VR LEARNING TASK

Forces in Motion

Learning area
Science – Physical Sciences

Year level
Year 7

Duration
90 minutes

Task summary

As an extension to the Forces in action learning task this lesson enables students to explore the concept of balanced and unbalanced forces, as well as simple machines, using XR technology.

Session overview	Students will deepen their understanding of balanced and unbalanced forces by investigating the effects of applying different forces to familiar objects of the same and different mass.
Digital technologies	✓ VR ☐ AR ☐ Robotics ☐ Drones ☐ Other: _____
Required resources	**Hardware:** • Immersive Virtual Reality (IMVR) headsets • Handheld Virtual Reality headsets (HHVR) • Devices • Laptops/ Tablets **IMVR Apps:** • **Gadgeteer** - Gadgeteer is a physics-based VR puzzle game where you build chain reaction machines to solve fun, intricate puzzles. This is a paid experience and will need to be downloaded on each IMVR station. **Videos:** • What are Balanced & Unbalanced Forces | Laws of Motion Physics (5:42) - teachers to use as an introductory task to remind students of balanced and unbalanced forces. **VR videos:**

- FIRST EVER 360° Rube Goldberg Machine | Joseph's Machines (0:55) - View a short Rube Goldberg machine in 360°.
- 360 Video - DO NOT Push The Red Button! (Rube Goldberg Machine) (1:40) - An animated Rube Goldberg machine.

Websites:

- **CoSpaces EDU** - An AR/VR creation tool that students can use to experiment with building simple machines with the built-in physics engine feature. Please note that while teachers can set-up free CoSpaces accounts, the physics engine feature is only available on Pro (paid) accounts. Please check optional resources for other activity ideas without a paid CoSpaces account.

Teaching resources:

- Teaching deck - this is a slide deck template that teachers can download and use for this learning task.
- Student digital notebook – to be distributed either in printed format or digitally via email or school learning management system.

Other resources to try (optional)

Miscellaneous:

- VR/AR Safety Poster (PDF)

Other physics ideas without CoSpaces EDU Pro:

- Get students to design a simple machine system prototype using a 3D building tool like Tinkercad. If the school has a 3D printer, students may opt to print their prototypes.
- Use Minecraft with Redstone to create systems with switches and switches, levers and pistons.
- Get students to build a simple machine system using traditional makerspace materials. Some useful materials for this project are:
  - boxes
  - wooden Rods
  - strings
  - thumb tacks
  - pins
  - cardboard
  - cardstock
  - small pieces of wood
  - elastic bands

Planning and preparation

Assumptions
Students should:

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NOTE: This learning task may be introduced in the middle or at the end of the unit.

- Have some background knowledge and understanding of the different types of forces and how they work, as well as what simple machines are.
- Have some skills and knowledge in using Gadgeteer, or have completed the tutorial section of the experience. Otherwise, students may need extra lessons to learn the functions of the experiences and the materials available.
- Have some skills and knowledge in using CoSpaces EDU with the ability to code and basic understanding of physics simulations in CoSpaces. Otherwise, students may need extra lessons to learn all about CoSpaces and its physics function.

Additional preparation for teachers

- Make sure that the IMVR experience, Gadgeteer, has been downloaded on all learning stations.
- Make sure that HHVR devices have the necessary apps installed. A YouTube video viewer is required for watching VR videos, so it's important that YouTube is allowed on the school network.
- Teachers should watch the VR videos and/or test the VR apps/games in advance to make sure that they are appropriate for their respective classes.
- Ideally, students would have one HHVR headset and one device each. But, if there's a limited number of HHVR headsets and devices, students may be put in small groups to share devices and take turns taking notes and viewing VR videos.
- Make sure all devices are fully charged and set-up appropriately before the lesson, with all apps installed and working.
- Make sure that all students have a copy of the student digital notebook either in printed format or digitally via email or school learning management system.
- Place students in 3 groups, and pair them up.

Task Sequence

1

Introductory activity / Provocation
(5 mins)

Display slide 2 of the teaching deck and introduce the lesson by watching the first 4 minutes and 11 seconds of What are Balanced & Unbalanced Forces | Laws of Motion Physics (5:42).

2

Prior knowledge check
(5- 10 mins)

Gather student's prior knowledge on balanced vs unbalanced forces by asking the following questions (found on slide 3 of the teaching deck):

- What does balanced forces mean? What are unbalanced forces?
- What are some examples of this around the room?
- What are simple machines? (Discuss pulleys, levers, inclined planes, bow and arrows, etc.)
- How can you demonstrate balanced and unbalanced forces with simple machines? (Discuss Rube Goldberg machines as an example)

3

Activities
(20 mins per rotation + 3 minute transition times)

Explain to students that they will be exploring forces and how they work with simple machines using virtual reality (VR).

Show students the rotation schedules on slide 4 of the teaching deck and explain lesson structure.

Use the next four slides to explain each station and what would be expected of students. Students also have a copy of the station explanations in their student digital notebook for later reference.

Station 1: IMVR
Students will work in partners, 10 minutes each, to explore the effects of forces on same and different sized objects. They can either create their own simple machine, or complete challenges where they need to strategically place common objects to reach the end goal.

Station 2: HHVR/Reflection
Students will view different Rube Goldberg Machines in VR and reflect on the forces used and simple machines included in the video. They will answer correlating questions in their student digital notebook. If they finish early, they can use the remainder of their session to plan out a chain reaction to unbalance a balanced object.

Station 3: Creation
Students will work independently to create their own forces/simple machines project. This can be as simple as showing a chain reaction on CoSpaces or creating a lever/pulley game using CoSpaces or TinkerCAD. They can change the mass of objects using the physics option to investigate the effects this will have in force. They can add some coding to their objects to bring their creations to life.

4

Check for understanding
(10 mins)

Using slide 8 of the teaching deck, wrap up the lesson with some reflection questions.

- What did you learn about balanced and unbalanced forces?
- What types of forces did you use today to unbalance your object?

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- When experimenting with the physics feature on CoSpaces, what did you notice the mass, bounciness and friction does to an object when unbalanced?
- What's a question you still have about balanced and unbalanced forces?

Differentiation for students with additional needs	Extension ideas	Video tips
Students can use hands-on materials to create their own simple machines /Rube Goldberg machines.	Ask students to add audio or text to their CoSpaces creations to explain their understanding of the forces at play in their creation, and at what points their balanced objects become unbalanced, what force caused this and what the results are.	The video for this learning task explains the physics feature of CoSpaces and how students can create chain reactions.

Curriculum Connections

Australian Curriculum Version 9.0	**Year 7 - Science** Investigate and represent balanced and unbalanced forces, including gravitational force, acting on objects, and relate changes in an object's motion to its mass and the magnitude and direction of forces acting on it (AC9S7U04)
Cross-curriculum priorities	☐ Aboriginal and Torres Strait Islander Histories and Cultures ☐ Asia and Australia's Engagement with Asia ☐ Sustainability
General capabilities	☐ Literacy ✓ Numeracy ✓ Digital Literacy ✓ Critical and creative thinking ☐ Personal and social capability ☐ Ethical understanding ☐ Intercultural understanding

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