Water Wheels (engquest)

Grade Level/s:	Subject/s:	Type:	Author:
5, 6, 7	Technologies,Geography	Unit Plan	Liam Fawcett

Water Wheels (engquest)

Single Lesson Plan

Concept Introduction

Task:	Activity:	Resources:
What is a water wheel? (10 minutes)	Show images of water wheels from around the world ranging from student created attempts with cups and spoons to farmers powering lights or milling grain to electricity generating industrial turbines. Have students ask questions and familiarise themselves with the concept of a water wheel and their potential uses. Explain that students will be creating their own water wheel over the next few lessons.	Internet (Google images) on a PowerPoint Projector
Research (15 minutes)	Students use the internet to look up images or ideas they can replicate or use as inspiration for their own water wheels. They can discuss their thinking and help out their peers with alternative ideas.	Computers, iPads etc.
Design and Planning (20 minutes)	Using either a pencil and paper or a drawing program on the computers students need to design their own water wheel that they can make with basic school resources (spoons, cups, plates, hot glue guns etc.). Students to provide a diagram from several view points and a list of materials they will need.	Pencil and Paper (or Drawing software)
Sharing (5 minutes)	Students share their concepts with a partner/group and get their thoughts about the design and material list. Students can help each to ensure they have a complete list of required materials	Computers (to show designs) Completed designs/plans

Prototype Construction

Task:	Activity:	Resources:
Materials introduction/safety (5 minutes)	Display the available materials and demonstrate how to safely use some equipment (carrying scissors, using hot glue guns). Demonstrate what a reasonable amount of resources looks like (some straws, not all the straws etc.)	sticky tape glue guns glue scissors plastic plates plastic cups spoons wire straws string pop sticks etc.
Prototype construction (30 minutes)	Students review their plans/designs from previous lessons. They collect materials listed on their designs and begin constructing water wheel prototypes. Testing proof of concept during the process (seeing if they spin etc.)	Materials subject to availability but may include sticky tape glue guns glue scissors plastic plates plastic cups spoons wire straws string pop sticks etc.
Testing (10 minutes)	Students take their designs and try them out with water. Take note of the strengths and weaknesses of their designs.	Prototypes Water Aquarium pump/watering can etc.
Packing up and storage (5 minutes)	Re-pack resources/materials and put the prototypes in a cupboard to keep them safe.	Cupboard space

Prototype Testing

Task:	Activity:	Resources:
Introduction/Safety (5 minutes)	Explain the purpose of the lesson is to test the prototypes. Demonstrate the equipment and how it can be used to power the waterwheel. Ensure students understand potential safety issues and how to sensibly work with water.	Water Water container Aquarium pump (with extendable tubing)
Last minute fixes and modifications (10 minutes)	Give students a chance to look over and fix any parts of their waterwheels that may have been damaged or fix issues they've since discovered. When ready students put their names down on the list (first finished will be first to test).	Water Water container Aquarium pump (with extendable tubing) Paper Pencil Projects and leftover equipment/resources from previous lesson.
Testing Prototypes (25 minutes)	Students take turns testing their prototypes and compare the way their waterwheel worked to the prototypes of other students. Any available time can be used to make minor modifications and re-test.	Water Water container Aquarium pump (with extendable tubing) Paper Pencil Projects and leftover equipment/resources from previous lesson.
Critiquing and recording (10 minutes)	Students reflect on how their waterwheel preformed and think about what additional parts could help improve their design. Record their ideas for a new part/design and explain how it could help.	Paper Pencil Prototype design

3D printed solution

Task:	Activity:	Resources:
Maker's Empire Software introduction (5 minutes)	Re-introduce Maker's Empire software, give out previous usernames and passwords and demonstrate (again) how to use shaper to create shapes etc.	Computers Maker's Empire Software
Design process (35 minutes)	Have students put their prototype in front of them and look at the part they designed last lesson. Create a part or new design in Shaper to fix or improve the design. E.g. better/stronger axle, cup/water holder design etc.	Computers Maker's Empire Software Prototype
Saving and Sharing (10 minutes)	Students save their work. I login to the Maker's Empire website and show the class the designs on the whiteboard. Each students talks about their design and how it could help improve their waterwheel. Vote for best options and *printer available* we print 2-3 options.	Computers Maker's Empire Software Prototype Projector 3D printer

Testing Solutions

Task:	Activity:	Resources:
Show solutions (5 minutes)	Show students the 3D printed solutions and discuss the ways they are intended to be used. Discuss the differences/benefits of the alternative equipment.	3D printed solutions
Retrofitting (15 minutes)	Students are given time and necessary equipment to retrofit the new parts to their original design.	sticky tape glue guns glue scissors plastic plates plastic cups spoons wire straws string pop sticks etc.

