



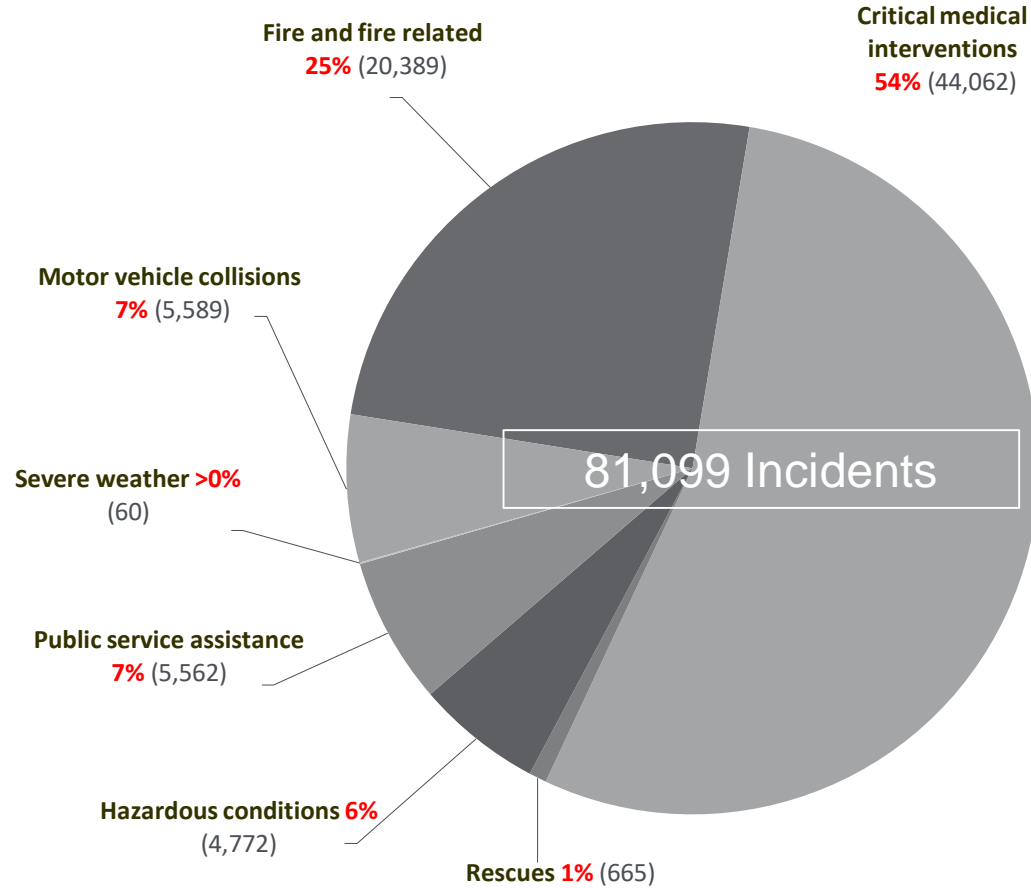
Enhancing Fire Safety Education with Virtual Reality: Presentation to the National Fire Protection Association (NFPA) June 2023

Who are We: The Calgary Fire Department & Fire Safety





Calgary Fire: Overall Trends



2022:
+12%
increase
in
Incidents





- Fire incidents occur across Calgary
- Areas of highest fire frequency are **Downtown** and **Northeast** area of Calgary

