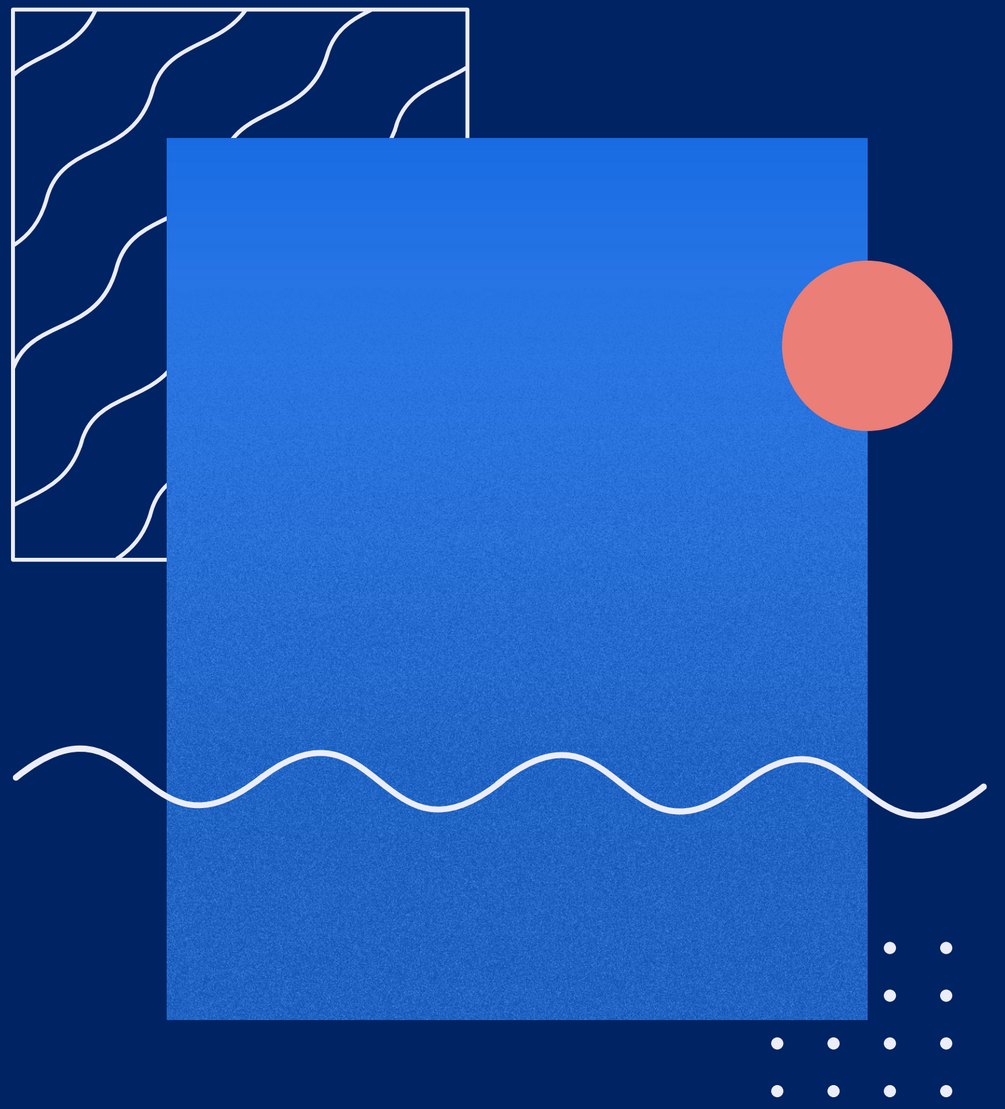
Quantum Computing Communications Strategy

BY ERIN, DENISE, & ERIK



Why is Quantum Computing Important?

Now

Financial, Chemistry, Pharmaceutical, Material Development

Future

Internet, Security Communications, Health, Artificial Intelligence

Goals for Communication Outreach

Get people interested in QC

Make QC easier to understand

Clear & simple messaging

Community outreach

TARGET AUDIENCE

Students/Young Adults

- Late-Millennials
- Gen Z
- Ages 15-24

TARGET AUDIENCE

WHO?

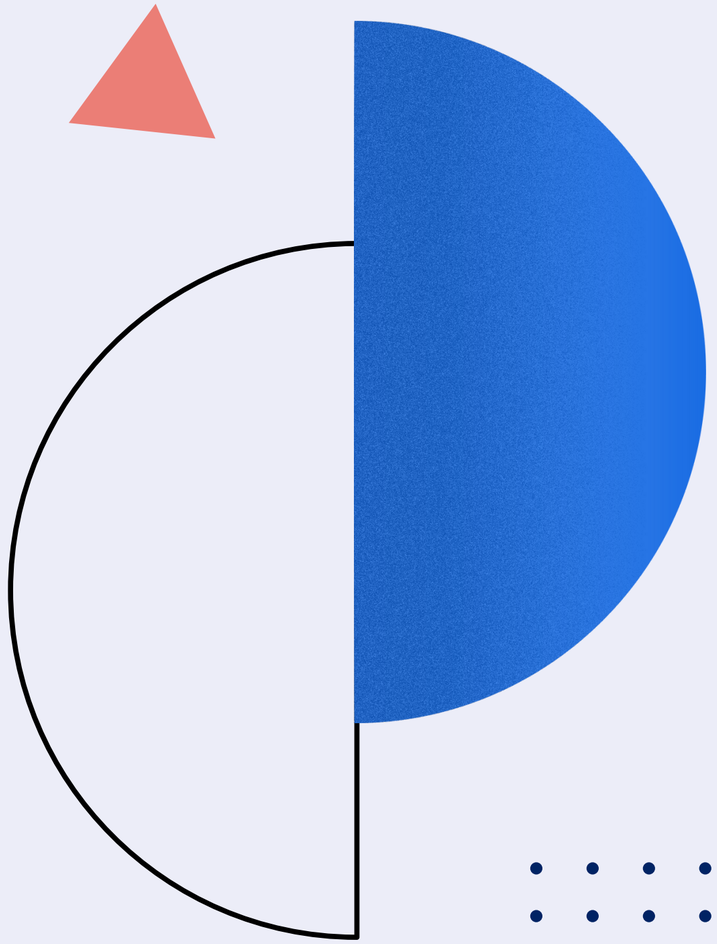
- Just starting out
- Tech-savvy, tech-curious
- Motivation:
  - Wanting to make a difference
  - Be part of emerging future
  - Be part of something important

