

Gamifying Earth Science

Australian Curriculum V9 Connections for CoRE's
Minecraft Education Edition (MC:EE) - Resource Respond
Rescue (RRR) Game

How do we use the games to design a teaching-learning
program to deliver a reportable curriculum?



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Game 1 - Minecraft - 'RRR'

Resource Respond Rescue (RRR)

Natural Disasters and the team that mitigates them!

Get ready to dive into the heart-pounding action of the Minecraft game Resource, Respond, Rescue! (RRR), set amidst the rugged landscapes of a fictional copper/gold mining town in Northern Australia.

In this adrenaline-fueled adventure, players find themselves thrust into the shoes of Emergency Response Teams (ERT), joining forces with the courageous volunteers of the State Emergency Services (SES). Together, they brave the elements, from raging bushfires to devastating floods, earthquakes, and tsunamis, as they act to safeguard the community and the precious mine from imminent danger.

But this game isn't just about pulse-pounding thrills—it's a captivating journey of discovery, offering a window into the diverse array of careers that extend far beyond the confines of the mine. From engineering marvels to logistical masterpieces, players witness firsthand how industry professionals apply their skills in the face of adversity, blazing trails in fields they never imagined.

As students band together in teams, they step into the shoes of mining personnel, embarking on a riveting training simulation within the ERT facility. With each step into the simulated canyon and lobby, they are catapulted into a world brimming with STEM knowledge, where every encounter promises to ignite their curiosity and shape their understanding of the world around them.

Guiding them through this exhilarating odyssey is none other than the ERT Leader, an enigmatic Non-Playing Character who serves as their beacon of hope amidst the chaos. With wisdom and guidance, the ERT Leader steers them through the challenges that lie ahead, ensuring they emerge from each encounter stronger, wiser, and ready to face whatever comes their way.

So buckle up and brace yourselves for an adventure like no other. With Resource, Respond, Rescue!, the stage is set for an epic journey of courage, camaraderie, and discovery. Are you ready to answer the call of duty and become a hero on your own? The fate of the mining town—and perhaps even the world—rests in your hands.



Game 1 - Minecraft - 'RRR'

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Natural Disasters and the team that mitigates them!

Geographical Representation of
the fictious RRR and its four
dioramas.



Game 1 - Minecraft - 'RRR'

Resource Respond Rescue (RRR)

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The Minecraft game comprises four distinct dioramas, each meticulously designed to correlate with a different facet of the mine's operations and its corresponding susceptibility to a specific natural disaster.

In these dioramas, players are presented with a scientifically accurate depiction of the interplay between mining activities and the environmental hazards of various natural disasters. Through meticulous attention to detail, each diorama encapsulates the nuanced relationship between the mine's infrastructure, operational procedures, and the potential risks natural phenomena pose.

By immersing themselves in these interactive environments, players gain a deeper understanding of the complex dynamics within the mining industry and the critical importance of proactive mitigation strategies in mitigating the impact of natural disasters. From the seismic vulnerabilities of underground mining operations to the challenges posed by wildfires encroaching upon surface facilities, each diorama offers a unique lens through which players can explore the intersection of science, engineering, and environmental stewardship.

The game is a powerful educational tool, fostering scientific literacy and promoting a holistic understanding of the intricate relationship

between human activities and the natural world. Through experiential learning and hands-on exploration, players are empowered to develop the critical thinking skills necessary to address the complex challenges of environmental sustainability and disaster resilience in the mining sector and beyond.

1. Accessed by the Purple Path is the town of **Quartz Ridge** and its **Railway line**. From here, the train carriages are loaded with copper concentrate to transport it from the pit to the port. The natural disaster scenario that potentially affects Quartz Ridge and its rail is **Bushfire**. Refer to pages 21 - 24 in the manual for more information.
2. The red path accesses the **Flood Scenario**, which is associated with the open pit known as the **Midas Mine** near Quartz Ridge. In the real world, open pit mines must have many mitigation strategies to prevent flooding, especially if they are located in high rainfall areas or near perennial streams subjected to tropical storm activity. Refer to pages 25 - 29 in the manual for more information.



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3. **Rattlerock** is the logistical centre for the mine and transport operations. Located near the open pit, the railway line and Quartz Ridge, it is accessed via the green path and is subjected to an **Earthquake**, representing a natural disaster. Please look at pages 30 - 34 in the manual for more information.



4. The fourth scenario or natural disaster is the **tsunami**. A tsunami is a huge wave created by fault movement along submerged plate tectonic boundaries or through the gravitational dislocation of landmasses into the ocean. The **port** and its associated town of **Shantytown** are on the northern Australian coastline, adjacent to the infamous Pacific Ring of Fire. If an earthquake occurs along these tectonic boundaries, tsunamis may affect the Australian coast. This scenario is accessed via the blue pathway. Please look at pages 35 - 39 in the manual for more information.

