Lesson 1: Quantum Art!

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Introduction

In this workshop, students will explore the complexity of quantum computing and how it is used in the world around them. They will consider some of the benefits and drawbacks of quantum computers compared to the computers we have today. They will also use the IBM Circuit Composer to build quantum circuits and create fractal art.

First, students will warm-up with a bingo and think about the terms ‘computer’ and ‘quantum’. . Students will then be introduced to two fundamental principles of superposition and entanglement. Students will be asked to consider the benefits of quantum computing and put their new knowledge to use leveraging the complexity of quantum circuits to create unique and beautiful fractals.

Learning objectives

- Describe the difference between difference between the computers we use in everyday life and quantum computers
- Identify basic principles of quantum computing
- Create art with quantum circuits

Key vocabulary

Quantum computer, computer, bit, superposition, entanglement, quantum circuit, fractal art

Preparation

You will need:

- Slides
- Bingo Sheet

- Jupyter Notebook to Create Fractal Art
- Google Slides Doc to Put Art
- Student Survey

Activity 1: What is a quantum computer?

Activity 2: Creating Fractal Art

Subject knowledge:

Activity 1: This activity is designed to give the students the necessary background on computing for them to understand the complexity of quantum computing. You will be required to support students with their understanding of the difference between regular computers and quantum computers. Slides 3-20 will support you in this.

Activity 2: In this activity, you will be required to lead students through a Jupyter notebook to create fractal art. You do not need detailed knowledge of Qiskit or fractals, and all necessary code is already written. Students just need to edit the quantum circuits to their liking.

Assessment opportunities

During Activity 2 and 3, you will be able to assess through question and answer whether or not the students are able to reflect on the principles of quantum computing. Before displaying the definitions of entanglement, superposition, and quantum computing, ask students what they think based on the exercises that they participated in. Use the discussion prompts in the lesson plan to help guide discussion and assess their understanding.

The presentations of art will allow you to assess whether or not the students are able to reflect on the complexity of quantum computers and the implications for our planet.

Outline plan

Please note that the slide deck labels the activities in the top right-hand corner to help you navigate the lesson.

**Timings are rough guides*

Starter activity (Slide 1-3) 10 mins	**Quantum Bingo** As the students enter the classroom, display slide 1. Once students are all seated, introduce the name of the lesson and introduce all volunteers.

	After all volunteers have been introduced, ask students to move around the classroom and complete their bingo sheet.
Introduction (Slides 8-11) 30 mins	**What is quantum computing?**
Activity 1 (Slides 11-18) 20 mins	**Superposition and Entanglement**
Activity 2 (Slides 19-21) 15 mins	**Creating Fractal Art**
Presentation Time (Slides 22–25) 15 mins	