WHY?

- People who can be in quantum computing for the long-haul
- Natural inclination toward tech

HOW?

- E-learning/apps
- Schools, social media
- Sense of curiosity/connection
- Tech world



MESSAGING

”Advancing Technology
to build
a better future”

”Changing the
World”

E-LEARNING / GAMIFICATION:

Why?

~ Inclusive learning techniques

~ Learn anywhere: More people, More places

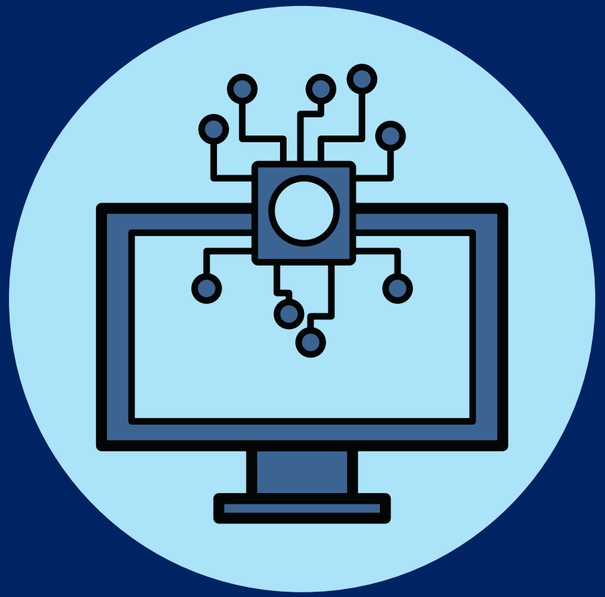
~ Enhanced user experience and understanding of QC

~ Quantitative data, Qualitative feedback

INCLUSIVE LEARNING:
LEARNING STYLES

VISUAL-SPATIAL

Seeing, observing
Dimensions, perspectives
Pictures, Diagrams
Manipulatives
Videos
More time to process information



KINESTHETIC

Tactile learners
Doing/experiencing
Act things out
Manipulate with hands/touch
Movement breaks
Physically sense what they learn

AUDITORY

Reinforcement by sound
Speech, music
Videos with sound
Have voice read text/directions aloud

READING/WRITING

Learn through reading text
Think by writing things out
Read directions before engaging

GAMIFICATION:

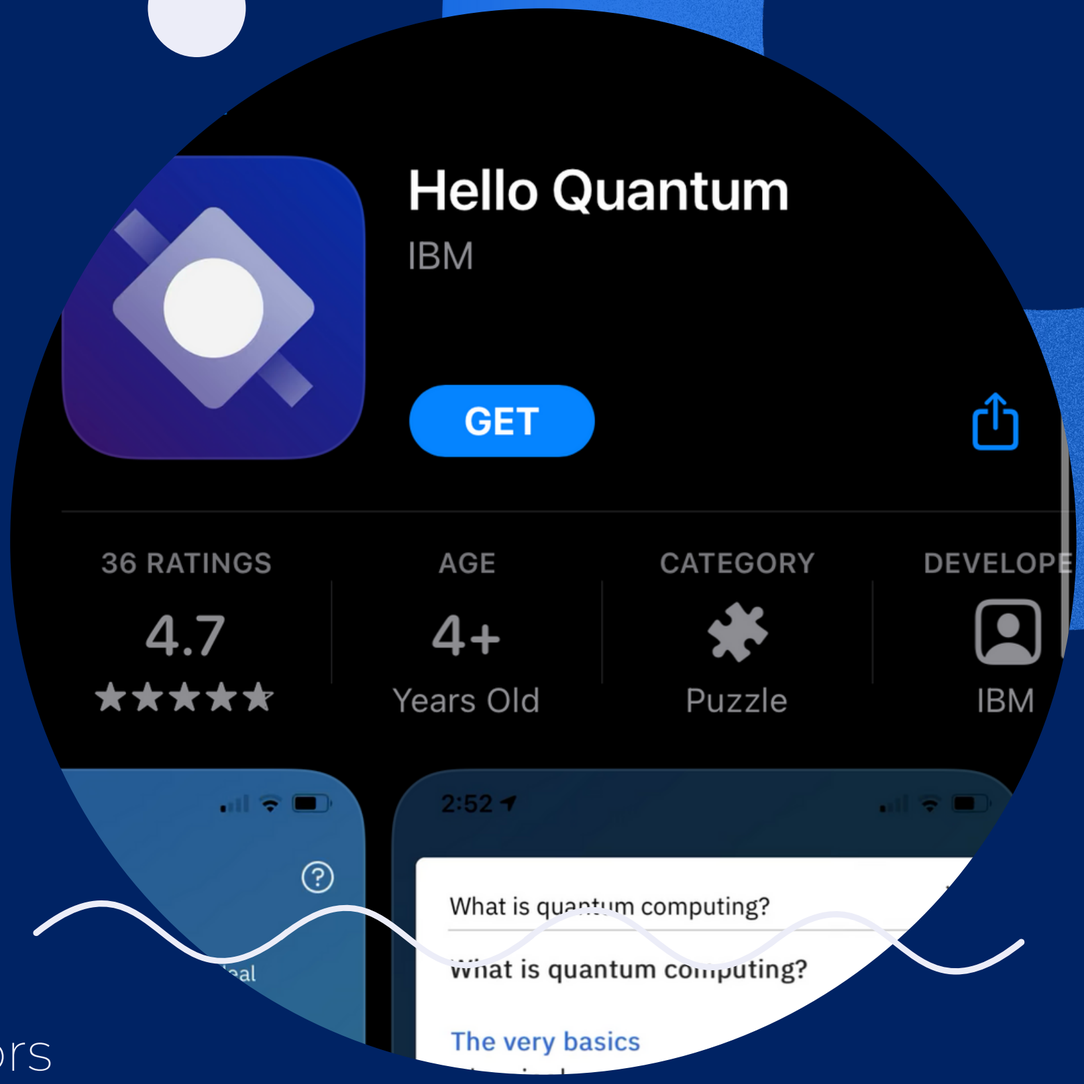
Engage students on a deeper level

Rewards for Achievements

- Leaderboards
- Progress bars
- Points

Actual Games

- Simulate quantum behaviors
- Simulate manipulation of those behaviors



APPLYING E-LEARNING / GAMIFICATION TO QUANTUM COMPUTING

INTERACTIVE, EXPERIENTIAL GAMEPLAY

- Teach aspects of QC that are hard to frame verbally

VALUE PROPOSITION

- Who are you?
- What do you do?
- How will this benefit the user?

*engage * understand * connect*

PSYCHOLOGY

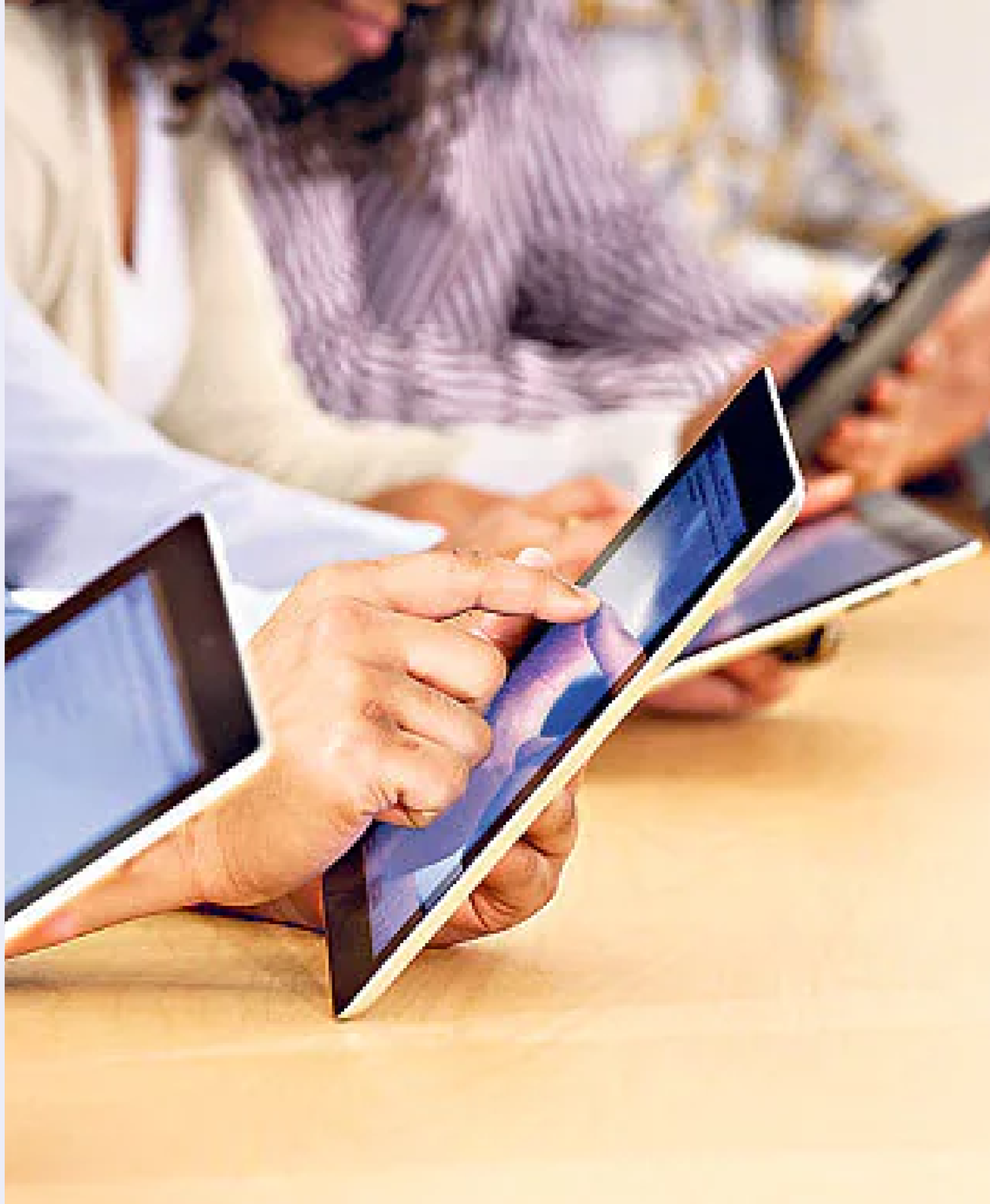
- Affiliation
  - People/experiences that make user happy
    - Part of the future
    - Feedback
    - Relate, empathize, reassure
- Status
  - Deep need to achieve better status
    - Achievement levels
    - Rewards
- Happiness
  - Reward with happy feelings
    - Accomplishments
    - Visuals
    - Ease of usage
    - Accessibility of learning
- Curiosity
  - Always wanting to learn more
    - Comes with satisfaction of first three points

