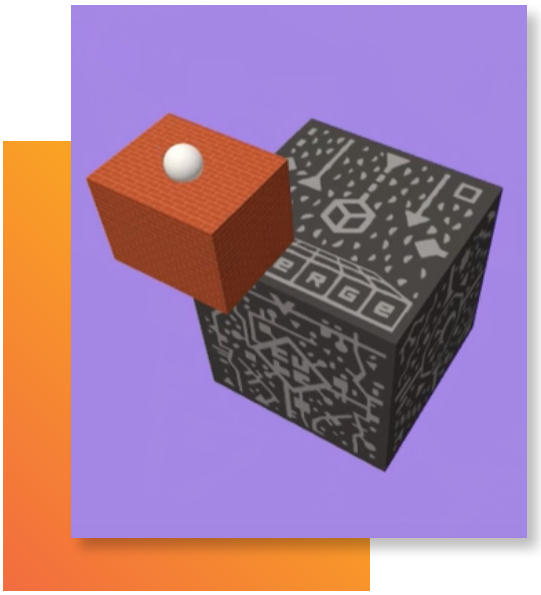
3D Shape Game Design

Grades 4–10

Created by Mike Page & Nate Lott

*Requires accounts with CoSpaces Edu Pro



Difficulty 3 | 2-60 minutes | 1 to 1

Tags: Math, Art, CoSpaces Edu

App/Tech Tools	CoSpaces Edu Pro accounts, MERGE Cube, MERGE Headset (optional), device (phone/tablet)

Materials

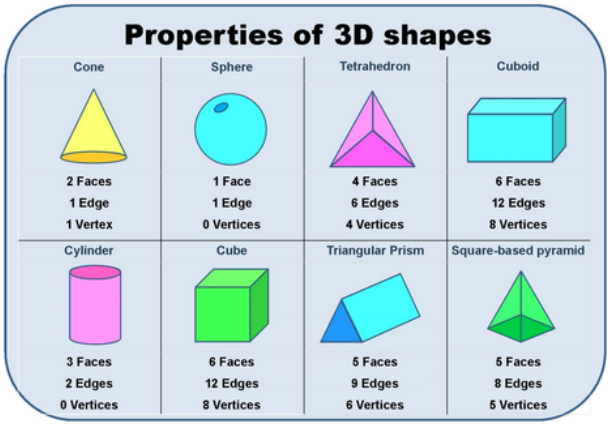
Learning Objectives

- Knowledge and understanding of 3D shapes.
- Manipulation of 3D shapes.
- Basic game design and structure.

Suggested Vocabulary: Cuboid, Cylinder, Tetrahedron, Cone, Pyramid, Ellipsoid (Sphere), Cube, Triangular Prism

Activity

1. Search the shapes above to see what they look like in 3D. You can talk about the attributes of these shapes.



2. Take out the Merge cubes and the tablet/phone and have students go to this url in their web browsers. That link will show them a game created using various geometric shapes that have been coded to move a ball through a course.

   You can check out how the game is played here Video 1

3. Ask the students to try and complete the course. Once they have played the game a number of times ask them to tell you the different shapes they saw in the game. Did it look like the shapes had been flattened or manipulated in a specific way to use them as a platform or launcher in the game? Depending on the level of the class you could talk about the x,y,z axis and how something that perhaps started as a cube could be pulled and stretched on these axis.

4. After you have done some research with them they will be creating their own game using various geometric shapes.

   The starter video for building their game is here Video 2

   This video is an introduction and allow for limitless design options for the students.

5. The construction of this game will require quite a bit of design practice with the Merge cube as the have to constantly test their game to check it playability.

Suggested Questions

- Can you combine 2 shapes together to form something new?
- On the Merge Cube can your partner name all of your shapes?
- Can shapes be stretched to form a ramp or platform?

- How could you form your shapes together to create a recognizable object (house, car)?
- Can you use the shapes to create your name?
- How can you create a shape with 10 sides?
- Can you use your shapes to build a sun and clouds?
- Can you create the Mege cube pattern in your game somewhere?

Extension Idea

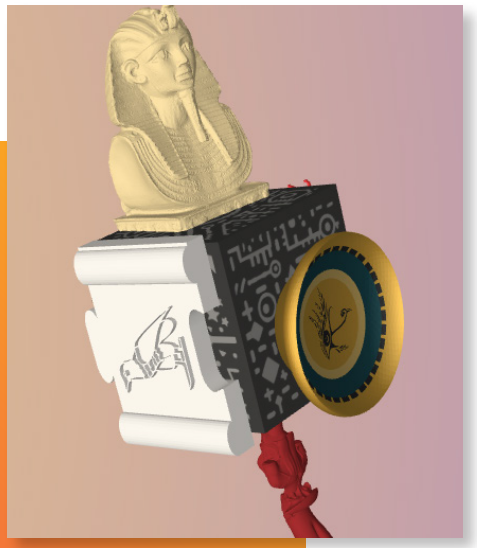
- MERGE Cube 6 sided option, they can perhaps add new levels on the sides of the Cubes.

Ancient Egypt in AR

Grades 4–10

Created by Mike Page & Nate Lott

*Requires accounts with CoSpaces Edu Pro & Tinkercad



Difficulty 2 | 2-60 minutes | 1 to 1

Tags: Social Studies, History, CoSpaces Edu, Tinkercad

App/Tech Tools	CoSpaces Edu Pro accounts, Tinkercad account, MERGE Cube, MERGE Headset (optional), device (phone/tablet)
Materials	

Learning Objectives

- Discovering and demonstrating knowledge of ancient civilizations. Focus on Ancient Egypt.

Suggested Vocabulary: Hieroglyphics, King Tut, Pyramid of Giza, Queens of Egypt, Gold

Activity

*Go here to view finished project idea.

1. Review background information about artifacts and key vocabulary in the classroom prior to this activity.

2. Students pick 6 artifacts from Ancient Egypt and place them on the cube. We suggest starting the lesson with the cube and the 6 objects and using the cube as the engagement hook to engage deeper learning. Important and interesting facts of all 6 sides are described on the cube.

3. **Egyptian Artifacts Resources:**

Glossary of terms - Click here King Tut - Click here Worksheets - Click here

3D Models to get inspiration from - Source 1 and Source 2

Suggested Questions

- What are some of the inventions that were born in the times of ancient Egypt?
- What are the levels of government in ancient Egypt and how do they compare with today's system?
- What are some inventions you think we need to solve problems in our lives?
- What time frame was Ancient Egypt thriving?