Re-testing (25 minutes)	Aquarium pump is set up again and student re-test their improved prototypes. Other groups watch and can discuss the effectiveness of the changes.	Water Water container Aquarium pump (with extendable tubing) Paper Pencil Projects and leftover equipment/resources from previous lesson.
Discussion/Sharing (5 minutes)	Opportunity for students to share how they feel their prototypes worked with the 3D printed elements. Other groups can suggest further improvements that could occur in the future.	Prototypes to talk to (if wanted)

Future Potential

Task:	Activity:	Resources:
Introduction (5 minutes)	Discuss how waterwheels have been used historically - grinding flour, lifting rope/chain, generating electricity. Lead students into thinking about how their waterwheels could be scaled up/down and utilised in a real world setting.	Images/videos on projector
Research and ideas (15 minutes)	Give students an opportunity to think about their design and how it worked. Using the internet for further ideas (if necessary) have them come up with potential uses for their prototype. Consider the size, use of the spinning motion, how it could be produced etc.	Internet (desktops and iPads) Pencil Paper
Sharing (20 minutes)	As a group share their thoughts for the best way this waterwheel could be used in a real life scenario. How they feel it could benefit people/a community etc. Answer questions from peers.	Prototypes to talk to (if wanted) Projector and internet available
Process feedback/lesson critique (10 minutes)	Opportunity for students to share their thoughts on the waterwheel design, make, critique process. They can make suggestions, explain what they liked, didn't like or would change etc.	Work produced to refer to (drawings, prototypes etc.)

Curriculum

South Australian TfEL:

4.4 communicate learning in multiple modes

Australian Curriculum:

Develop project plans that include consideration of resources when making designed solutions individually and collaboratively (ACTDEP028)
link (http://rdf.australiancurriculum.edu.au/elements/2014/09/648ab0a9-fcc2-4b35-9ad8-fad594b56609)

Examining The Essential Features Of Existing Processes To Inform Project Planning Including Safe Work Practices That Minimise Risk (ELBT225)
link (http://rdf.australiancurriculum.edu.au/elements/2014/09/9c675bfc-0f22-4fe3-a4ee-8a2d60e05f90)

Setting Milestones For Production Processes And Allocating Roles To Team Members (ELBT268)
link (http://rdf.australiancurriculum.edu.au/elements/2014/09/87878c78-ed26-4990-97de-76c04472692d)

Identifying When Materials, Tools And Equipment Are Required For Making The Solution (ELBT165)
link (http://rdf.australiancurriculum.edu.au/elements/2014/09/872ce6b5-deb1-4b49-9af5-b02fcdcb8ddd)

Outlining The Planning And Production Steps Needed To Produce A Product, Service Or Environment Using Digital Technologies (ELBT143)
link (http://rdf.australiancurriculum.edu.au/elements/2014/09/a5b5d5fd-d72c-4d06-a01a-b7977bcfffbf)

Reflecting On Planned Steps To See If Improvements Can Be Made (ELBT392)
link (http://rdf.australiancurriculum.edu.au/elements/2014/09/b14f533a-5986-46c6-80ab-398cfb567a88)

Negotiate criteria for success that include consideration of sustainability to evaluate design ideas, processes and solutions (ACTDEP027)
link (http://rdf.australiancurriculum.edu.au/elements/2014/09/26e94f5b-d29b-4364-aae9-475bf157aad1)

Independently And Collaboratively Identifying Criteria For Success, Processes And Planning, For Example Using Visual Representations Such As A Flowchart (ELBT297)
link (http://rdf.australiancurriculum.edu.au/elements/2014/09/67e1cd1d-cb6d-447a-9275-67af6fa70de8)