CREATING AN APP

Quantum Computing learning made easy

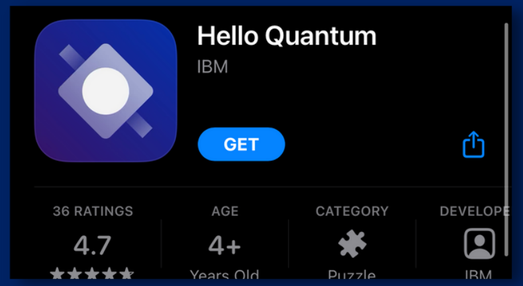
Tool for curriculum based in-school learning (after-school program, elective course, etc.)

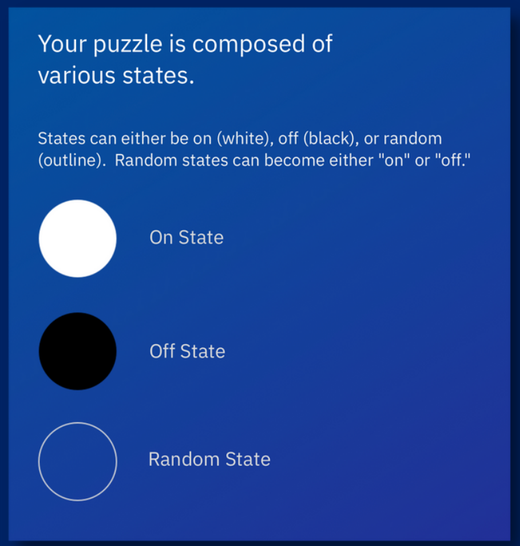
Get students excited to learn more!