Extension Idea

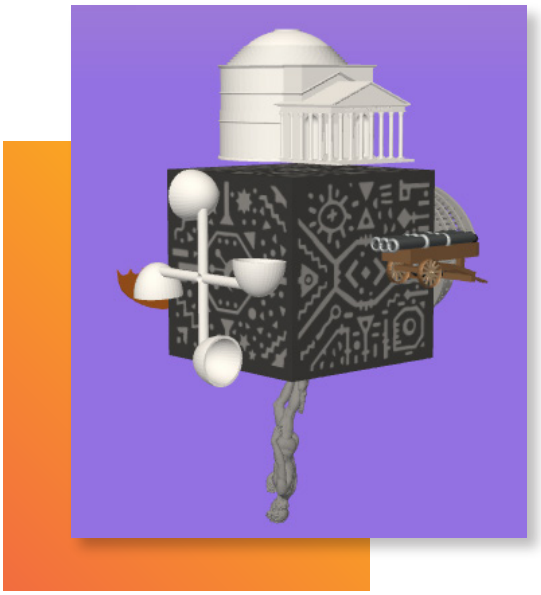
- Students can create their own objects in Tinkercad or download stl's or obj's from Tinkercad or Sketchfab.

VR Experiences worth checking out

Ancient Rome in AR

Grades 4–10

Created by Mike Page & Nate Lott *Requires accounts with CoSpaces Edu Pro & Tinkercad



Difficulty 2 | 2-60 minutes | 1 to 1

Tags: Social Studies, History, CoSpaces Edu, Tinkercad

App/Tech Tools	CoSpaces Edu Pro accounts, Tinkercad account, MERGE Cube, MERGE Headset (optional), device (phone/tablet)
Materials	

Learning Objectives

- Discovering and demonstrating knowledge of ancient civilizations. Focus on Ancient Rome.

Suggested Vocabulary: Anemometer, Flying Machine, Leonardo da Vinci, Statue of David, Coliseum, Triple Barrel Cannon, Pantheon

Activity

*Go here to view finished project idea.

1. Use the following Links for student-led research.

   Link 1 Link 2 Link 3

2. View Rome NOW with a VR headset - Click here

Suggested Questions

- What are some of Leonardo da Vinci's inventions that we still use today?
- What are some of Leonardo da Vinci's inventions have changed from then and what are they now?
- What are some inventions you think we need to solve problems in our lives?
- What time frame was Ancient Rome thriving?
- What were the sports and activities that happened at the Coliseum? Why did it start? Why did it end? - Click here

Extension Idea

- Students can create their own objects in Tinkercad or download stl's or obj's from Tinkercad or Sketchfab.

Energy Efficient at Home

Grades 4–10

Created by Mike Page & Nate Lott

*Requires accounts with CoSpaces Edu Pro & Tinkercad

Difficulty 3 | 2-60 minutes | 1 to 1

Tags: Science, CoSpaces Edu, Tinkercad

App/Tech Tools CoSpaces Edu Pro accounts, Tinkercad Education account, MERGE Cube, MERGE Headset (optional), device (phone/tablet)

Materials

Learning Objectives

- Demonstrate understanding of energy saving devices at home, control and manipulate objects on a 3D plane.

Suggested Vocabulary: Carbon footprint, Clean energy, Efficient, Grid, Kilowatt, Radiation

Activity

*Go here to view finished project idea.

1. Draw a house on the board with 6 different rooms. Ex. bedroom, kitchen, bathroom, etc. Ask the students 3 ways they think they could save energy in these 6 rooms. Students can brainstorm ideas in small groups and present their ideas in a class discussion. Perhaps each group could focus on one room in the discussion. Then the teacher can bring up the image below and talk about each room, there are hundreds of sites on the internet that describe how to be energy efficient.

*See next page for example.

2. Tell students they will be placing 6 items on their Merge cube so they can code it to talk about how to be energy efficient at home.

3. Students will be given a Merge Cube and a tablet.

4. Students can then view the two videos here and here on how to place objects from Google Poly in CoSpaces on the Cube.

5. Students can pose questions about their 3D objects on their Merge Cube that other students could write the answers to as they view their creation.

Suggested Questions

- Do you turn your computer off?
- Do you wash clothes in hot water?
- Do you drive short distances?
- Are you buying incandescent bulbs because they're "cheaper"?
- Is your sink or toilet leaking?
- Leaving your appliances plugged in when you're not using them?
- Are your air filters dirty?
- Are you throwing recyclables into the trash?
- Drafty windows?
- Buying bottled water?

Extension Idea

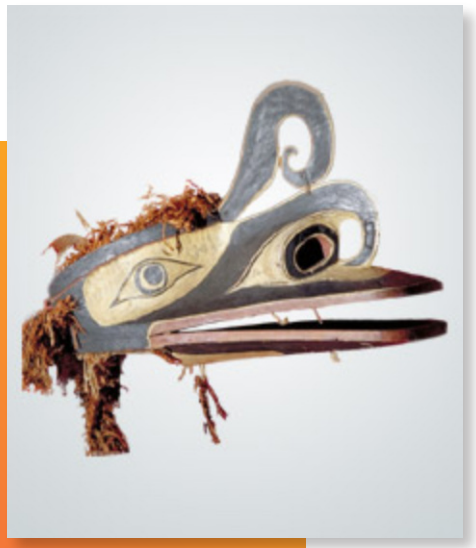
- Students can create their own objects to be more energy efficient in Tinkercad. From a creation of a simple lamp to solar panels, they can construct many objects to place onto the MERGE Cube to view in AR.

VR Experiences worth checking out

First Nations Mask

Grades 4–7

Created by Mike Page & Nate Lott *Requires accounts with CoSpaces Edu Pro and Sketchfab



Difficulty 3 | 2-45 minutes | small group

Tags: Social Studies, CoSpaces Edu, Sketchfab

App/Tech Tools	CoSpaces Edu Pro accounts, Sketchfab account, MERGE Cube, MERGE Headset (optional), device (phone/tablet)
Materials	

Learning Objective

Understand how to bring complex 3D models into a virtual environment. Coding interactive components into that environment for presentation purposes. Viewing, testing and adapting that environment in Augmented Reality.

Activity

1. In this lesson students will be downloading 2 First Nations traditional masks, placing them in CoSpaces, coding them to move and adding sound effects. The lesson is based around social studies and gaining a better understanding of two masks in traditional culture but once students know how to take models off of Sketchfab the lesson can be modified to fit any subject.

2. Start by reading the Huxwhukw and Galukwampt masks history here this will give your students a well rounded understanding of the importance the masks hold in First Nations dance ceremonies.

3. Next click here to take your students to the file they will need to download.

4. Watch the videos below which will explain how to place the masks into CoSpaces and then to view them on your MERGE Cube.

   Placing your files in CoSpaces. Video 1 Coding your files to move. Video 2

Extension Ideas

- It is possible bring sounds into your scene, start by taking your students to the site here.
- Placing that sound into your space. Video 3
- If you have a microphone on your computer you could add your own narration to the scene.

Suggested Questions

- The account that is mentioned in the video has hundreds of interesting artifacts, could you search through more 3D files and bring them into your scene?
- The scale of your objects can be made quite large, how big can you make the object on your Merge Cube?
- Do you think you could add some buttons to rotate the object in a specific direction?
- Could you find a gif of a First Nations traditional dance and add it to the scene?