Students enter the Minecraft diorama and are greeted by Non-Playing Characters (NPCs), which provide students with basic information on continuing with gameplay.

They collect their book and quill, camera and personal protective equipment from the foyer and then are encouraged to interact with NPCs within the ERT facility.

Throughout the ERT facility, students can explore, find and record information regarding different natural disaster mitigation strategies in the dioramas surrounding the space. The students can download the journal and portfolio, export them, and email them to the teacher for assessment.

Once students have explored the facility, they can go to each natural disaster scenario (bushfire, flood, earthquake and tsunami) and test the mitigation strategies they have discovered.

Only 4 of the 14 mitigation strategies will be successful for each scenario. Through communication and collaboration with their fellow students, CoRE has found that RRR works best within the classroom setting.



Game 1 - Minecraft - 'RRR'

Resource Respond Rescue (RRR)

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How to use the game in your classroom? It is STEM Learning.

In a bold leap into the future of education, our game has been meticulously crafted to mirror the intricacies of the real world, drawing inspiration from the dynamic realms of **STEM (Science, Technology, Engineering, and Mathematics)**. Envisioned as a captivating journey through the RRR (Resource, Respond, and Rescue) world, students are beckoned to embark on an immersive adventure where collaboration is paramount, working in teams of 2 - 3.

Fueled by the spirit of teamwork, students are thrust into the heart of the action, tasked with unravelling the mysteries of science, unravelling complex problems, and devising ingenious strategies to safeguard a bustling mining town, its precious mine, intricate railway systems, and bustling port. Through this interactive experience, learners absorb scientific principles, hone critical thinking skills, and cultivate a spirit of innovation.

But the innovation doesn't stop there.

Our game serves as a springboard for a comprehensive term-long program, seamlessly integrating interdisciplinary science into its fabric.

From Earth Sciences to cutting-edge technologies, students traverse

diverse terrains of knowledge, all while delving deep into the intricacies of Science as a Human Endeavour (Refer to Pages 20-21).

Moreover, assessment and reporting are seamlessly woven into the fabric of gameplay, providing educators with invaluable insights into students' progress and proficiency. As students immerse themselves in this experiential learning journey, they are empowered to transcend mere spectators, becoming architects of their own learning destiny.

And the pinnacle of innovation lies in the culmination of this transformative experience: **creating a Minecraft Mining Town World**. With newfound knowledge and skills, students embark on a quest to fashion their own virtual utopia, drawing upon their ingenuity and research prowess to craft an unparalleled masterpiece.

Our approach epitomizes authentic STEM learning, where theory seamlessly converges with practice, and innovation knows no bounds. Through this visionary blend of gaming, education, and creativity, we ignite a spark within each student, propelling them towards a future brimming with limitless possibilities.

*Welcome to the future of learning.
Welcome to the RRR world.*

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Alternatively, we also propose a modular approach to learning, where a series of lessons unfold for a diorama or even a pair, offering a tactile and immersive experience. This allows for tailored, in-depth exploration, which is ideal for meeting specific curriculum requirements or time constraints.

Within this booklet lies a treasure trove of insights, meticulously crafted to delve into the intricate nuances of each diorama. Here, scientific principles intertwine seamlessly with real-world applications, offering a glimpse into the dynamic interplay between theory and practice within the confines of a fictitious mining town.

As you navigate through each diorama, many ideas and extension tasks await, beckoning educators to chart a course that resonates with their programming strategy. From unravelling complex concepts to envisioning career pathways, the possibilities are as vast as the endless expanse of the Australian Curriculum V9. Yet, this isn't merely a journey of isolated fragments. Rather, it serves as a bridge, connecting dioramas into a cohesive narrative, where the overarching game concept comes to life.

By delving deep into the integrated Science as a Human Endeavour curriculum, educators are empowered to pose thought-provoking questions, laying the groundwork for a holistic program design.

Let this system serve as your launching pad, propelling you towards a future where learning transcends boundaries and innovation knows no limits. With each diorama as a stepping stone, we embark on a journey of discovery, fueled by curiosity and guided by the promise of a brighter tomorrow. Welcome to a new era of education, where the game of learning unfolds before your very eyes.



Quartz Ridge & The Bushfire

Diorama 1 - Key concepts, learning ideas and associated careers.