11 Apr 2023 - Calgary Fire Crews Fight Industrial Fire in South East

27 Mar 2023 - Explosion Rocks Calgary's Marlborough Neighbourhood Leaving Serious Injuries and Devastation

24 Mar 2023 - Calgary Fire Department Fights Multiple House Fires

22 Mar 2023 - Carbon Monoxide Alarm Alerts Residents to Danger

08 Mar 2023 - 12 Residents Alerted to Danger in Their Home by CO Alarm

06 Mar 2023 - Calgary Fire Department responds to structure fire in Castleridge

04 Mar 2023 - Calgary Fire Department Responds to Carbon Monoxide Incident

02 Mar 2023 - Calgary Fire Crews Respond to Lake Bonavista Basement Fire

01 Mar 2023 - Calgary Fire Department Responds to a Fire in Beddington

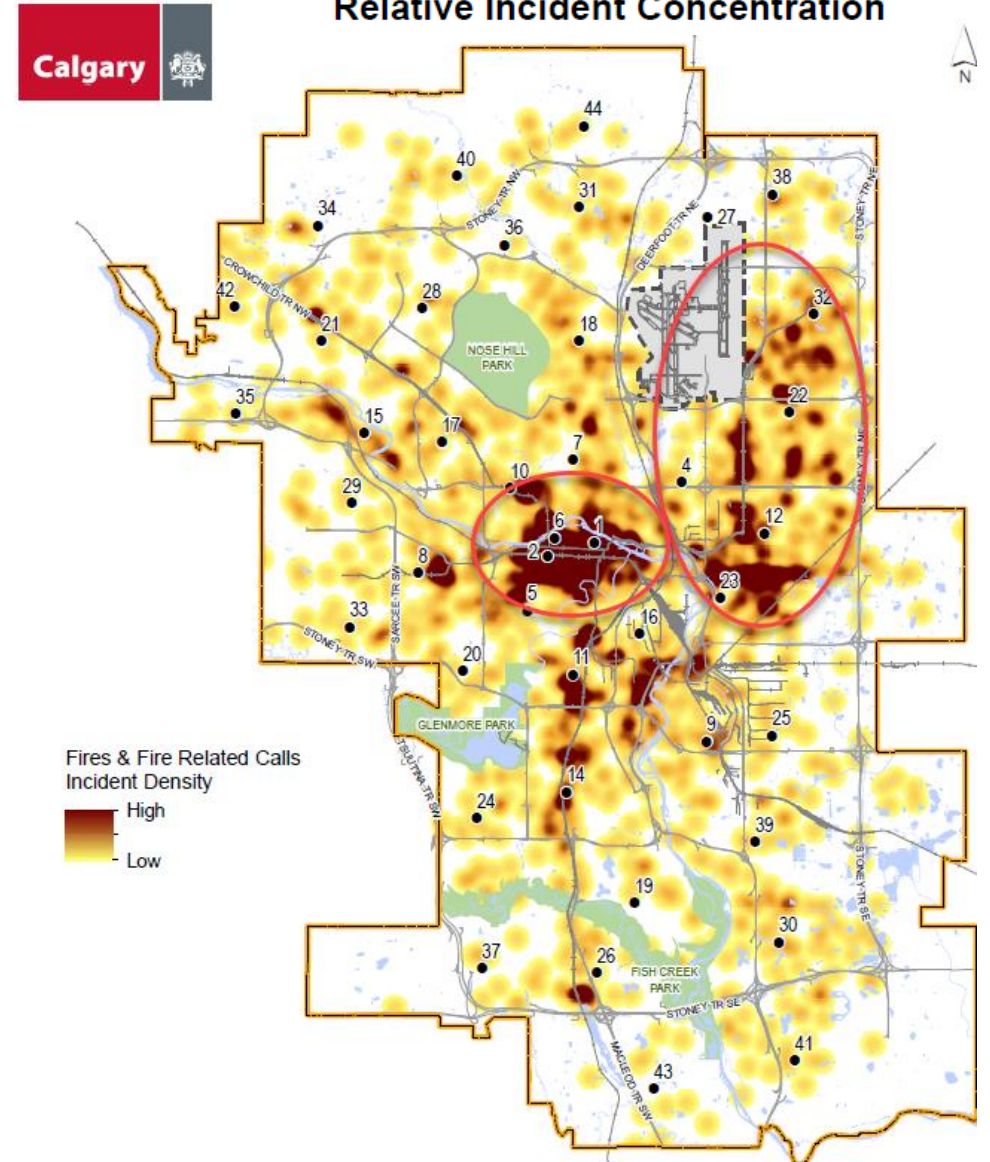
17 Feb 2023 - Fatality Housefire in Penbrooke Meadows

14 Feb 2023 - Calgary Fire Crews Fight Auburn Bay Garage Fire

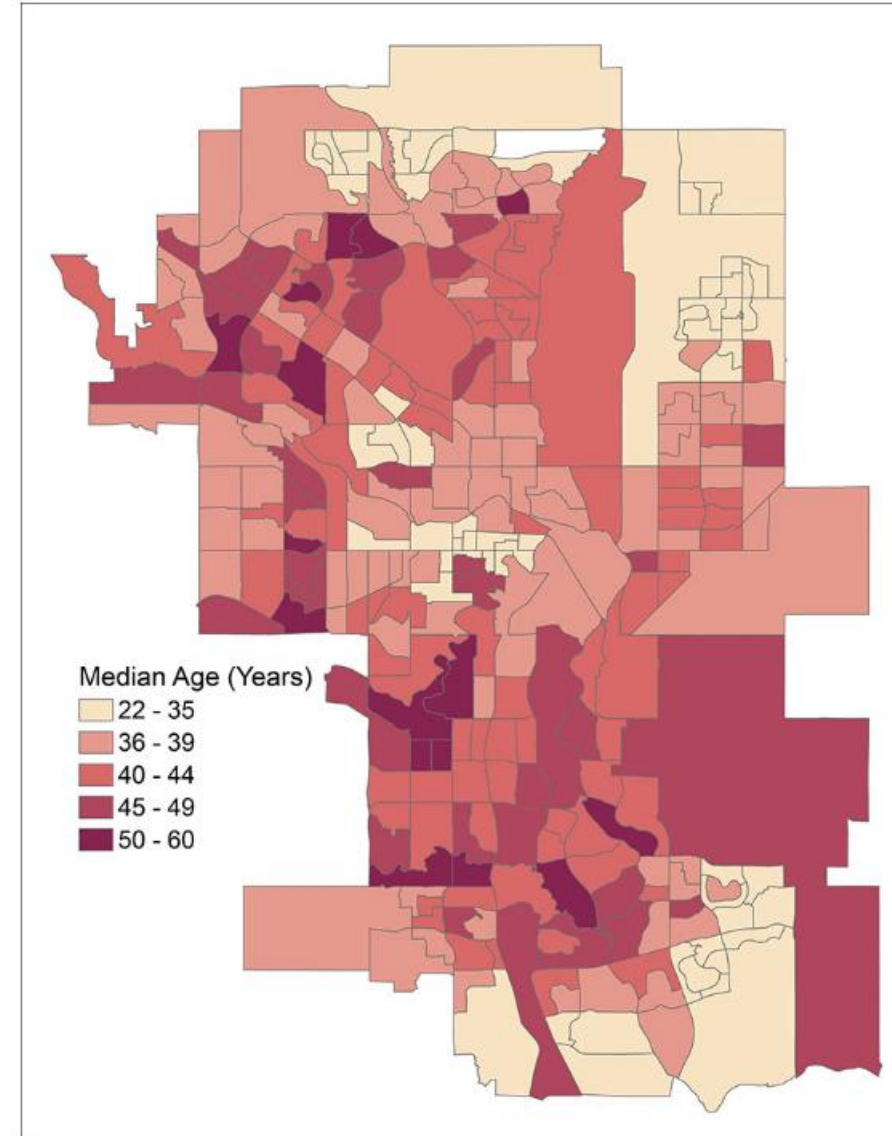
04 Feb 2023 - Fire Crews Battle Residential Structure Fire in the City's South East

02 Feb 2023 - Calgary Fire Crews Respond to South East for Tragic Townhouse Fire

Calgary Fire Department
2022 Fire related Calls Distribution
Relative Incident Concentration



- Total Population: **1.3 Million**
- 177,000 Calgarians aged 65 years and over.

