an authentic context to promote situated learning and achieve learning outcomes



Provide training opportunities without costly lab equipment and avoid possible dangers during equipment operation and training

Aims & Objectives

- VR as an authentic context to assist in achieving the learning outcomes of performing biopharmaceutical engineering operations
- Provide training opportunities without costly lab equipment and avoiding possible dangers during equipment operations training
- Mitigate limited access to equipment for hands-on training

Gamification

gamification /ˌgeɪmɪfɪˈkeɪʃ(ə)n/ (noun)

the application of typical elements of game playing to other areas of non-game activity

Deterding (2011)


1:1 scale of single-use bioreactor in 3D

Methodology

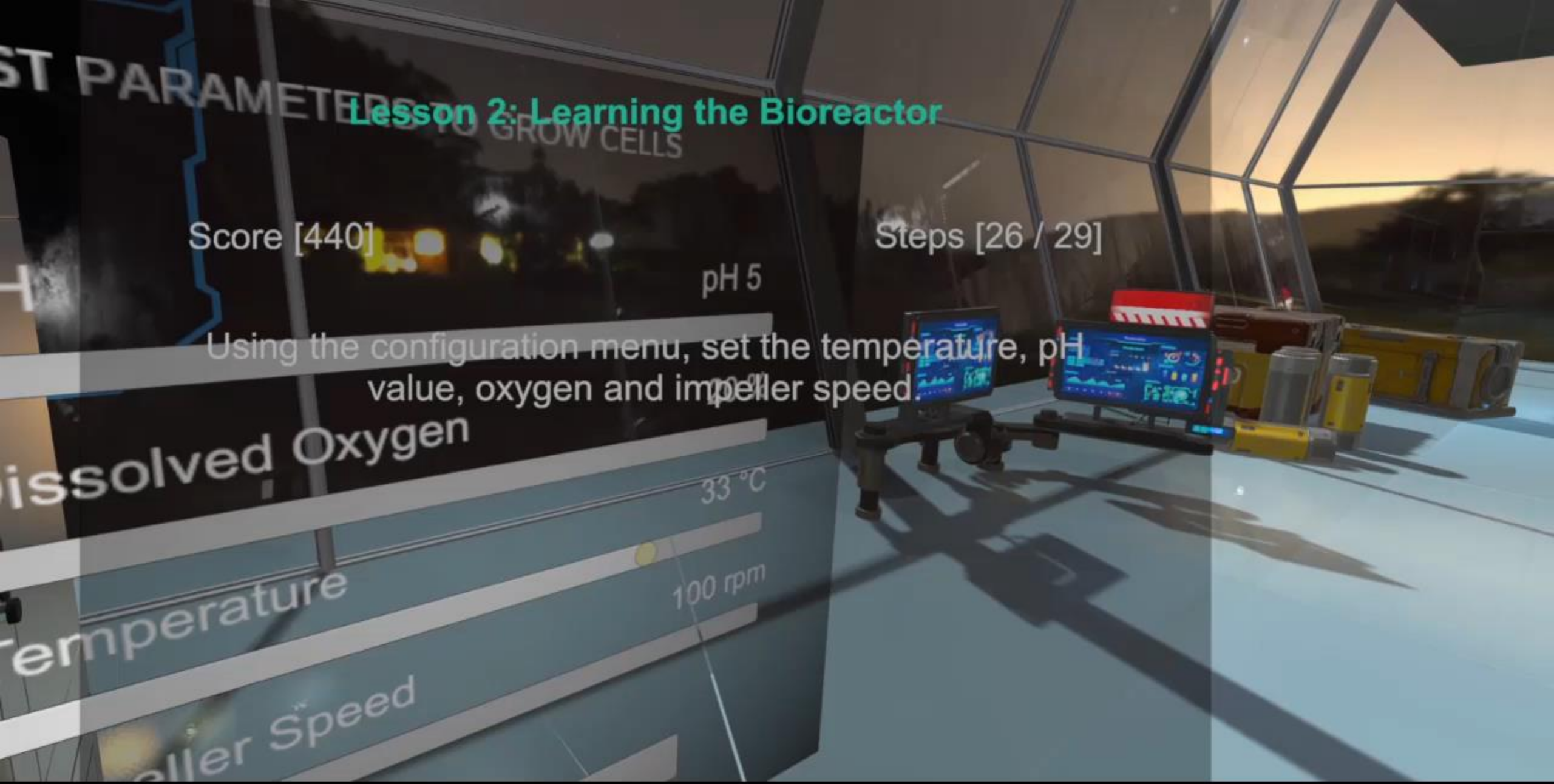
- Three main lessons with **game attributes** implemented
- Based on the game attribute taxonomy by Bedwell et. al (2012)

Three levels:

1. Bioreactor component identification
2. Bioreactor setup
3. Aseptic transfer operations & cell cultivation

Game Attributes	Description
Control	Similar real life movements and direct manipulation, control environment exploration
Challenge	Different difficulty levels, instructions, highlights and hints as scaffolds
Assessment	Points, scores and completion of steps, feedback
Rules/Goals	Completion of specific steps to progress
Environment	Lab or sci-fi environment
Game fiction	sci-fi story to assist protagonist with global infection

Lesson 1: Identifying Bioreactor Components
Score [0]
Steps [0 / 6]
Identify bioreactor [Door Lock Mechanism]



Lesson 2: Learning the Bioreactor

Score [440]

Steps [26 / 29]

Using the configuration menu, set the temperature, pH value, oxygen and impeller speed.

User Evaluation

Pilot qualitative study of the VR learning environment with a think-aloud protocol, semi-structured interviews. 7 volunteer participants.

“It was fun, rather immersive experience”

“Only one playthrough, understand theory-wise, know what to do in the VR. 2nd playthrough will be more familiar”

"It’s worthwhile, there’re things to learn and for better memory retention, right, definitely more sessions will be needed“

“This gave me an idea of where those parts are… on how they interact and actually how to operate those smaller parts”

“This is to help everyone who has no experience with the real thing (to) learn about the real thing”

Conclusion & Future Work

- VR application provides certain useful benefits and advantages in terms of access to expensive lab equipment and the opportunity for repeated practice
- Evaluated gamified VR application via pilot qualitative user evaluations
- Results and feedback received are overall positive
- Participants reported sustained interest with repeated replay requests and achieved high levels of immersion
- Future work could involve additional specific gamification attributes within the application, detailed user evaluation

Questions?

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