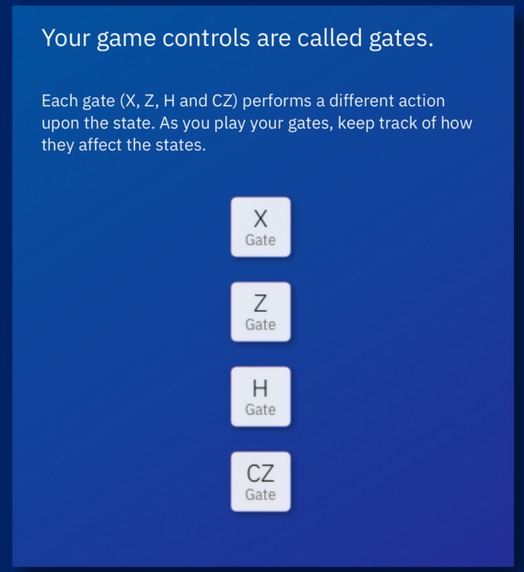


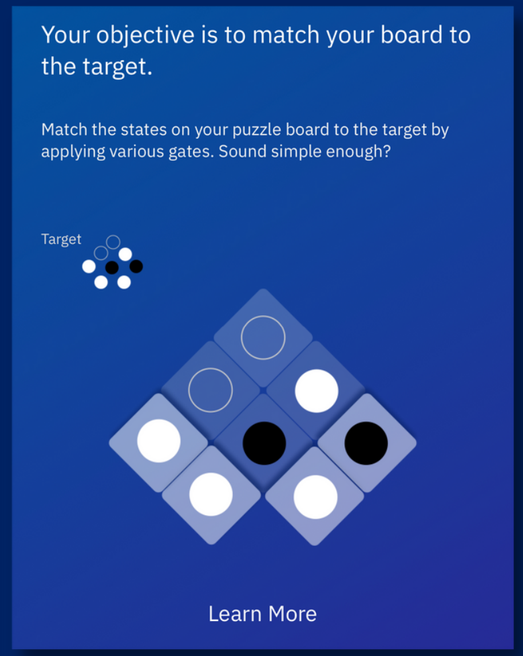
CURRENT QC APPS

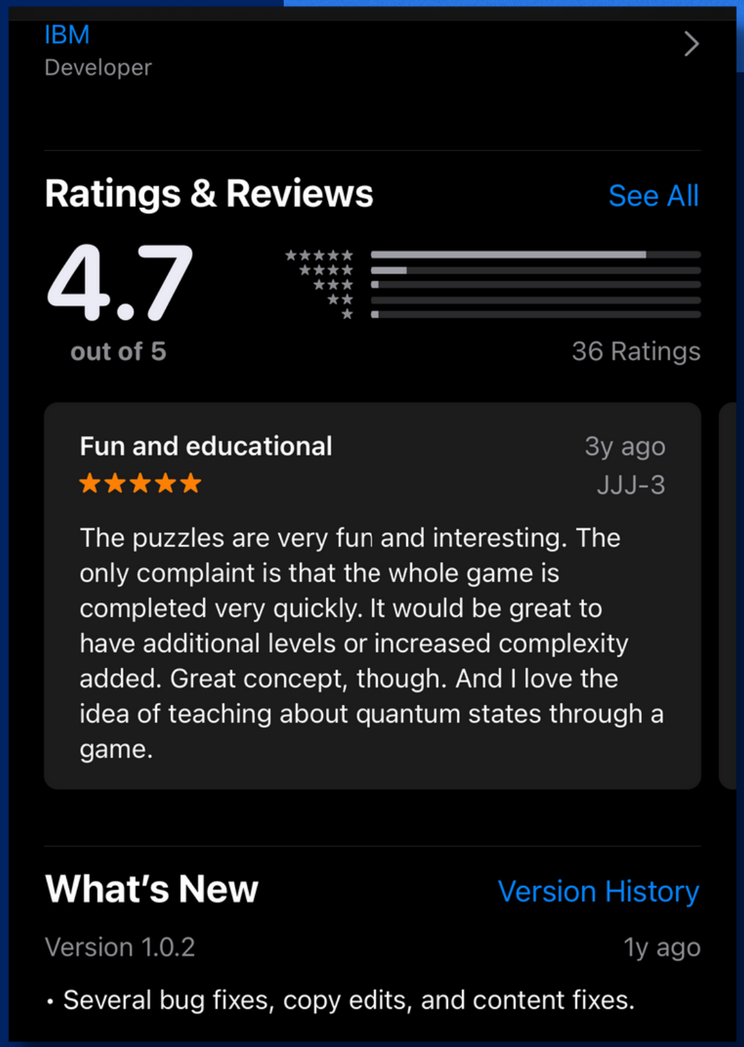
EXAMPLE: "HELLO QUANTUM"

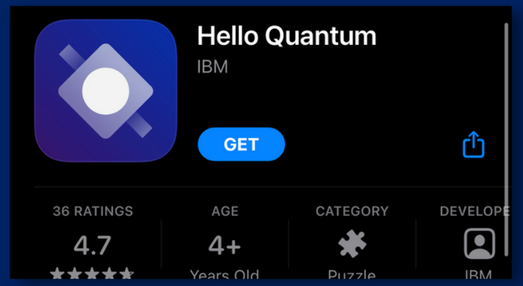












EXAMPLE: "HELLO QUANTUM"

What is quantum computing?

The very basics

Classical computers store and process information using *bits*, objects that take one of two possible values. We usually call them `0` and `1`. In this game we represent these values with different colored circles: black and white.

Quantum computers instead use quantum bits, or *qubits*. We can manipulate them in ways that are impossible to do with bits alone. This can make them harder to keep track of, which is exactly why normal computers struggle to simulate them. But, if we know what we are doing, we can harness them to solve problems that even supercomputers couldn't manage within our lifetime.

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Measuring qubits

Getting the right information from a qubit depends on measuring it in the right way. Despite many different possible ways of measuring qubits, two types of measurements have become our favorites. In this game, we want to show what is going on inside each qubit. We want to show what would happen if we did either of our favorite measurements. So we represent each qubit as a pair of colored circles, just as in the image below.

One kind of measurement checks the bottom circle. Is it black, or is it white? The other kind of measurement checks the top one.

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Introducing IBM Q

Manipulating information using qubits used to be something only scientists could do. Now anyone can have a go, using IBM's *Q Experience*. (For a quick guide in how to set up the IBM Q Experience for the experiments suggested in this article, see here)

https://www.flickr.com/photos/ibm_research_zurich/33072160062/

The *IBM Q Experience* represents quantum programs using a collection of lines, each representing the life of a qubit. The events in the life of a qubit are represented by the symbols that you can drag on to the line. To run an experiment, you just drag on the right

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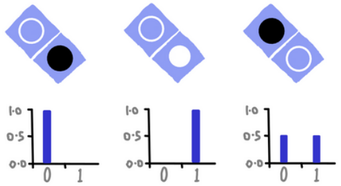
experiment, you just drag on the right things.

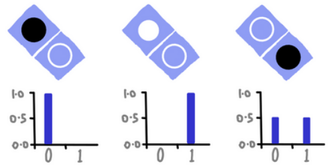
Here's the symbol you need to ask about the qubit's bottom circle.

Since we are checking whether the bottom circle is black or white, the bit values we get as an answer will reflect these possibilities. We get a `0` if the bottom circle is black, and `1` if it is white. If it is neither, the qubit is in a bit of a quandary. It can only answer questions with a `0` or `1`, so it has no other answer to give. In the case of an outline circle, it just randomly decides whether to give us a `0` or a `1` .



To check the top circle, we need to use a couple of the symbols (which are called *gates*, by the way).

This measurement will also result in an answer of `0` or `1` depending on whether the circle is black or white, but now it is the top circle that we are looking at.