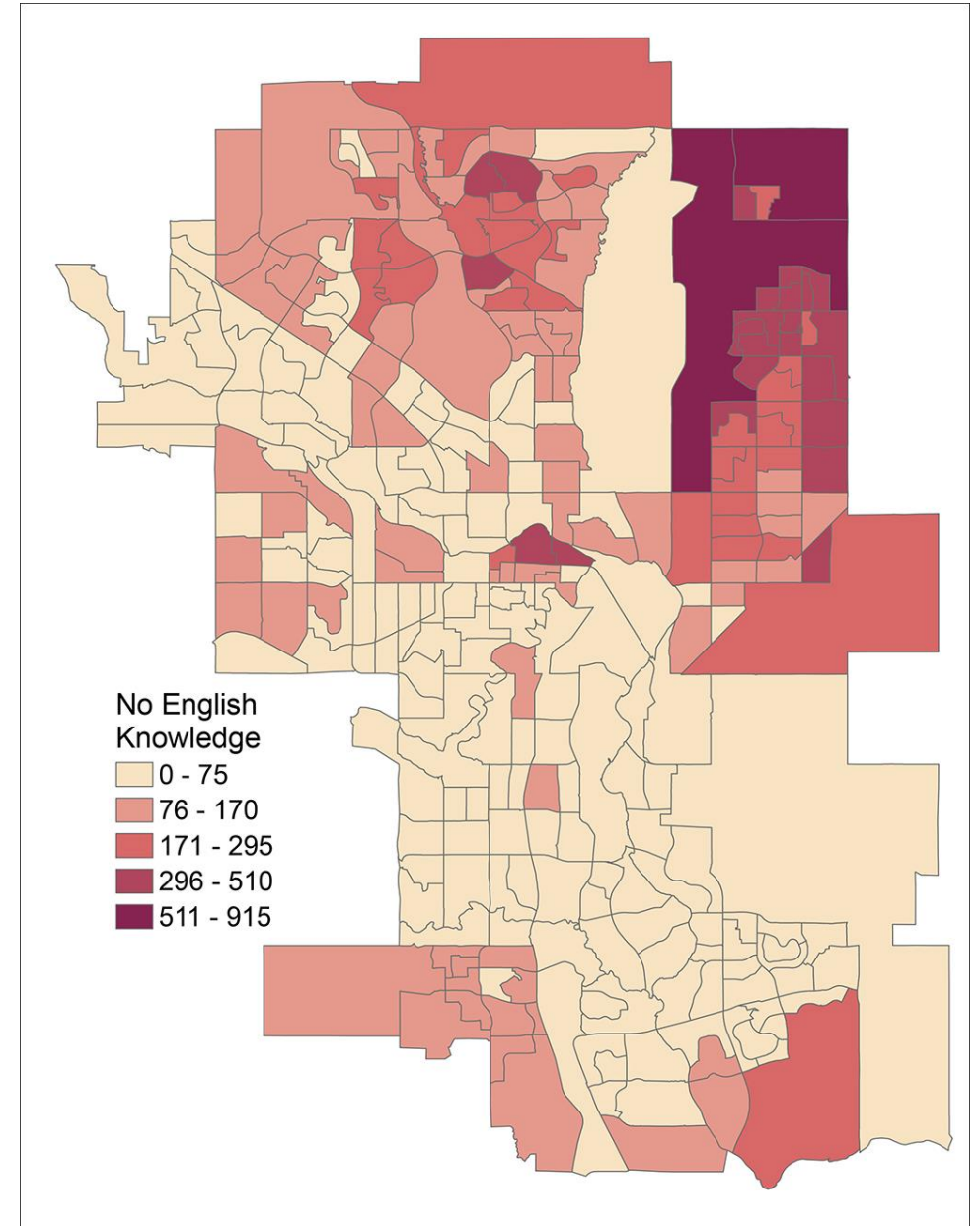




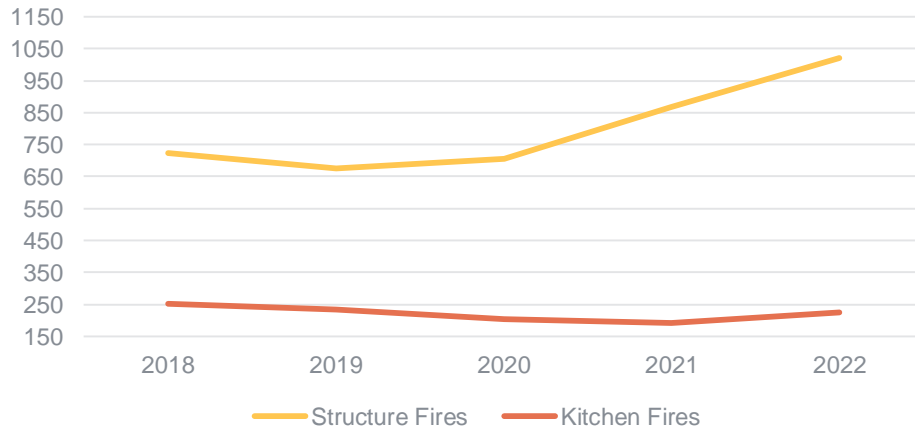
- **33,000** Calgarians have no English knowledge.
- Approximately **19%** of Calgarians speak a non-official language most often at home.
- **Between 2016 and 2021, 81,000** recent immigrants came to Calgary.