Evaluating The Suitability Of Materials, Tools And Equipment For Specific Purposes (ELBT176)
link (http://rdf.australiancurriculum.edu.au/elements/2014/09/b61a99c5-795d-48a0-89b8-a93ed3654796)

Reflecting On How Well Their Designed Solutions Ensure Safety And Wellbeing Of Users And Consumers And Meet The Needs Of Communities And Different Cultures (ELBT437)
link (http://rdf.australiancurriculum.edu.au/elements/2014/09/790ce14b-599c-49e4-8264-1f195fd1d11a)

Considering The Criteria For Success In Relation To The Benefits And Costs Of Production Processes, The Environmental Impact, Future Use And Application, And Social Values And Ethics Of Clients (ELBT443)
link (http://rdf.australiancurriculum.edu.au/elements/2014/09/30edeabf-e43f-48ef-9b14-1c4f9fae7ac9)

Evaluating Products, Services And Environments From A Range Of Technologies Contexts With Consideration Of Ethics And Sustainability (ELBT324)
link (http://rdf.australiancurriculum.edu.au/elements/2014/09/e8b18c25-8494-46f4-8edf-5bf9e35e6113)

Apply safe procedures when using a variety of materials, components, tools, equipment and techniques to make designed solutions (ACTDEP026)
link (http://rdf.australiancurriculum.edu.au/elements/2014/09/4bf5ec16-d3fe-46a8-a2a6-7495e977c1d7)

Matching Material And Joining Techniques To The Design Intention, For Example Accurately Cutting And Sewing The Fabric Pieces To Make A Community Banner Or Joining Components To Produce An Electric Circuit (ELBT398)
link (http://rdf.australiancurriculum.edu.au/elements/2014/09/584313ca-a299-405a-bea0-378ff0c21759)

Working Safely, Responsibly And Cooperatively To Ensure Safe Work Areas, For Example The Safe Use Of Equipment When Making A Water Resistant, Floating Craft Or A Model Of An Environmentally Sensitive Outdoor Shelter (ELBT27)
link (http://rdf.australiancurriculum.edu.au/elements/2014/09/7b61b9e2-0c45-4d5c-8c56-f2f1151c7d86)

Using Appropriate Personal Protective Equipment Required For The Use Of Some Tools And Equipment, For Example Protective Eyewear (ELBT375)
link (http://rdf.australiancurriculum.edu.au/elements/2014/09/ead2ce71-6d9b-47ef-beeb-4362bd5975a9)

Manipulating Materials With Appropriate Tools, Equipment And Techniques, For Example When Preparing Food, Cultivating Garden Beds, Constructing Products (ELBT357)
link (http://rdf.australiancurriculum.edu.au/elements/2014/09/46e13eed-0f3d-44dc-b5a8-4b5180e53aec)

Generate, develop, communicate and document design ideas and processes for audiences using appropriate technical terms and graphical representation techniques (ACTDEP025)
link (http://rdf.australiancurriculum.edu.au/elements/2014/09/8abf34c6-43f0-48c4-a26b-5c673f37cbf0)

Generating A Range Of Design Ideas For Products, Services Or Environments Using Prior Knowledge, Skills And Research (ELBT408)
link (http://rdf.australiancurriculum.edu.au/elements/2014/09/ecc70bac-4ded-4719-8922-2fe8ac3055fd)

Developing Alternative Design Ideas And Considering Implications For The Future To Broaden The Appeal And Acceptance Of Design Ideas (ELBT200)
link (http://rdf.australiancurriculum.edu.au/elements/2014/09/adb45c63-290a-4731-abb6-99032031ac5b)

Analysing And Modifying Design Ideas To Enhance And Improve The Sustainability Of The Product, Service, Environment Or System (ELBT365)
link (http://rdf.australiancurriculum.edu.au/elements/2014/09/059cdc15-9fbe-4dcd-ad2f-47592878e0ea)