VR Experiences worth checking out

Interactive Maps

Grades 4–8

Created by Mike Page & Nate Lott

*Requires accounts with CoSpaces Edu Pro and Tinkercad

Difficulty 3 | 3-45 minutes | small group

Tags: Social Studies, CoSpaces Edu, Tinkercad, Maps, Coding

App/Tech Tools	CoSpaces Edu Pro accounts, Tinkercad account, MERGE Cube, MERGE Headset (optional), device (phone/tablet)
Materials	

Learning Objectives

- Create a 3D model of Canada or the United States then code it with interactive elements for presentation in AR.
- Export and modify a 3D model in Tinkercad to CoSpaces.
- Use math to create a scale representation of a statistic.
- Use Social Studies inquiry processes and skills to: ask questions; gather, interpret, and analyze ideas; and communicate findings and decisions.

Activity

1. This lesson allows students to take data/information and create interactive Augmented Reality presentations or visuals. View an example here. Students can take population statistics, capitals, imports/exports or state/provincial natural resources and create a 3D interactive visual representation.

2. Determine what information you want students to display on their 3D model. Start students with the example from the above link, displaying 3D models of the provinces of Canada focusing on the province of BC, and then displaying the provincial flag and an interesting fact (Source: Daily Hive) about that province.

3. For creating a US model, use google docs for information using this link: 3D models here. For Canada, use this link for information: 3D models here and have students save them to their computer's desktop.

4. When they have created their models, have students view the YouTube videos below which will guide them step-by-step to get their models into CoSpaces. They will then code their 3D models.

   Loading your models: (Creating an Interactive Map Part 1) Video 1

   Coding your Scene (Part 1): (Creating an Interactive Map Part 2) Video 2

   Coding your Scene (Part 2): (Creating an Interactive Map Part 3) Video 3

5. Once scene is complete, students can use their merge cubes to display the interactive map through CoSpaces.

Extension Ideas

- Students can manipulating a 3D model to display a demographic in Tinkercad. They will choose a demographic to display in a 3D bar graph format, for this example we chose "Distribution of recent immigrants to Canada" here (Canada Immigration Newsletter).

- Have students log into their TInkercad accounts.

- "Copy and Tinker" either Canada here or USA here (From Tinkercad).

- Have students review this video (Creating an Interactive Map Part 4) Video 4 to create a 3D map and bring it into CoSpaces.

- The interaction that can be coded into the map is limitless. If you would like your students to learn more fundamental coding in CoSpaces go through the "CoSpaces" lessons here.

Suggested Questions

- Where did certain subgroups of migrants or immigrants tend to settle? What push-pull factors may have contributed to this?
- How do increases in human population and per-capita consumption of natural resources impact Earth's systems?
- How does immigration shape a nation's identity?
- How does a nation adjust to changing demographics?
- Why do some places have greater access to healthy foods than others?
- How did this process deepen your understanding and appreciation for demographics in general? Why is it important for students to study demographics?

VR Experiences worth checking out

It Takes a Village

Grades 3–8

Created by Jeannie Timken

Difficulty 2 | 30–45 minutes | 1 to 1/pairs

Tags: Makerspace, Creativity, Geography

App/Tech Tools	D!G app, MERGE Cube, MERGE Headset (optional), device (phone/tablet), Google Slides
Materials	Paper/pencil or Google Slides, Padlet

Learning Objective

- Construct a model of the home that you have designed to become part of a sustainable community.

Activity (Day 1) – if separating between two days

1. Review the Sustainable Development Goals.
2. Review the five themes of geography and how each factors into sustainable development.
3. Review geographical features and how each can factor into sustainable development.
4. Make a copy of and complete the Hyperdoc to plan your model – click here.

Activity (Day 2) – if separating between two days

5. Using the information on the completed Hyperdoc, construct a model that includes a sustainable dwelling and surrounding geographical features.

Suggested Questions

- What do we need in order to create a community that is sustainable?
- How can we make sure that we care for our world so that resources last?

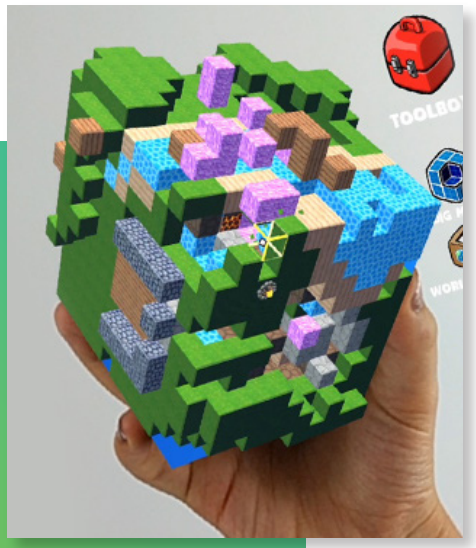
Extension Idea

- Write a real estate listing for your dwelling and share on a Padlet.

Landforms In Your Hand!

Grades 4–6

Created by Christine Danhoff



Difficulty 1 | 60+ minutes | small group

Tags: Earth Science, Landforms

App/Tech Tools	D!G app, MERGE Cube, MERGE Headset (optional), device (phone/tablet)
Materials	Internet Access, Flipgrid

Learning Objectives

- Students will use the Dig App and Merge Cube to create an augmented reality experience that demonstrates a specific landform.
- Students will explain and share the different features of the landform they created.

Activity

1. Review Big Question- "What are some of the different types of landforms and what are their characteristics?" Have you been to or seen any of these types of landforms before? Show examples of different types of landforms and let students explore using Google Earth.
2. Students will research and explore their chosen landform, take notes, etc.
3. Share and example of a student-created landform in Dig and their video explanation.

4. Students will build and create their landform using the tools in the Dig App. If you want them to create multiple landforms, each side of the cube could be a different landform.

5. Students will use the video camera function in Dig to show and demonstrate the landform. Students will open their video and add voiceover for their explanation of what they created using tools such as Screencastify, WeVideo, iMovie, etc.

6. Videos will then be uploaded to the Flipgrid Topic to share with classmates, community, parents, etc. and prompt discussion.

Suggested Questions

- What are some of the different types of landforms and what are their characteristics?
- Are floodplains good for farming?
- What is the deadliest volcano eruption?
- What do oxbow lakes often become?
- Why are mountains formed?
- How were rift valleys formed?
- What is the biggest moraine?
- How are water arches formed?
- When was the Khait landslide?

Extension Ideas

- Students will answer questions using Flipgrid (See example of a topic) and be able to respond to other classmates, share with the community and parents.

- Students could also post their videos to a class website, create QR links of each video and post around the classroom as a type of "museum" for other students to explore.