Top 10 non-official languages spoken most often at home, Calgary, 2016 and 2021

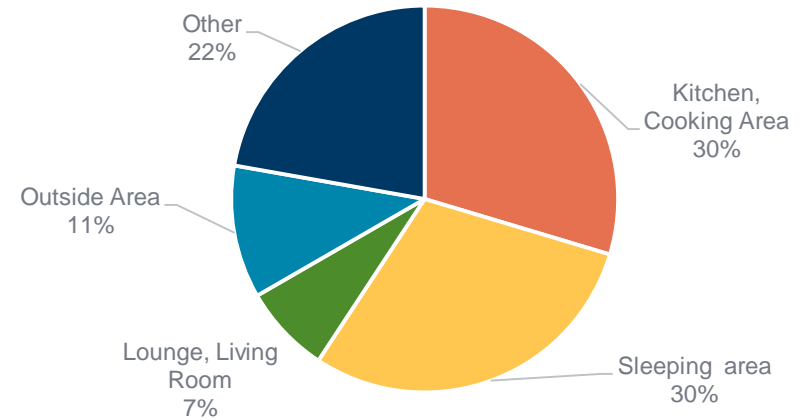
Ranking	2016	2021
1	Punjabi	Punjabi
2	Tagalog	Tagalog
3	Cantonese	Mandarin
4	Mandarin	Cantonese
5	Spanish	Spanish
6	Arabic	Arabic
7	Urdu	Urdu
8	Vietnamese	Vietnamese
9	Persian	Korean
10	Korean	Russian



Number of Fires In Calgary
2018-2022



2022 Fire Injuries by Area of Origin



- #1 Source of Ignition Fires = Stove
- 25% of Fires Start in Kitchen
- 30% of Fire Injuries Result from Kitchen Fires
- 30% of Fire Injuries Result from Bedroom Fires



So Now What? Virtual Reality Pilot: Background & Research

- Previous success with experiential learning using fire trailer
- Limitations:
 - Seasonality
 - Language Ability
 - Access to Parking



So Now What? Virtual Reality Pilot: Background & Research



Notes:

- **Most academic research on fire safety education conducted outside of North America**
- **Most VR modules focused on commercial training (fire extinguisher, etc)**

Applicable Studies

- Smith, S., & Ericson, E. (2009). Using immersive game-based virtual reality to teach fire-safety skills to children.
- Ericson, E. R. (n.d.). Development of an immersive game-based virtual reality training program to teach fire safety skills to children.
- Feng, Z., González, V. A., Amor, R., Lovreglio, R., & Cabrera-Guerrero, G. (2018). Immersive virtual reality serious games for evacuation training and research: A systematic literature review.
- Oliva, D. Somerkoski, B., Tarkkanen, K., Lehto, A., Luimula, M. (2019). Virtual reality as a communication tool for fire safety- Experiences from the VirPa project

What is Virtual Reality?

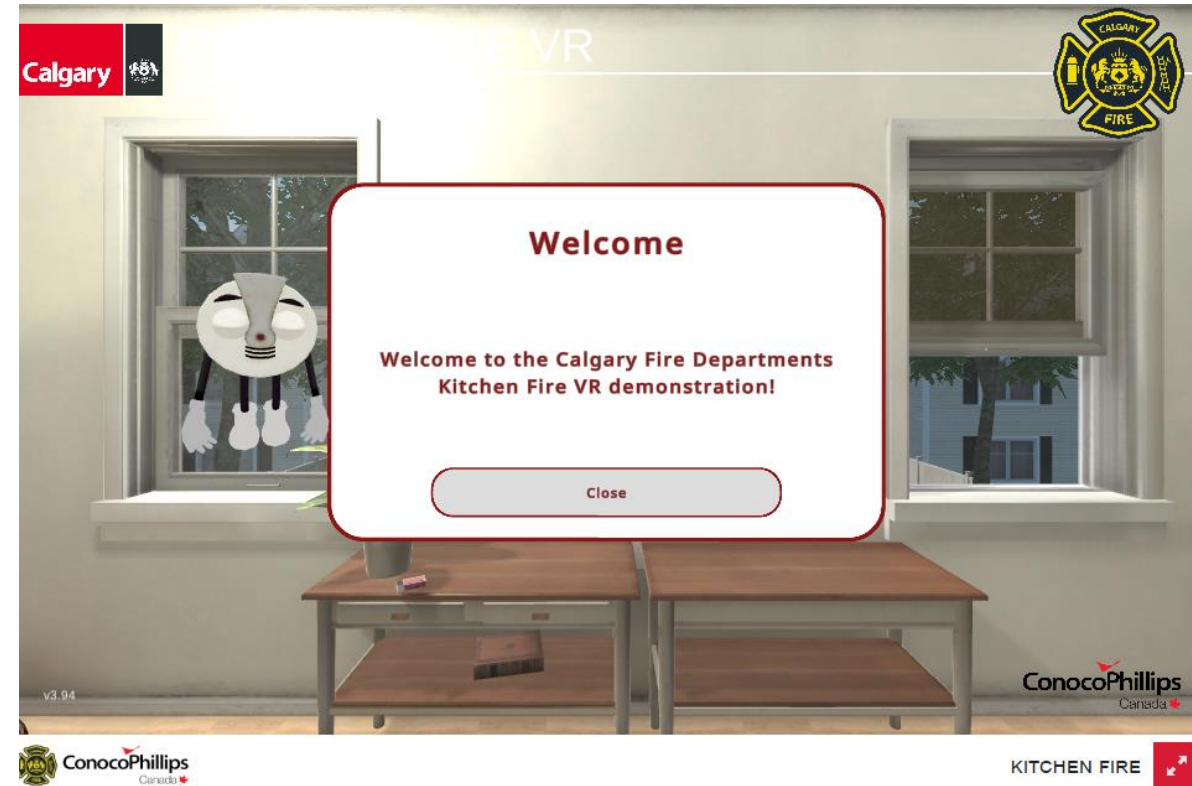
- Uses a headset to place a user in a computer-generated world.
- Uses head tracking and controllers, allowing a user to look around and interact with environment.
- Follows whichever direction a user moves, giving a 360-degree view of a virtual home.