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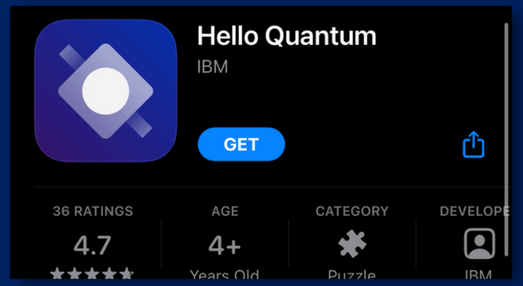


EXAMPLE: "HELLO QUANTUM"

Level 1 Completed

Congratulations on solving your first set of puzzles which helped you explore the grid of circles using the X, Z, and H gates! The grid represents a pair of qubits: the basic building block of quantum computers. Your first task was to reset the qubit states so the white circles turned to black. There's more to explore on Level 2!

At any point if you get curious to dig deeper, you can check out the 'Learn More' sections along the way. This explains how the puzzles represent the basics of quantum computation. Or, you can ignore them and keep playing the puzzles!

Play Level 2

Replay Level 1

View Scorecard

Learn More

Level 2 Completed

Congratulations on stepping up to solve more puzzles on Level 2! If you've checked out the 'Learn More' section, you'll know that the black and white circles correspond to bit values of 0 and 1 that we can get out of the quantum computer. In the previous level, you set the qubits up to output 0. But in this level, you experimented with setting some up that output 1.

Play Level 3

Replay Level 2

View Scorecard

Learn More

Level 3 Completed

Congratulations on solving the third set of puzzles! Level 3 is significantly harder with the introduction of the CZ gate, but the gate opens up more possibilities for you to explore the entire grid. By the end of the game, you created quantum entanglement, which is one of the key principles unique to quantum computing.

Play Level 4

Replay Level 3

View Scorecard

Learn More

Congratulations on Completing all the Puzzles!

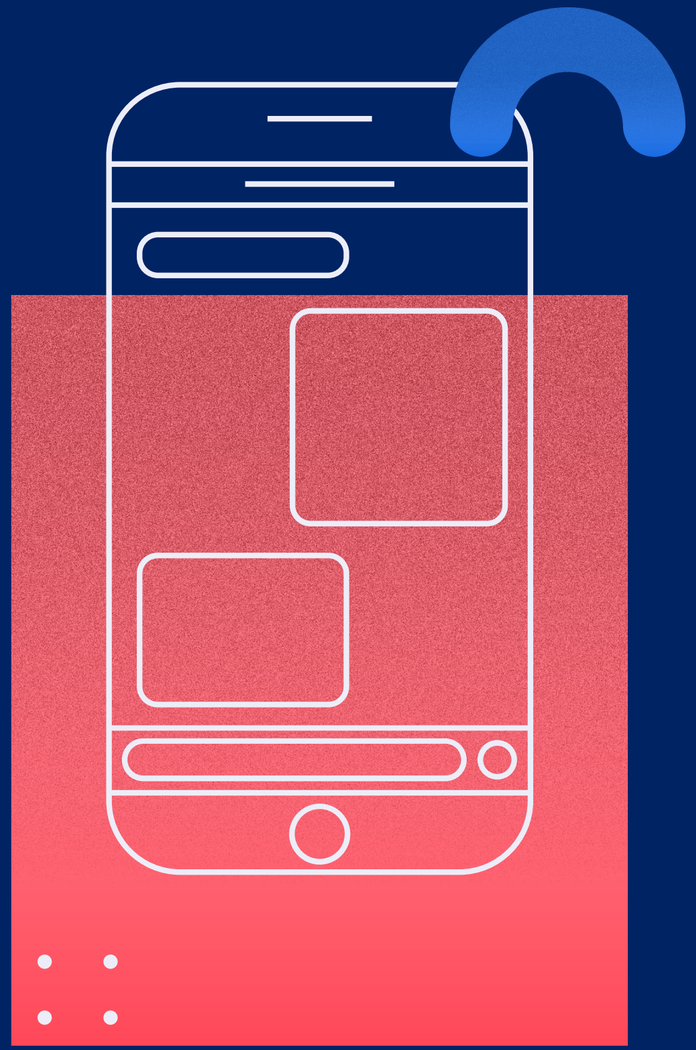
You solved all the puzzles in each of the levels! The puzzles introduced you to the fundamentals of quantum computing. We've got a few recommendations if you want to keep going and get even more acquainted with quantum computing!

Explore the Science!