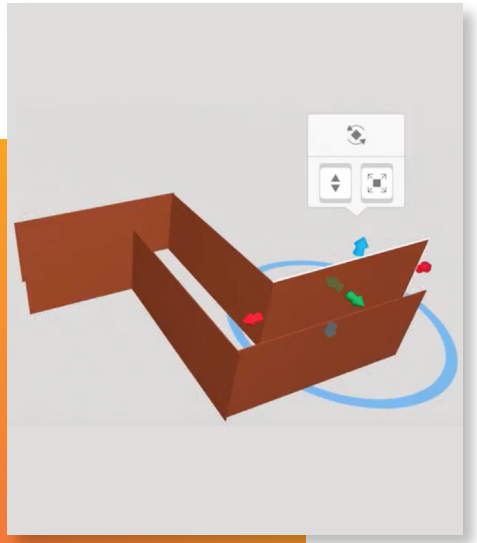
VR Experiences worth checking out

Maze & Robot Creator

Grades 4-9

Created by Mike Page & Nate Lott

*Requires accounts with CoSpaces Edu Pro and Tinkercad



Difficulty 3 | 4-45 minutes | 1 to 1

Tags: Math, Measurement, X/Y axis, CoSpaces Edu, Tinkercad

App/Tech Tools	CoSpaces Edu Pro accounts, Tinkercad account, MERGE Cube, MERGE Headset (optional), device (phone/tablet)
Materials	

Learning Objectives

- Use 3D design programs to create, manipulate and measure 3D objects.
- Code a 3D design in a virtual space to move in specified directions using an x,y,z axis.
- Identify and use appropriate tools, technologies, and materials for production.
- Learn visual programing languages.
- Create a 3D model in the CAD program Tinkercad.

Activity

1. In this lesson, students will be building their robot in the 3D design program using their Tinkercad account. This video provides a step-by-step tutorial for setting up and managing student accounts Tinkercad. (Tinkercad Sign up) For students who are using Tinkercad for the first time, they can learn to build their robot by following the videos here. (Building a Robot Part 1-4)

2. For students in grade 8-9 or who are more comfortable with Tinkercad, they can access a more advanced robot lesson where they build the robot through existing shapes by clicking "Copy and Tinker" here (Robot Lesson)

3. Once students' robots are complete, they will bring them into CoSpaces and code them to move through the maze.

Tinkercad: (Maze Part 5) Video 1

CoSpaces: (Maze Part 6) Video 2

CoSpaces: (Maze Part 7) Video 3

MERGE Cube: (Maze Part 8) Video 4

Suggested Questions

- What happens if we start to create a maze that does not have 90 degree right angles?
- Could we code our robot to speak each time it turns?
- Could we have our robot change colors each time it moves?
- Do you think there is a way to automate the robot's movements?
- Can you use the "hole" function in Tinkercad to bring in the robots head and body separately? Then code the head to turn?
- Can you could get a partner's robot into your space?

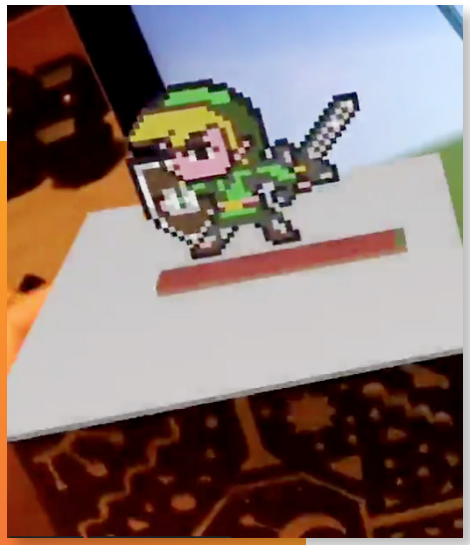
VR Experiences worth checking out

Minecraft Pixel Art

Grades 4–7

Created by Mike Page & Nate Lott

*Requires accounts with CoSpaces Edu Pro and Minecraft Education



Difficulty 3 | 3-45 minutes | 1 to 1

Tags: Minecraft, Art, Coding, CoSpaces Edu

App/Tech Tools	CoSpaces Edu Pro accounts, Minecraft Education account, MERGE Cube, MERGE Headset (optional), device (phone/tablet)
Materials	

Learning Objectives

- Create a piece of art through 3-D digital tools.
- Processes, materials, movements, technologies, tools, strategies, and techniques to support creative works.
- Develop and refine ideas, processes, and technical skills in a variety of art forms to improve the quality of artistic creations.
- Processes that transform ideas and experiences into visual images.

Activity

1. In this lesson students will create pixel art in the Multi User Virtual Environment (M.U.V.E.) Minecraft. Then you will transfer that art into AR with CoSpaces and the Merge Cube.

2. Students will begin by exploring examples of pixel art here (Google Search) and choose one that they like.

3. Students will then use grid paper, size dependent on project, and colored pencils to create their design. Make sure students label and number the x and y axis to make it easier to track their design.

4. Students will then look at some examples of pixel art in Minecraft. Use the videos below:

   YouTube Pixel Art Part 1 Video 1 YouTube Pixel Art Part 2 Video 2

5. Once students are ready, they can begin to create their art in Minecraft.

6. Once completed they will need to bring their art from Minecraft and into CoSpaces. There are two different methods for doing this depending on what version of Minecraft students are using.

   Pixel Art Part 3 Video 3 Pixel Art Part 4 Video 4

7. Students will then drag the model into CoSpaces and it will display in their scene, which could then be placed on their Merge Cube. Click here to see what it looks like.

Suggested Questions

- Currently your models are 2D. How can you add depth to your models on a 3rd axis?
- Could you take multiple models off of Minecraft and using the coding you have learned give the person viewing your art the ability to cycle through multiple models?
- Can you add text and sound into your scene to be able to talk about how you created your art and why you chose this model?
- Can you pull in terrain around your model to make it look like it is sitting in a mountainous or water scene?

Extension Idea

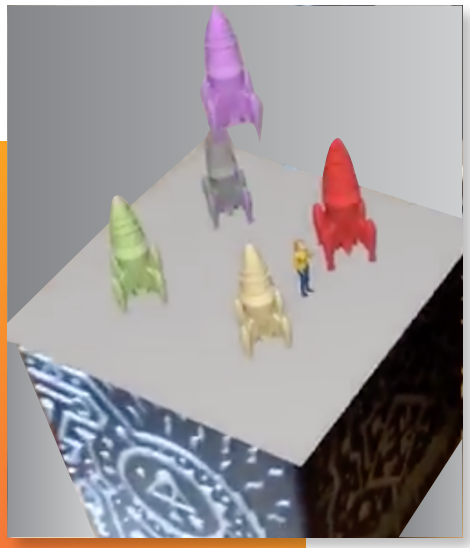
- Students can add gifs to their scene to add visual information with the help of this video Video 5

Physics - Rocket

Grades 5-9

Created by Mike Page & Nate Lott

*Requires accounts with CoSpaces Edu Pro and Tinkercad



Difficulty 3 | 4-45 minutes | small group

Tags: Physics, Spacing, Coding, CoSpaces, Tinkercad

App/Tech Tools	CoSpaces Edu Pro accounts, Tinkercad account, MERGE Cube, MERGE Headset (optional), device (phone/tablet)
Materials	

Learning Objectives

- Students will learn about 3D design in Tinkercad and computational thinking in CoSpaces.
- Students will use a coding function called lists.
- Students will explore a rocket's necessary shape and components.