Concepts	Ideas	RRR Careers
• Energy Transfers • Energy Transformations • Energy Systems	• Fire and lightning • Energy • Electrical Energy • Heat and Light	• NPC Bushfire Expert • NPC Town Fire Chief
• Reversible and Non-Reversible Reactions • Combustion Reactions	• Chemical Reactions • Reactants and Products • Retardants	• NPC Bushfire Expert • NPC Town Fire Chief
• Natural Ecosystems • Anthropogenic Impacts	• Australian Bush • Abiotic & Biotic Elements • Food chain & web systems	• NPC Bushfire Expert • NPC Town Fire Chief
• First Nations Traditional Management Systems	• Seasons • Cool Burning • Land Management	• NPC First Nations Fire Expert
• Anthropogenic Management Systems	• Fire mitigation strategies traditional and contemporary	• NPC ERT Leader • NPC Environmental Ranger

Quartz Ridge & The Bushfire

Australian Curriculum Connections    

Year	Science	HaSS
3	Physical Sciences <u>AC9S3U03</u> identify sources of heat energy and examine how temperature changes when heat energy is transferred from one object to another	History <u>AC9HS3K01</u> causes and effects of changes to the local community, and how people who may be from backgrounds have contributed to these change
5	Biological Sciences <u>AC9S5U01</u> examine how particular structural features and behaviours of living things enable their survival in specific habitat	
6	Biological Sciences <u>AC9S6U01</u> investigate the physical conditions of a habitat and analyse how the growth and survival of living things is affected by changing physical conditions Physical Sciences <u>AC9S6U03</u> investigate the transfer and transformation of energy in electrical circuits, including the role of circuit components, insulators and conductors	

Quartz Ridge & The Bushfire

Australian Curriculum Connections   

Year	Science	HaSS
6	<u>Chemical Sciences</u> <u>AC9S6U04</u> compare reversible changes, including dissolving and changes of state, and irreversible changes, including cooking and rusting that produce new substances	
8	<u>Chemical Change</u> <u>AC9S8U07</u> compare physical and chemical changes and identify indicators of energy change in chemical reactions	
9	<u>Earth and Space Sciences</u> <u>AC9S9U03</u> represent the carbon cycle and examine how key processes including combustion, photosynthesis and respiration rely on interactions between Earth's spheres (the geosphere, biosphere, hydrosphere and atmosphere)	

Quartz Ridge & The Bushfire

Australian Curriculum Connections

RRR - Extension Ideas

Science Investigation	Activity
1. Eucalyptus Oils. Which eucalyptus leaves burn the fastest? Describe how the combustion reaction occurs in this environment. 2. Oil energy. Identify the best oil to heat water the quickest. What are the energy transformations that occur in this process?	1. Create a model that describes the energy transfers and transformations that occur during the formation of lightning in a thunderstorm to sparking a fire in an arid, desert environment. 2. Write a bushfire poem that reflects their common occurrence in Australia and how diagnostic they represent the Australian landscape. 3. Design and make a diorama that demonstrates First Nations bushfire and land management strategies.

Midas Mine & The Flood

Key concepts, learning ideas and associated careers.

Concepts	Ideas	RRR Careers
• Water Cycle • Kinetic Theory of Matter	• Flooding and extreme weather conditions • Changes in state of water as a part of extreme weather systems • La Nina/El Nino	• NPC ERT Leader • NPC Hydrologist • NPC Meteorologist • NPC Pastoralist
• Earth Resources • Non- Renewable Resources	• Rocks and minerals and the metals they contain to sustain our society	• NPC ERT Leader
• Landscapes	• Formation of rivers and valleys • Weathering and erosion • Desert inland lake systems	• NPC Hydrologist • NPC ERT Leader
• Infrastructure Protection	• Alteration of drainage systems • Underground/acquifer water systems	• NPC ERT Leader • NPC Hydrologist • NPC Civil Engineer

Midas Mine & The Flood

Australian Curriculum Connections.



Year	Science	HaSS
3	Earth and Space Science <u>AC9S3U02</u> compare the observable properties of soils, rocks and minerals and investigate why they are important Earth resources	
4	Earth and Space Science <u>AC9S4U02</u> identify sources of water and describe key processes in the water cycle, including movement of water through the sky, landscape and ocean; precipitation ; condensation; and evaporation	Geography AC9HS4K05 <u>the importance of environments, including natural vegetation and water sources, to people and animals in Australia and on other continents</u>
5	Earth and Space Sciences <u>AC9S5U02</u> describe how weathering, erosion, transportation and deposition cause slow or rapid change to Earth's surface Chemical Sciences <u>AC9S5U04</u> explain observable properties of solids, liquids and gases by modelling the motion and arrangement of particles	Geography AC9HS5K05 the management of Australian environments, including managing severe weather events such as bushfires, floods, droughts or cyclones, and their consequences Civics and Citizenship AC9HS5K07 how citizens (members of communities) with shared beliefs and values work together to achieve a common goal

Midas Mine & The Flood

Australian Curriculum Connections.