Virtual Reality Project Cost – Where did we get funds?

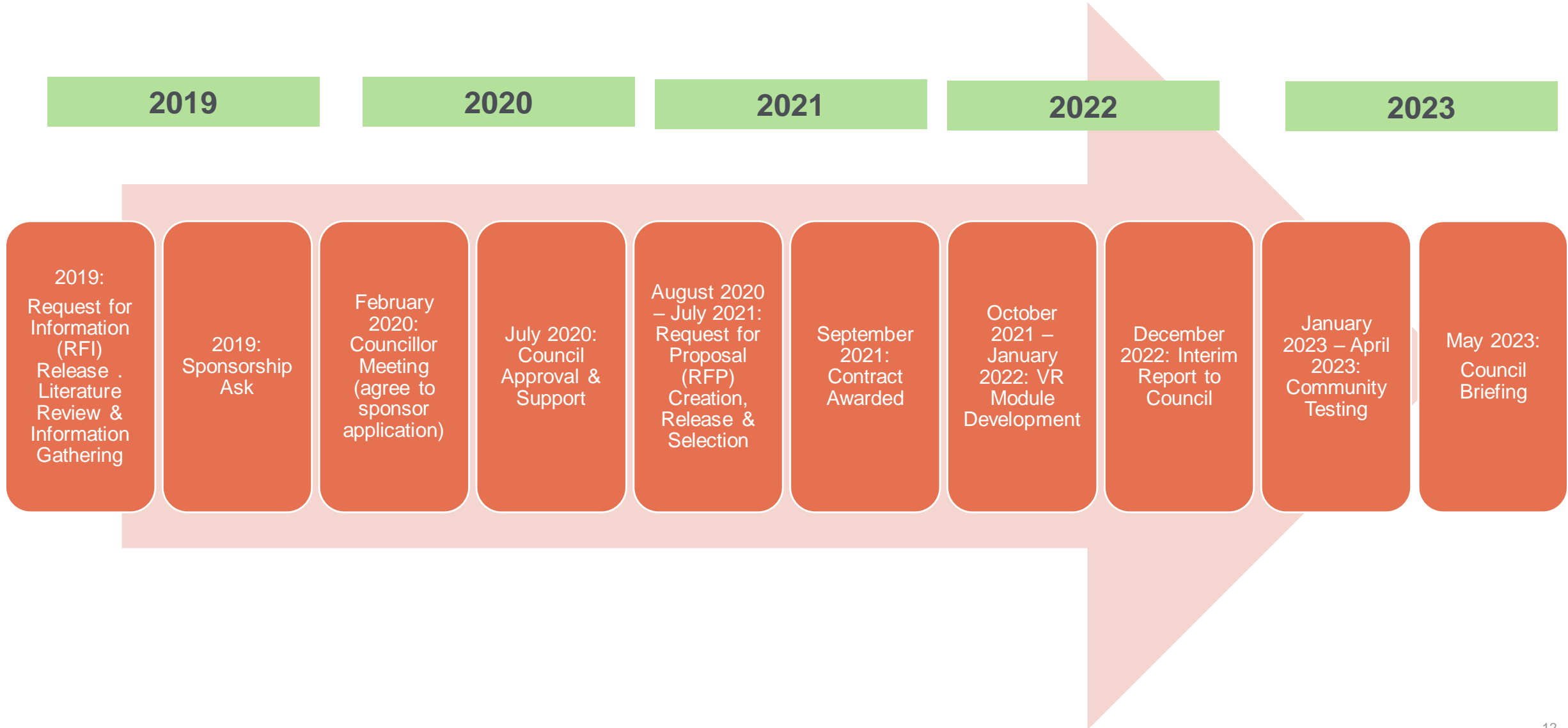
- I. Development Costs (Funded by Council Innovation Fund & Sponsorship): ~**\$110,000**
- II. Hardware Costs (Fund by Sponsorship): ~**\$25,000**
- III. Annual costs for subscriptions and/or maintenance and support((Funded by Sponsorship) : ~**\$5,000-year**