Activity

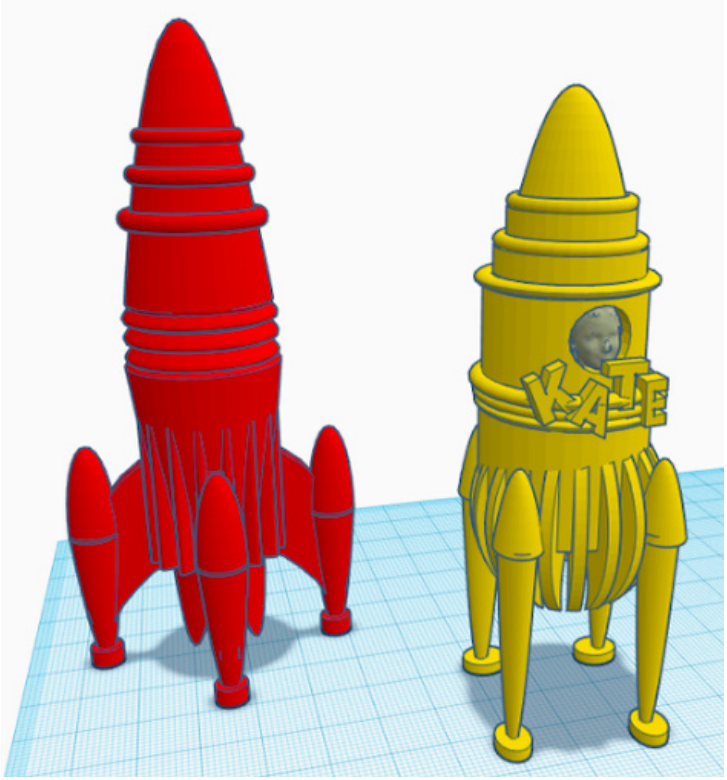
1. Have students open their Tinkercad account in another tab.
2. Have them come back here (Mars Rocket) - Click duplicate and tinker.
3. Video 1 Learn how to use work planes in tinkercad. This video works on one skill, however students should pay close attention if they want to learn a more effective way to work with a work plane. Work planes allows students to work on different levels on their custom rocket with ease.

4. Video 2 Another small video and skill yet crucial part to tinkercad. If students have mastered the work plane in video one, video 2 scaffolds from that video. Students will learn to align objects and create rings onto their spaceship.

5. Video 3 Students will continue to build on previous skills. Congratulate students on finishing the first two videos. Have them go back to the original work plane and learn to duplicate and flip items to work on the bottom half of their rocket.

6. Video 4 Students will complete this part of the lesson by adding the legs to the rocket using the skills they have been working on. We suggest pausing the video when a new skill is shown then complete that skill before returning to the video. Students will now go on to CoSpaces.

An example of a custom rocket:



7. Video 5 Students will learn how to export their rocket as an STL and drag that file into CoSpaces. Once their file is in CoSpaces, they will learn how to duplicate it and place their custom rockets into the CoSpaces grid. Almost time for take off.

8. Video 6 Students will now begin coding using CoBlocks in CoSpaces. Students will learn about the X,Y and Z axis and how to shoot the rockets into the virtual sky.

9. Video 7 Students will be using the CoSpaces app and the Merge Cube or surface tracking to view their rocket project in 3D.

10. Students can now add other list elements to their scene, such as interactive features.

Example Space on CoSpaces Edu - Click here Example on Twitter - Click here

Extension Idea

- Have students continue creating their model by expanding with the unit - Space to learn the different layers of the Earth's atmosphere. (NASA'S Space Place:Stratosphere)

Suggested Questions

- What is the best shape for a rocket to have a successful launch and travel in space?
- What components does a rocket need and how will you recreate them?
- Through time, how have rockets changed to be more successful?
- What design flaws have made some rockets unsuccessful in their mission ?
- Design your perfect rocket and explain why you think it will succeed ?
- What are the layers of the earth's atmospheres and how are they similar and different?

Planet "Pop"ularity

Grades 3–5

Created by Megan Tucker

Difficulty 1 | 45-90 minutes | small group

Tags: Earth Science, Physical Science, Rocketry, Solar System, Planets, Data Collection, Astronomer, Aerospace Engineer

App/Tech Tools	Galactic Explorer app, MERGE Cube, MERGE Headset (optional), device (phone/tablet)
Materials	Poster Paper (1 per team), Writing Utensils (pencils, markers, crayons), Straw Rocket Directions and Materials (Template - click here, scissors, tape, straw) (1 per person)

Learning Objectives

- Students will collaborate to use the Merge Cube and Galactic Explorer App effectively.
- Students will create notes to become an expert on one of the eight planets in our Solar System.
- Students will orally present information on one of the planets in our Solar System as a team.
- Students will engineer and launch a NASA Straw Rocket using given directions and materials.
- Students will collect data based on the landing placement of the NASA Straw Rocket.
- Students will analyze data to determine planet popularity from rocket landings.

Activity (Day 1) - if separating between two days

1. Prior to conducting the activity, divide the class into teams, preferably forming 8 different teams and arrange the students so that they are sitting with their assigned team.

2. Ask the students if they can name all 8 planets in our Solar System. (Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune)

3. Introduce the career of Astronomer (someone who studies our universe and Solar System) to the students and tell them that they will be exploring this job today as each team is going to become an expert on one of the planets using Merge Technology and then present their findings to the class.

4. Assign each team one of the planets (either by intentional assignment or choice) and explain that each team will research the assigned planet using the Galactic Explorer App and a Merge Cube. Through research, the team will complete a poster with a sketch of the planet and at least 2 interesting facts about the planet. The teams will have to work together to have one team member hold the Merge Cube, one team member hold the iPad/Tablet, and one team member take notes to use to create the poster.

5. Allow the teams time to explore the Merge Cube/App, take notes and create a poster with a sketch of the planet and 3 fun facts. Make sure to remind the students to switch roles and take turns holding the Merge Cube, iPad/Tablet and taking notes.

6. Pass out the poster paper and instruct the students to turn their notes into a Planetary Poster for their assigned plant.

7. When the posters have been completed, have each group present their planetary research (Planetary Poster) to the class as a team with the option of having students take notes on the presentations so that each individual has all the information for each planet. (Jigsaw method)

Activity (Day 2) – if separating between two days

1. Ask students what they know about "rocket science".

2. Review the career of Astronomer and introduce the career of Aerospace Engineer (someone who designs aircraft and/or spacecraft)

3. Tell the students that today they will become Aerospace Engineers and engineer a straw rocket that will travel to the planets that were researched.