Representing And Communicating Design Ideas Using Modelling And Drawing Standards Including The Use Of Digital Technologies, For Example Scale; Symbols And Codes In Diagrams; Pictorial Maps And Aerial Views Using Web Mapping Service Applications (ELBT364)
link (http://rdf.australiancurriculum.edu.au/elements/2014/09/b45f775a-3a31-4e00-80e6-4876549184f2)

Experimenting With Materials, Tools And Equipment To Refine Design Ideas, For Example Considering The Selection Of Materials And Joining Techniques To Suit The Purpose Of A Product (ELBT267)
link (http://rdf.australiancurriculum.edu.au/elements/2014/09/6b897f57-6cba-4870-93e0-78ef6a957b77)

Critique needs or opportunities for designing, and investigate materials, components, tools, equipment and processes to achieve intended designed solutions (ACTDEP024)
link (http://rdf.australiancurriculum.edu.au/elements/2014/09/ba61fd1b-b7ed-4d58-8cb0-b7dd0dca64f9)

Exploring The Steps Involved In The Process To Satisfy A Design Brief, Need Or Opportunity (ELBT34)
link (http://rdf.australiancurriculum.edu.au/elements/2014/09/3ca02564-9519-46fc-b438-eec11c74fc9c)

Investigating Designed Solutions From Around The World To Make Suitable, Quality Decisions That Meet The Design Brief, Challenge Or Scenario (ELBT97)
link (http://rdf.australiancurriculum.edu.au/elements/2014/09/1bf47f61-4046-463c-9528-cf522bdddc8e)

Identifying The Importance Of Complementary Parts Of Working, Everyday Systems By Deconstructing The Components, Structure And Purpose Of Products, Services Or Environments (ELBT69)
link (http://rdf.australiancurriculum.edu.au/elements/2014/09/95651eea-698e-417c-a35e-dee42b90939d)

Testing A Range Of Materials, Components, Tools And Equipment To Determine The Appropriate Technologies Needed To Make Products, Services Or Environments, For Example A Moving Vehicle (ELBT376)
link (http://rdf.australiancurriculum.edu.au/elements/2014/09/f7955d4f-a1ff-4b70-ab36-433928a1c400)

Investigating How To Minimise Material Use And Manage Waste By Critiquing The Environmental And Social Impacts Of Materials, Components, Tools And Equipment (ELBT2)
link (http://rdf.australiancurriculum.edu.au/elements/2014/09/0e4889d9-1297-47bc-b70a-ff9d32be08b8)

Design and Technologies Processes and Production Skills
link (http://rdf.australiancurriculum.edu.au/elements/2014/09/180e9771-f4e6-4153-9a91-75d144cc424e)

The economic, cultural, spiritual and aesthetic value of water for people, including Aboriginal and Torres Strait Islander Peoples and peoples of the Asia region (ACHGK041)
link (http://rdf.australiancurriculum.edu.au/elements/2014/09/cc311175-3528-402b-93a2-838df402be91)

Examining And Comparing Places In Australia And Countries Of The Asia Region That Have Economies And Communities Based On Irrigation, For Example, Rice Production In Leeton In Nsw And The Mekong Delta In Vietnam Or Java In Indonesia (ELBH654)
link (http://rdf.australiancurriculum.edu.au/elements/2014/09/828fb45f-60d1-4aeb-9218-3d89bae5d50b)

Exploring The Multilayered Meanings (Material, Cultural And Spiritual Wellbeing) Associated With Rivers, Waterholes, Seas, Lakes, Soaks And Springs For Aboriginal And Torres Strait Islander Peoples (ELBH422)
link (http://rdf.australiancurriculum.edu.au/elements/2014/09/205a3864-2f7a-45ca-bde1-d70a45a300be)

Examining Bays, Rivers, Waterfalls Or Lakes In Australia And In Countries Of The Asia Region That Have Been Listed As Either World Heritage Sites Or National Parks For Their Aesthetic And Cultural Value (ELBH537)
link (http://rdf.australiancurriculum.edu.au/elements/2014/09/117bcd46-11ce-4e49-af2e-91761fa1a81d)

Investigating The Spiritual Significance Of Water In An Asian Culture (ELBH497)
link (http://rdf.australiancurriculum.edu.au/elements/2014/09/2280078c-825a-4ae1-b4e5-aa72af9d5539)