**Sponsored via ConocoPhillips*





Learning Experience Highlight: RFP & Council Advocacy

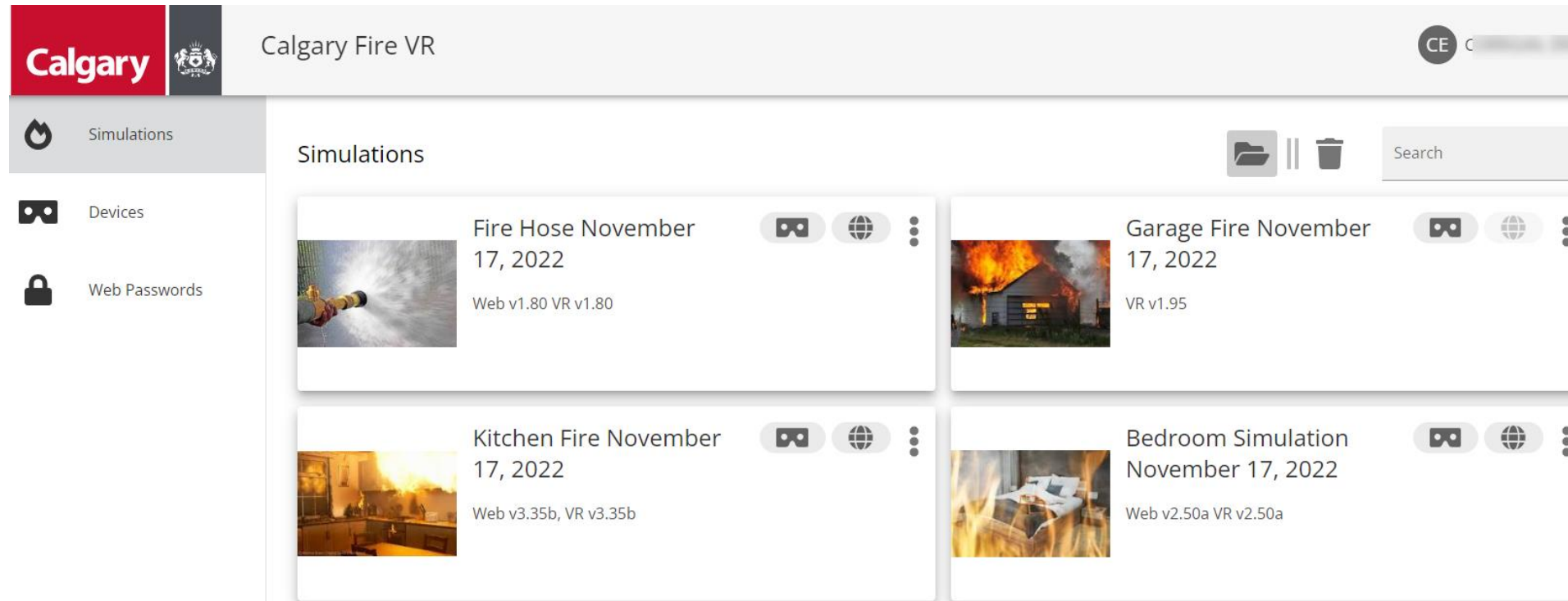


General Overview: CFD Virtual Reality



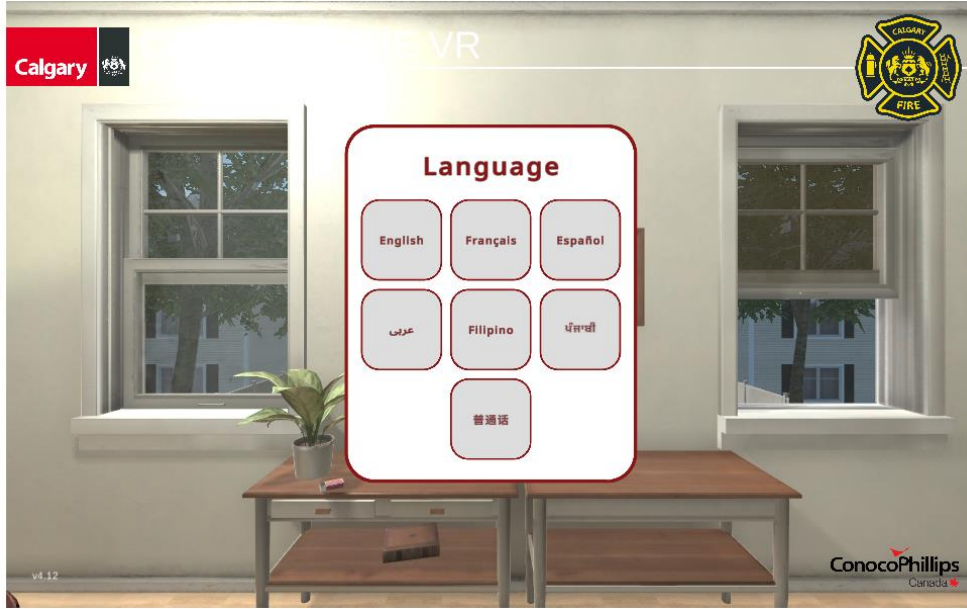
- Priority learning modules developed
- VR design: inclusive, interactive & impactful





1. Spotting hazards in bedroom/introduction to using virtual reality
2. How to safely mitigate a cooking fire
3. How to egress properly from a second floor bedroom
4. Fire extinguisher practice
5. Fire Hose Game educational challenge