4. Follow the directions here and have each student individually build a straw rocket.

5. Spread out the Planetary Posters on the floor and explain to the students that they will be launching their rockets to the different planets.

6. Have the students create a data table that lists the names of all 8 planets and has a column to make tally marks each time their straw rocket lands near each of the planets.

7. Check data tables to make sure they are ready for data collection and then have the students line up by planetary team to launch the rockets towards the Planetary Posters on the floor.

8. Go over safety rules for the launch, including all launch in one direction.

9. Have the students launch on your signal and freeze after each launch to observe the rocket landing and record the data of which planet the rocket landed on or in the closest proximity.

10. Decide on a predetermined number of times for each student to launch and record data Repeat as needed in order to rotate multiple times through each team.

11. Discuss the data at the end of class and see which planet had the most landing popularity as evidenced by the tally marks.

12. Help the students evaluate the data collected and form conclusions based on data trends, including talking about why a planet may have had the highest tally marks (placement, aim, etc.)

13. Review the careers of astronomer and aerospace engineer and wrap up the lesson.

Extension Ideas

- Students create graphs to display the data collected.
- Students take notes on each planet as they land on the planet, trying to collect all 8.
- Students recreate the planet in CoSpaces App for Merge Cube.
- Students recreate the planet in DIG! App for Merge Cube.
- Students recreate the planet using materials from a MakerSpace.

Planets in our Solar System

Grades 4–7

Created by Mike Page & Nate Lott

*Requires accounts with CoSpaces Edu Pro and Tinkercad

Difficulty 2 | 3-45 minutes | small group

Tags: Solar system, Diameter, Circumference, CoSpaces

App/Tech Tools	CoSpaces Edu Pro accounts, Tinkercad account, MERGE Cube, MERGE Headset (optional), device (phone/tablet)

Materials

Learning Objectives

- To recognize the major characteristics of the planets.
- Compare, contrast and personalize your learning in CoSpaces.
- Understanding diameter, circumference, degrees and aspects in block based coding to create the planet rotations yourself.
- Equip students with skills needed to navigate independently in CoSpaces and create a 3D, interactive model of our Solar System.

Activity

1. Familiarize students with CoSpaces. Using these videos, introduce students to this platform and provide the first steps in developing skills in the 3D plane here.

(Video 1) Navigating CoSpaces and Basic Plane Functions. (Video 2) Exploring coordinate grid and coding to create a scene. (Video 3) Using code to create movement in a scene

2. Once students display understanding of these skills, expand onto other aspects of project including: APK of planet size, location, fun facts, research and other information to get students familiar with our galaxy.

3. Assess students background knowledge of AR. What do they connect with? Pokemon Go? Snapchat?

4. Students will be working to develop skills in 3D design .obj files, coding and AR in one lesson. They will then be able to begin their adventure into learning about our planets, their location and how they rotate.

5. Assess whether students can identify the planets and/or name them in order. Lessons on our Solar System can be ongoing outside of this particular activity. Students can brainstorm facts about each planet as a introduction to the topic. Share these facts where all students can see them. Have students add them to their CoSpaces. Once CoSpaces lesson is constructed, students can view and discuss their creations on the Merge Cube.

6. Launch after all students show fluency in CoSpaces. Have Students download .obj files save them into CoSpaces. They will arrange the planets in the correct order, size and location. Students are not expected to do any coding at this point. Upon completion, students will watch videos, using headphones preferably, demonstrating how to complete the coding aspect.

7. Students will now begin to add the code to their projects, include important facts, and share learning with their classmates. Students will use their VR Headset or a tablet while accessing the CoSPaces App and their Merge Cube to view their creation.

Extension Ideas

- Students can work in collaborative pairs or teams to explore and share each other's code and any facts they have researched about the solar system.

- Have students create a CoSpaces information lesson that can be displayed on the Merge Cube. Students can share spaces and see what other facts students have researched.

- Students can create planets on tinkercad to the correct size and scale and adding physical features such as colors, craters, rivers and rings (see chart below).

Element	Actual Diameter (km)	Approximate Scaled Diameter
Sun	1, 392, 000	1, 392 mm (54.8 in)
Mercury	4, 879	5 mm
Venus	12, 104	12 mm
Earth	12, 756	13 mm
Moon	3, 475	3.5 mm
Mars	6, 794	7 mm
Jupiter	142, 980	143 mm
Saturn	120, 540	125 mm
Uranus	51, 120	51 mm
Neptune	49, 530	50 mm
Pluto	2, 300	2.3 mm

- Here is our lesson on our Open Source Lab website.
- Here is a google drive folder of all the planets. Also, I have attached pictures of the code used in CoSpaces.
- Here is a link to view it in CoSpaces and on the Merge Cube.
- **Please Note:** CoSpaces Pro has a cost of $4 USD per licence or you can use COSMIKEPAGE for a 30 day free trial with 100 licences.

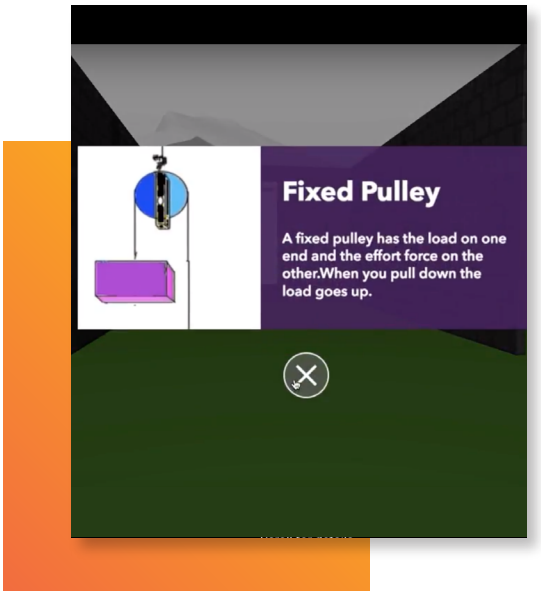
Suggested Questions

- Where is Earth located in the solar system and how far is each planet from Earth?
- Which is the biggest planet in our solar system?
- Which is the smallest planet in our solar system?
- What do the positions of the sun and specific planets have in common when viewing it on the Merge Cube?

Simple Machines

Grades 4–7

Created by Mike Page & Nate Lott *Requires accounts with CoSpaces Edu Pro and Tinkercad



Difficulty 2 | 3-45 minutes | small group

Tags: Simple machines, Complex machines, CoSpaces Edu

App/Tech Tools	CoSpaces Edu Pro accounts, Tinkercad account, MERGE Cube, MERGE Headset (optional), device (phone/tablet)
Materials	

Learning Objectives

- Demonstrate student learning of simple machines. This is a grade 4 example where they took images from online and inserted them in.
- Export and modify a 3D model in Tinkercad to CoSpaces.
- Use science inquiry processes and skills to — ask questions; gather, interpret, and analyze ideas; and communicate findings and decisions.