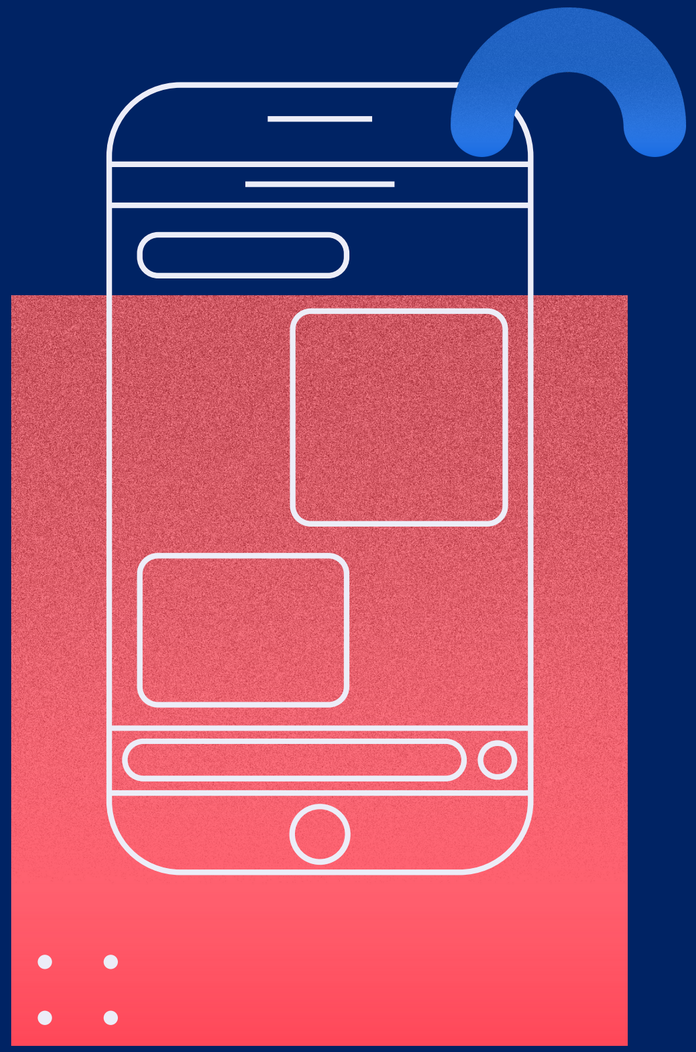
Visit IBM Q Experience

Play Again

LEARN FROM OTHERS



SOCIAL MEDIA - INFLUENCERS



John Martinis

Startup: Silicon Quantum Computing

Academic Papers: 569

Anastasia Marchenkova

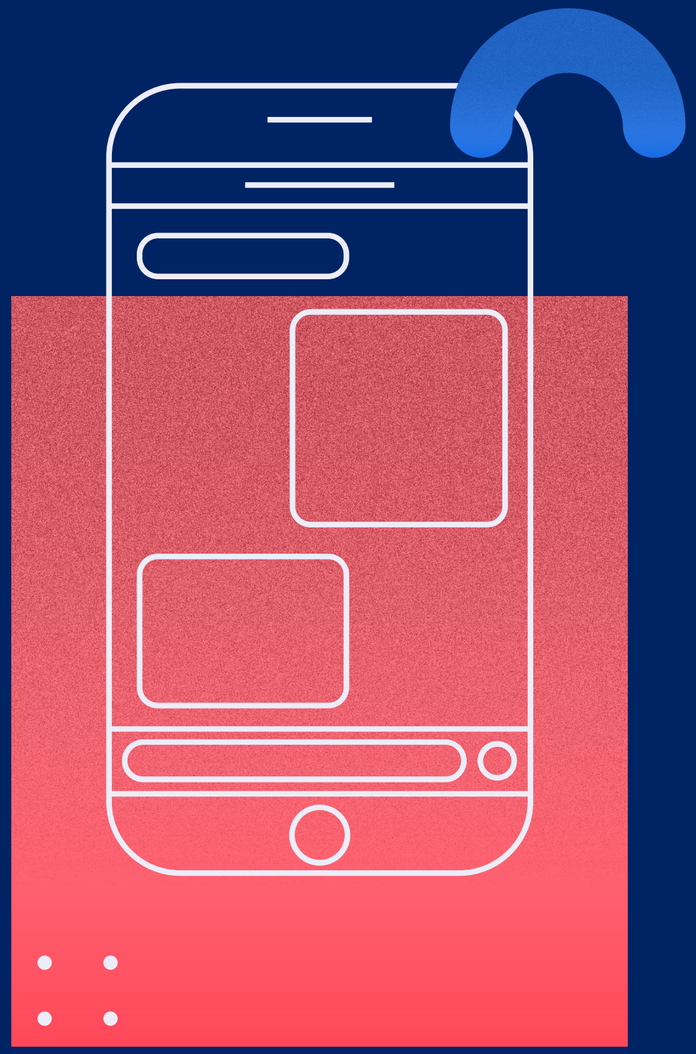
440,000 YouTube views

12.5K followers

Scott Aaronson