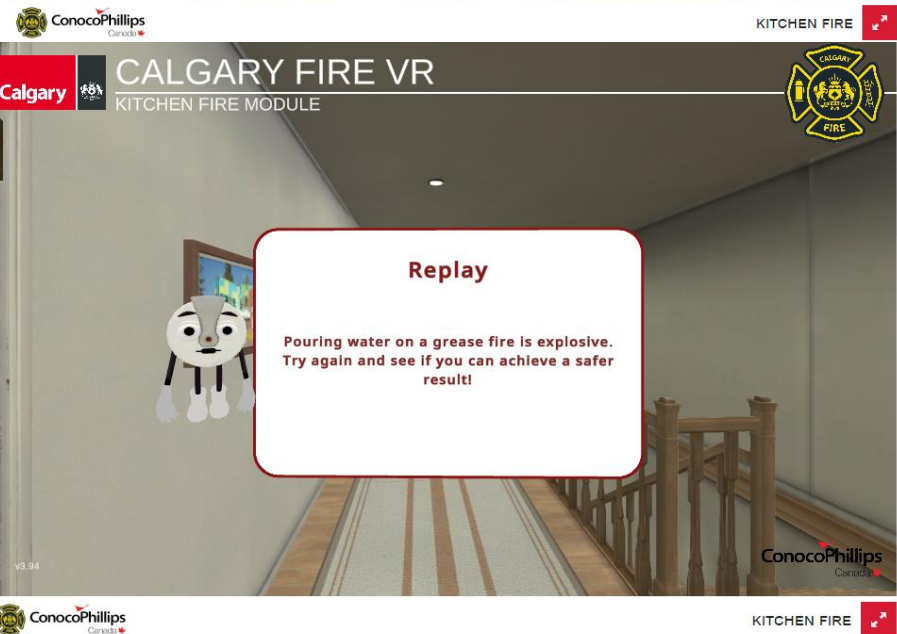
CFD Virtual Reality: Languages



- Translation of VR modules:
 - Spanish
 - Arabic
 - Tagalog
 - French
 - Punjabi
 - Cantonese
 - Blackfoot



CFD Virtual Reality: Educational Design



Principles for CFD VR Design:

- I. Present content/ Gain attention.
- II. Guide the learner in practice.
- III. Provide for independent practice by the learner including opportunity to “learn by failure” (model advocated by Roger Schank)
- IV. Provide Immediate Feedback
- V. Assessment

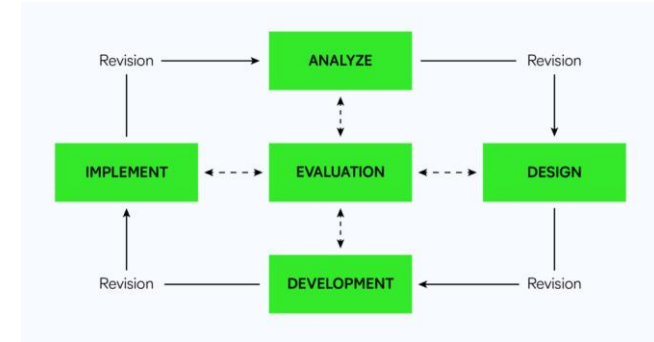


Kitchen Fire VR Video





Vulnerable Sector Feedback – Who Did we Engage With?



Engagement Results: Challenging Participant Feedback (What to Prepare For)

Familiarity with VR:

- Most participants had never used VR before or had little experience with the technology

Common Symptoms Experienced During VR:

- 17% experienced dizziness
- 6% experienced nausea
- 4% experienced headache
- 4% experienced general feeling of unwellness





	<p align="center">Calgary Fire VR Software Warnings, Disclaimers and Software License Agreement</p> <p align="center">Software Users Only (On Their Own Personal Device) #2103647</p>	
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Photosensitivity and Virtual Reality Health & Safety Notice

- A small percentage of people may experience seizures when exposed to certain lights, patterns or images that may appear in video or computer software such as Calgary Fire VR. This may occur even with no history of epilepsy or seizures. **If this should occur, consult your doctor or a medical health professional immediately.** If you, or anyone in your family, have an epileptic condition or history of epilepsy, consult your doctor prior to using Calgary Fire VR.
- Confirm that you are in good health before using the virtual reality ("VR") headset and software. Please consult a doctor before using the VR headset and software if you are pregnant, elderly, or have serious physical, mental, visual, or heart condition.
- Note: Certain people are susceptible to various symptoms and conditions when using Calgary Fire VR or a virtual reality headset, including people with:
 - epileptic seizures or loss of consciousness, involuntary movement, or convulsions
 - blurred or altered vision
 - motion sickness, dizziness, disorientation, or nausea; and/or
 - repetitive motion injuries and eye strain, eye, or muscle twitches

Immediately stop using Calgary Fire VR and consult your doctor if you or your child experience any of these symptoms or other discomfort while using Calgary Fire VR or using a virtual reality headset. Do not operate a motor vehicle, operate machinery, or engage in activities that may have potentially serious consequences until you have fully recovered from any of these symptoms.

- Children and teenagers are more likely than adults to experience photosensitive seizures and parents should monitor their use of Calgary Fire VR.
- Do not use Calgary Fire VR under the influence of alcohol or drugs or while using prescription or non-prescription medication.
- Sound volume for the Calgary Fire VR should be kept at a low enough level so that you can be aware of your surroundings while playing, and to avoid any damage to your hearing.

Content Warning

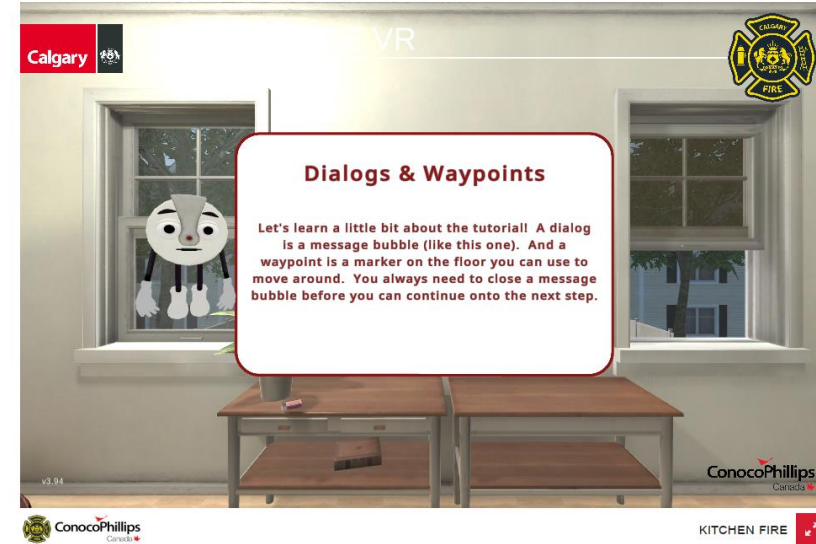
- The scenarios in Calgary Fire VR portray what might occur during a realistic fire incident. If you feel the need to stop participating in the scenario, you can always do so.

