Questacon MAKER PROJECT

WORKSHOP TEACHER RESOURCE

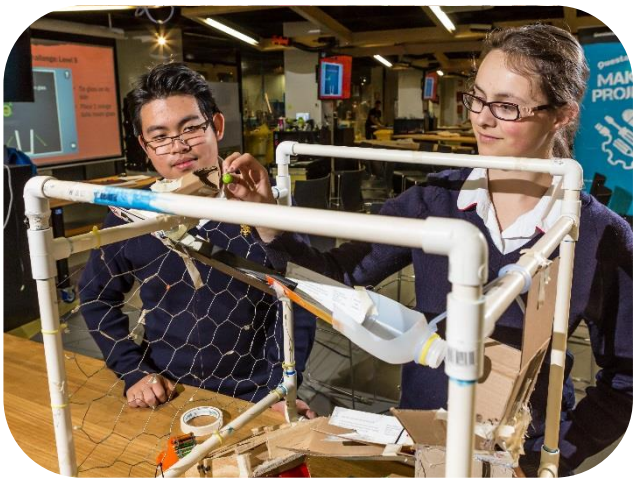
Lesson Plan: Ball Run (120 minutes)

This resource provides all you need to know to run your own Ball Run workshop in your classroom, similar to those run at the Ian Potter Foundation Technology Learning Centre in Canberra, and aligns with the Innovation Process.

The Ball Run activity focuses on the Make, Try and Refine segments of the Innovation Process. Ball Runs are best described as continual "works-in-progress" or prototypes. They require precision and refinement, and places for changes are best discovered through frequent testing.

You can find more activities, lesson plans, information about the Innovation Process, and even a resource to help you build your own Ball Run frames for your classroom at the Teacher Resources section of our website at www.questacon.edu.au.

Activity Objectives



Students will work in small groups (2-3 students) to create a unique solution to control the descent of a marble through a maze using simple materials and tools such as card, string, masking tape, scissors and hot glue – whatever is cheap, recycled and accessible!

Students will be required to overcome challenges (make a run that lasts for 10 seconds) and are encouraged to continuously refine their run due to added restrictions or alternate materials.

Materials and Tools

- Ball run frames (2D or 3D) – check out our Teacher DIY resource to create your own 3D frames for your classroom
- Marbles or similar balls
- Raw materials; card, paper, string, toothpicks, toilet rolls, paddle-pop sticks, twisty-ties, paper cups, plastics (including bottles), wood, rubber bands, piping, CDs and cases – whatever you can find.

- Tools, including; scissors, safety knives, hot glue guns, masking tape, safety glasses, saws/drills – dependent on materials and OHS
- Stopwatches/timing devices

The Ball Run activity can be run along a single plane on a wall (2D) or in a cage structure (3D). Pin boards and magnetic boards can also be used to great effect. This allows you to create vertical runs that use very little horizontal space. Cardboard or paper ramps can be easily adjusted and repositioned to reduce material use and allow for simple refinements. For guidance in building 3D Ball Run frames, check out Teacher DIY at the Teacher Resources section of our website www.questacon.edu.au. For inspiration using only paper, scissors and tape for this lesson, please visit our friends at www.paperrollercoasters.com.

Lesson Outline – 120 minutes

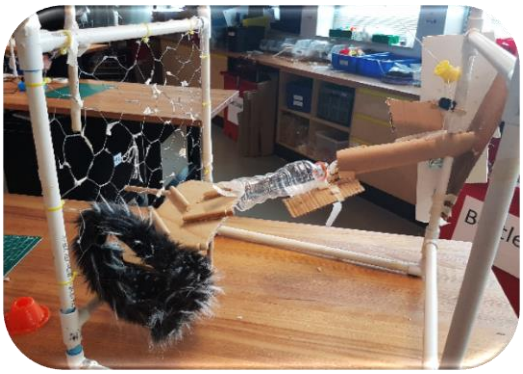
The below lesson outline provides an overview of workshop elements.

Please ensure you follow your school WH&S procedures while conducting this lesson.

Introduction (15 minutes)	Introduce the Innovation Process, tools, materials and workspace. Introduce ball runs and the challenge (utilise video of a ball run in action, see Further Investigation). Students break into small groups (2-3).
Main Activity (80 minutes)	Students construct and test their own desk-top ball run using household recycled materials. *Main Challenge: Marble must go from top to bottom of the run in 10 seconds* For students below Year 8, you can begin with a short challenge designed for early success (10 minutes) before introducing frames. *Early Success Challenge: Using limited materials (e.g. 1 sheet of paper, one piece of card and 5 tooth picks), design and prototype two tracks that slow and control a marble's descent.* Encourage students to share/describe their ramp designs, including the materials they used and why, with the rest of the class (e.g. features may include tunnels, ramps, barriers, structural supports, varied slope). Then introduce the remainder of the materials and frames.
Extension Activities	There are a number of extension activities that can be tailored to the individual groups and their designs, such as: • Incorporate 1-2 prefabricated maze pieces that slow/redirect the marble • Switches

	• Bring ball back to top • Separate multiple or big/small marbles • Join two runs together
Wrap-up (25 minutes)	Design Sharing: Watch and time students' ball runs, and encourage class reflection as a group. Facilitate questions and discussion on workshop, including: • Approach to the challenge(s) • What did you find the most challenging throughout the process? • Was testing important during the design phase? • What would you do differently next time? • If you were to build this full scale what materials could you use? Ball run deconstruction: recycle as much material as possible. Optional: final video of an inspiring ball run/Rube Goldberg contraption.

Example Ball Runs



Further Investigation

Real-world examples include bubble gum dispensers or coin donation boxes. Others can be found be searching YouTube for "Marble Runs," "Ball Runs," or "Biisuke Ball's Big Adventure." Consider showing both elaborate and low-tech examples to set expectations, e.g. the Biisuke runs take a team of creative developers a week to produce for a Japanese children's TV show.

If available, we also recommend downloading the Questacon Marbellous Ball Run App for tablets to explore digital prototyping and ball run construction.

Curriculum Links

Our resources provide a framework for classroom activities and lesson plans that link to the Australian Curriculum in both the Science, and Design and Technology streams. Some of these curriculum links are highlighted below.

Science Inquiry Skills	Science as a Human Endeavour	Science Understanding
Science Inquiry Skills are incorporated across all year levels by encouraging questioning and planning, planning and conducting, processing and analysing data and information, evaluating, and communicating.	If this lesion plan is extended to research and discuss the applications of ball runs, where and how they are used in society (e.g. coin mints and manufacturing, fruit and chocolate conveyors, recycling plants), it links to the Science as a Human Endeavour Strand. *ACSHE228*	As well as investigating the physical force gravity, if this lesson plan is extended to research and discuss motion and transfer of energy it links across various subjects in the Science Understanding Strand. *ACSSU076, ACSSU117, ACSSU118, ACSSU155, ACSSU190, ACSSU229*

Design and Technology Processes and Production Skills	Design and Technology Knowledge and Understanding
This activity provides hands-on engagement and skills and aligns with project management, design, and production with a strong emphasis on safety. *ACTDEP035, ACTDEP037, ACTDEP050*	Facilitating discussion surrounding real life applications of technology, and the impact of cultural, financial, ethical and social factors on design can extend the scope of this activity to incorporate additional curriculum links. *ACTDEK046*

If you have any questions regarding this teacher resource, contact the Smart Skills team at QSSI@questacon.edu.au, and connect with us on Twitter and Facebook.

If you would like to know more about our teacher professional development opportunities, contact the teacher professional development team at teachers@questacon.edu.au.