Activity

1. This can be done in a number of ways. Students can choose a number of simple machines, focus in an be an expert on one simple machine or grade/skill depending, students can move onto complex machines. We chose to focus on all 6 simple machines in a grade 4 class. My grade 7 class is creating their simple machines in Tinkercad and bringing them over into cospaces then into AR on the Merge Cube.

Here are the list of simple machines we cover:
Wheel & Axle, Inclined Plane, Wedge, Lever (3 types), Pulley (3 types), Screw

CoSpaces video Video 1

2. Determine what information you want your students to display on their simple machine pictures or models. Your students can brainstorm facts as a class, do personal research and come up with a set number of facts that need to be presented.

   Loading your images or coding the scene Video 2

3. The interaction you can code into your map is limitless. If you would like your students to learn more fundamental coding in CoSpaces go through the "CoSpaces" lessons here. Once your scene is complete grab your Merge Cube and display the interactive map on it through CoSpaces by pressing play. SHARE WITH YOUR FRIENDS!!!

Suggested Questions

- An electric fan is made up of several simple machines. Tell where you would find an inclined plane on a fan. Also, tell where you would find a wheel and axle. Can you create this in 3D and into AR?
- Where do you use simple machines in daily life? Examples.
- The floor of a bathtub is an inclined plane. Explain. Can you create this in 3D and into AR?

Extension Idea

- We will be creating our own simple machines in Tinkercad. More basic tinkercad lessons can be found here. This is where students can be creative and make their own simple machines in 3D instead of images from the internet. Here are some examples of simple machines on Tinkercad. Please copy and tinker if you want a place to start with your students.

Snowflakes

Grades 4–10

Created by Mike Page & Nate Lott

*Requires accounts with CoSpaces Edu Pro & Tinkercad

Difficulty 3 | 2-60 minutes | 1 to 1

Tags: Science, Math, Art, CoSpaces Edu, Tinkercad

App/Tech Tools	CoSpaces Edu Pro accounts, Tinkercad account, MERGE Cube, MERGE Headset (optional), device (phone/tablet)
Materials	

Learning Objectives

- View different snowflakes around the merge cube, possible hook for a water cycle unit or a unit on snow or winter.

Suggested Vocabulary: Geometry, empathy, winter, snowflakes

Activity

*Go here to view finished project idea.

1. Visit this website first (how snow is made).

2. Visit the CoSpace link above to will view snowflakes of various designs. Each snowflake was designed on Tinkercad. Use the cube and your mobile device and you will see be able to see Merge snowflakes falling from the clouds. Use this as a hook for your water cycle unit or a unit on snow or winter in primary classes.

Suggested Questions

- Can snow be dangerous?
- Can it be too cold for snow?
- Are all snowflakes different?

Extension Ideas

- Video on how to make a snowflake Video 1
- Extension Lesson alternative - Click here
- Grid - This is a good place for students to draw their snowflake before they create it in 3D.

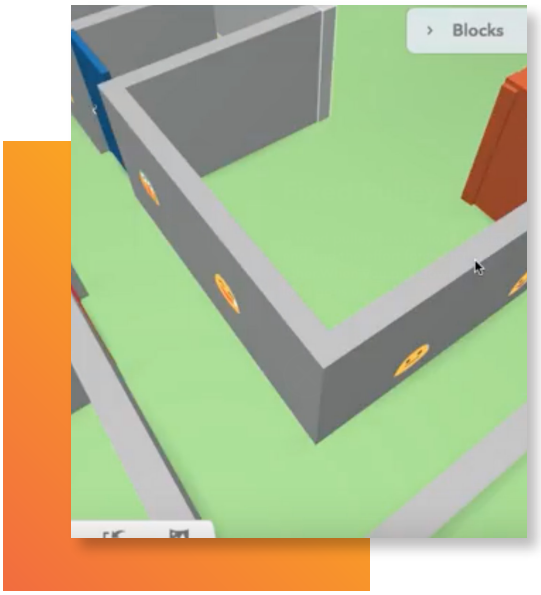
VR Experiences worth checking out

VR Game Builder Part 1

Grades 4–7

Created by Mike Page & Nate Lott

*Requires accounts with CoSpaces Edu Pro and Tinkercad



Difficulty 3 | 3-45 minutes | small group

Tags: Game Design, Design Thinking, STEAM, Prototyping

App/Tech Tools	CoSpaces Edu Pro accounts, Tinkercad account, MERGE Cube (optional), MERGE Headset, device (phone/tablet)
Materials	

Learning Objectives

- Use tools or technology to explore and create patterns and relationships, and test conjectures.
- Develop, demonstrate, and apply mathematical understanding through play, inquiry, and problem solving.
- Construct a first version of the product or a prototype, as appropriate, making changes to tools, materials, and procedures as needed

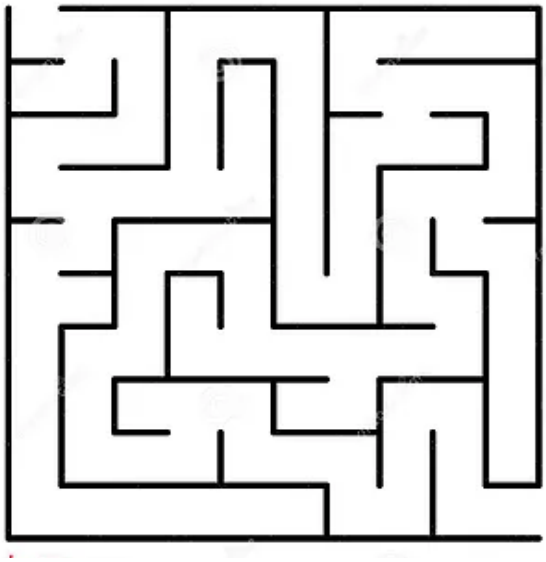
Activity

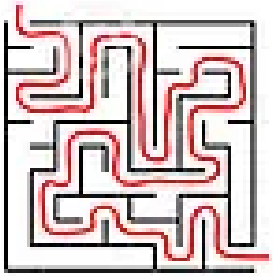
This is a 2 Part lesson that will take your students through the steps to build their first VR game. Part 1 will teach them the basics of movement and variables. Part 2 will look at lists and event handlers. By the end of the two lessons students will have a variety of tools they can draw from to take their game in multiple creative directions. These lessons integrate Language Arts, Math, Computer Science and Art.

1. Start by having students open their CoSpaces account, they will be learning the basics of movement in these instructional videos below:

   VR Game Video 1-3

2. Next ask students to design their own maze using a paper and pencil.





3. Students can then proceed to their CoSpaces account and build their maze, following the videos below:

   Building a Maze Video 4 Coding Robot Movement Video 5

4. Next, the students will be building a room with a key that will open a door. To create this, the students will be learning about coding and variables. The students can proceed to watch the instructional video below on how to create the scene and code it.