Any use of Calgary Fire VR is at your own risk. To the maximum extent permitted by applicable law, you expressly acknowledge and agree that your use of Calgary Fire VR, and products you use in connection with Calgary Fire VR, are at your sole risk. The City of Calgary does not take any responsibility for any effects or harm that may result from your use of Calgary Fire VR.

Common Symptoms:

- Explain Common VR Symptoms & Waiver Explicitly Before Use
- Emphasize Stopping Experience at Anytime
- Offer Variety of Usage Options:
 - Sitting
 - Standing
 - Web Access
 - Eye Gaze





Non-Familiarity with VR:

- Introductory Tutorial Explains Basic VR Features
- Tutorial Walks Players Through Spotting Hazards while Teaching How to Use Controllers
 - Controller Options were limited
 - Time out “close” button on dialogue boxes
- VR Experience Casted to CSO’s Computer For Guidance
 - Provide external batteries to extend battery life and casting capabilities



Engagement Results: Overall Participant Feedback



- **90%** enjoyed the VR Fire Safety Education Experience
- **86%** would recommend VR fire safety experience
- **65%** feel more safe and prepared to deal with a fire in home
- **75%** will tell others what they learned today
- **75%** said VR is more impactful than other fire safety education experiences such as presentations or demonstrations



Engagement Results: Participant Feedback

What was the best part of the VR experience?

Immersive experience

Very knowledgeable

That you were actually there

How realistic the environment is, it adds to the value of the experience

Learning about not leaving charging phones under pillows. I did not know that!

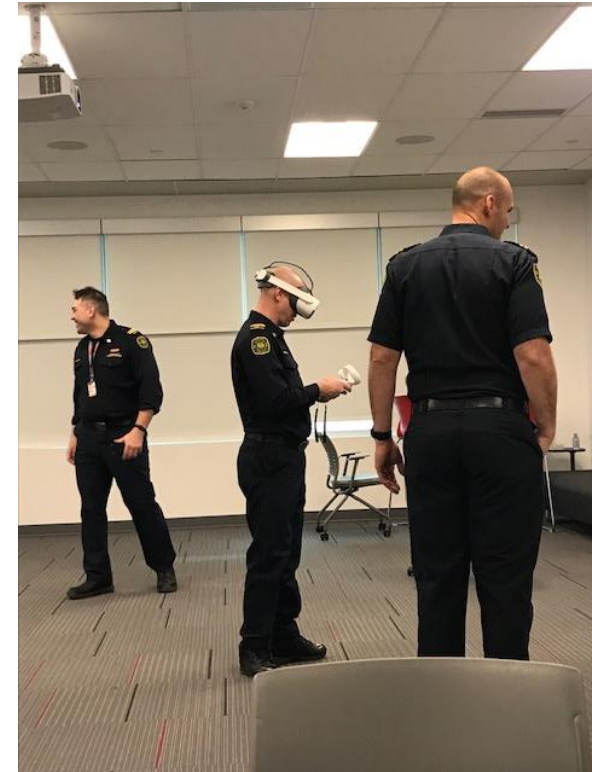
Educational benefit by "doing" as opposed to just listening to learn. And it was cool!

That is seemed like a video game

Interactive with actual home features

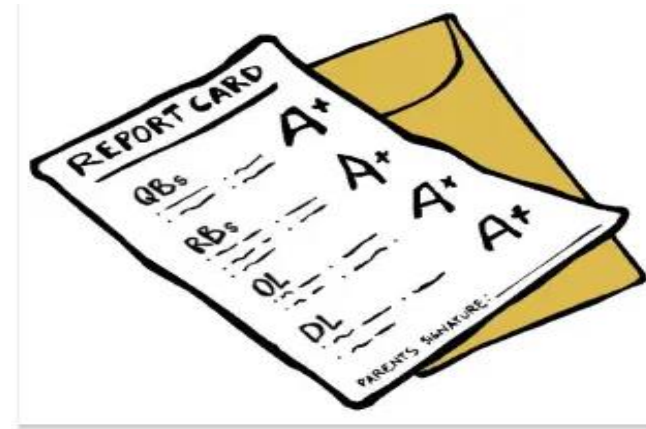
nice to try out new tech/gamified approach

Very fun way to learn as stay focused





Engagement Results: Participant Scorecard (Educational Testing)



Example Report Card Player 1 (Baseline: Firefighter Testing)	
	Time (Seconds)
Kitchen Fire Action Taken	
FRYING PAN LID-Did Not Slide	17.87
FRYING PAN LID-Did Slide	19.08
BURNER-HELPFUL-REDUCED_HEAT	25.92
COMPLETE-FINDING EXIT DOOR	13.8
SCENE-LOADED-MUSTERPOINT	~
Total Time	76.67

Example Report Card Player 2 (Vulnerable Sector Testing)	
	Time (Seconds)
Kitchen Fire Action Taken	
WATERGLASS-SPARKED_MORE_FIRE	17.87
TOWEL-LIT_ON_FIRE	19.08
SESSION-RESTARTED	25.92
BAKINGSHEET-HELPFUL- Did slide	13.8
BURNER-HELPFUL-REDUCED_HEAT	17.87
COMPLETE-FINDING EXIT DOOR	19.08
SCENE-LOADED-MUSTERPOINT	~
Total Time	113.62

- I. Further engagement: Who do we target?
- II. Media Launch
- III. Future simulations
- IV. Future languages
- V. Future accessibility (ASL, etc.)