349,000 YouTube views

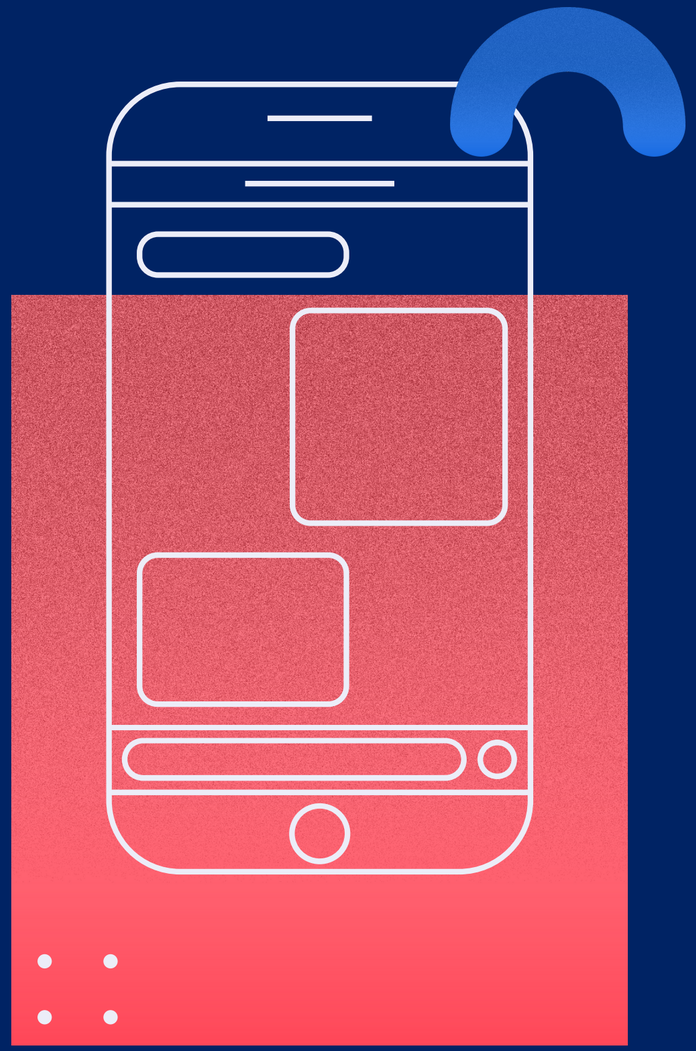
Author: Quantum Computing since Democritus

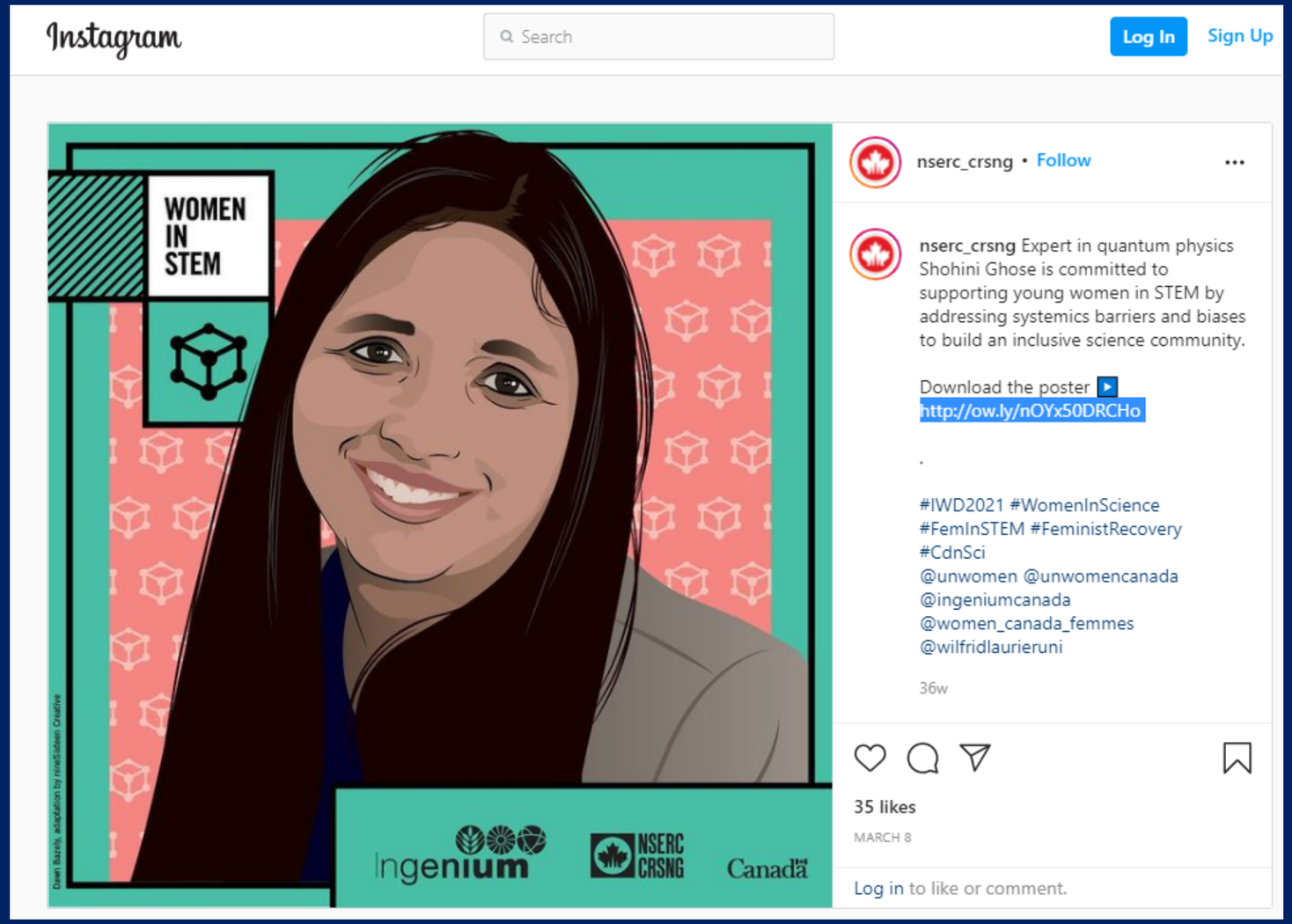


BE WHERE OUR AUDINECE IS

-Influencers
-Access Niche Communities
-Educate while Entertaining
-Don't act like a robot
-Find Insights from Social Media

MARKET TOWARDS WOMEN





THANK YOU!