   Video 6

5. Next, the students will add a room with multiple keys using the video explaining how to use variables in coding below:

   Video 7

Extension Idea

- The Students will be creating their own 3D key in Tinkercad to use in their scene. They could also create other objects to place into their game. Have students log into their Tinkercad account then proceed to the video below to build the key to bring into CoSpaces:

Video 8

Suggested Questions

- Could you hide the key around the room to make it more difficult to find?
- The key does not have to be a flat picture; could you create a key in Tinkercad or find one on Google Poly and bring it into the scene?
- What items can you bring into the room to make it look more like a room? Examples: paintings, desks, chairs, etc
- What other ways can you enter the room? Can you use another object or click on a certain object to activate the door?

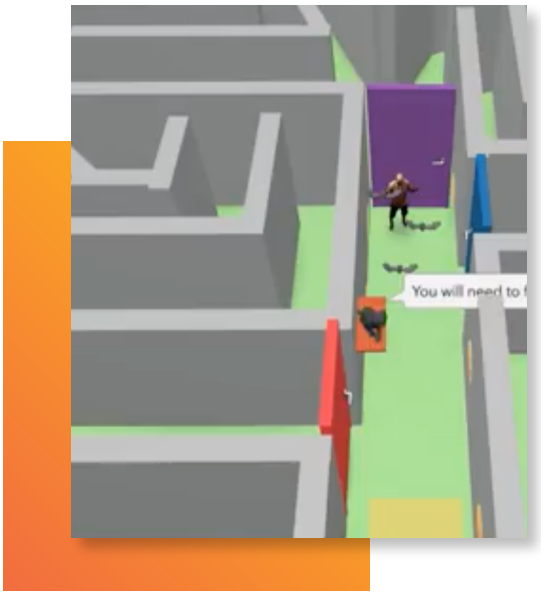
VR Experiences worth checking out

VR Game Builder Part 2

Grades 4–7

Created by Mike Page & Nate Lott

*Requires accounts with CoSpaces Edu Pro and Tinkercad



Difficulty 3 | 3-45 minutes | small group

Tags: Game Design, Design Thinking, STEAM, Prototyping

App/Tech Tools	CoSpaces Edu Pro accounts, Tinkercad account, MERGE Cube (optional), MERGE Headset, device (phone/tablet)
Materials	

Learning Objectives

- Use tools or technology to explore and create patterns and relationships, and test conjectures.
- Develop, demonstrate, and apply mathematical understanding through play, inquiry, and problem solving.
- Construct a first version of the product or a prototype, as appropriate, making changes to tools, materials, and procedures as needed

Activity

This is the 2nd lesson in which students will be looking at Lists and Event Handlers that will make their game much more interactive and life-like. By the end of the two lessons, students will have a variety of tools they can draw from to take their game in multiple creative directions. These lessons integrate Language Arts, Math, Computer Science and Art.

1. Start by having students open their CoSpaces account. They will be learning the basics of Lists and how to make multiple objects move either at the same time or individually and use object collision to trigger and event using Lists here (VR Game 2 Part 1-2)

2. Students will be looking at how to create Event Handlers to build triggers that make something happen when you set them off with the help of the video below:

   VR Game 2 Part 3 Video 1

Extension Idea

- There are a number of effects students could add to their growing game tool list that will enhance the players experience.

- How to create a dissolve effect to items - VR Game2 Part 4 Video 2

Suggested Questions

- Animals are not the only thing you can have move using a list. What about shifting the walls?

- What are some other ways you could use object collision to create a trigger in the maze?

- Who said the maze has to have one floor, create a staircase to a second level?

- Could you place your robot from the previous activity into the maze to be part of the adventure?

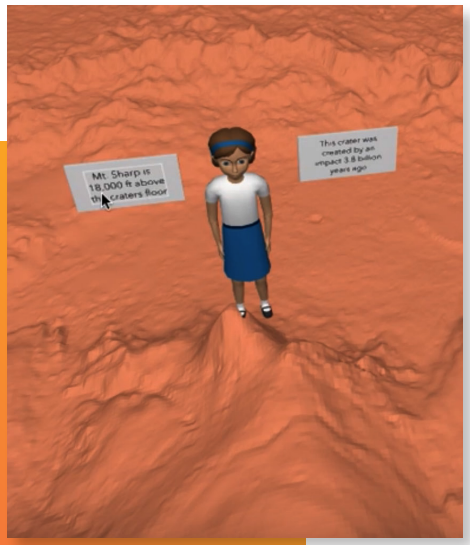
- Could you write a story that will explain how your character became trapped in the maze?

Welcome to Mars

Grades 4–7

Created by Mike Page & Nate Lott

*Requires accounts with CoSpaces Edu Pro and Tinkercad



Difficulty 3 | 3-45 minutes | small group

Tags: Solar System, Mars, Design, CoSpaces Edu, Tinkercad

App/Tech Tools	CoSpaces Edu Pro accounts, Tinkercad account, MERGE Cube, MERGE Headset (optional), device (phone/tablet)
Materials	

Learning Objectives

- Develop a presentation on a specific topographical feature on Mars.
- Create interactive presentations while communicate ideas, findings, and solutions to problems, using scientific language, representations, and digital technologies as appropriate.
- Demonstrate a sustained intellectual curiosity about a scientific topic or problem of personal interest.
- Transfer and apply learning to new situations.

Activity

In this lesson students will be observing a 3D virtual tour of a specific Mars topographical feature then rebuilding that tour (or pieces of it) inside CoSpaces, finally displaying it in AR on the Merge cube or in VR.

1. Start by having students explore the amazing virtual reality audio tour of the Gale Crater on Mars here (LA Times, Discovering Gale Crater) They should take notes on what they see and perhaps even sketch out interesting features that can be included in their final presentation.

2. Next have students drag and drop the .stl file of the crater to place into their CoSpaces.

3. Browse through NASA's 3D models on their 3D Resources page here (NASA 3D Resources). You are looking for the model of the Gale Crater.

4. Have students log into their CoSpaces account then proceed to the video to learn how to build your presentation.

   Video 1 Video 2

   Now load the scene onto your Merge cube or into your VR goggles!

Suggested Questions

- Could you create other maps of locations on Mars and create AR presentations on them?
- There are many different .stl models on the NASA 3D Resources site. Could you place a satellite above your scene and have it move in a circular pattern?
- Can you find a way to include the Curiosity rover in your scene and talk about what it was doing there?
- There is another Merge lesson where you create our solar system, how could you link this presentation with that model?
- Could you build a living space in Tinkercad and bring that into CoSpaces, then talk about how it would function?

Extension Ideas

- Gale crater is the landing site of the Mars rover, Curiosity. Have students log into their Tinkercad account then "Copy and Tinker" the Curiosity file here (Mars Rover designed by Nate Lott)
- Can you recreate the rover and bring it into your scene?