Year	Science	HaSS
8		Geography AC9HG8K01 <u>geomorphological processes that produce different landscapes and significant landforms</u>

RRR - Extension Ideas

Science Investigation	Activity
1. Storm'in water. Model different desert river systems to identify the flow rate and amount of erosion following a heavy rainfall event. 2. Levee modifications. How do levee banks work to protect a mine and it's town from a severe flooding event.	1. Build an open-pit mine. Research an Australian open-pit mine and make a traditional or digital scaled model of the open-pit, including the natural landscape. 2. Weather in a bottle. Simulate the formation of a tropical cyclone in a bottle. Identify suitable materials that can be used to make different weather systems.

Rattlerock and the Earthquake

Key concepts, learning ideas and associated careers.

Concepts	Ideas	RRR Careers
• Earthquakes • Plate tectonics • Faultlines	• Forces that cause an earthquake • Energy transfers and transformations during an earthquake • balanced and unbalanced forces • Earthquake prediction and coincidences	• NPC ERT Leader • NPC Seismologist
• Earthquake Proof Infrastructure	• Buildings and forces • balanced and unbalanced forces • tension and contraction • Energy • Forces	• NPC ERT Leader • NPC Shire Utilities Manager • NPC Civil Engineer • NPC Shire Town Maintenance

Rattlerock & The Earthquake

Australian Curriculum Connections.



Year	Science	HaSS/DDT
4	Physical Sciences <u>AC9S4U03</u> identify how forces can be exerted by one object on another and investigate the effect of frictional, gravitational and magnetic forces on the motion of objects	Civics and Citizenship <u>AC9HS4K07</u> the differences between rules and laws, why laws are important and how they affect the lives of people
7	Physical Sciences <u>AC9S7U04</u> investigate and represent balanced and unbalanced forces, including gravitational forces, acting on objects, and relate changes in an object's motion to its mass and the magnitude and direction of acting on it	Design and Digital Technology <u>AC9TDE8K03</u> <u>analyse how force, motion and energy are used to manipulate and control engineered systems</u>
8	Earth and Space Sciences <u>AC9S8U03</u> investigate tectonic activity, including the formation of geological features at divergent, convergent and transform plate boundaries and describe the scientific evidence for the theory of plate tectonics	

Rattlerock & The Earthquake

Australian Curriculum Connections.



Year	Science	HaSS/DDT
8	<u>Physical Sciences</u> <u>AC9S8U05</u> classify different types of energy as kinetic or potential and investigate energy transfer and transformations in simple	<u>Design and Digital Technologies</u> <u>AC9TDE8K03</u> <u>analyse how force, motion and energy are used to manipulate and control engineered systems</u>

RRR - Extension Ideas

Science Investigation	Activity
Liquifaction following an earthquake. Which lego building will collapse first? Playdoh and Lasagna Faultlines. Which combination of playdoh and lasagna sheets will cause the greatest energy release and most destruction?	- Build a Pagoda. What materials will you use to build a Pagoda accurately? - Make a seismometer. What is the best way to make a seismometer and it's richter scale? Is there an app that can be used to help measure vibrational activity? - Script and storyboard a documentary on earthquakes and their affect on society.

Shantytown and the Tsunami

Key concepts, learning ideas and associated careers.

Concepts	Ideas	RRR Careers
• Earthquakes • Plate tectonics • Faultlines • The Ring of Fire	• Forces that cause an earthquake • Energy transfers and transformations during an earthquake	
• Tsunami	• Formation of Tsunami • Speed and velocity • Displacement • Energy of Impact • gravitational forces	
• Protective Structures	• balanced and unbalanced forces	

Shantytown & The Tsunami

Australian Curriculum Connections.



Year	Science	HaSS/DDT
4	Physical Sciences <u>AC9S4U03</u> identify how forces can be exerted by one object on another and investigate the effect of frictional, gravitational and magnetic forces on the motion of objects	
7	Physical Sciences <u>AC9S7U04</u> investigate and represent balanced and unbalanced forces, including gravitational forces, acting on objects, and relate changes in an object's motion to its mass and the magnitude and direction of acting on it	Design and Digital Technology <u>AC9TDE8K03</u> <u>analyse how force, motion and energy are used to manipulate and control engineered systems</u>
8	Earth and Space Sciences <u>AC9S8U03</u> investigate tectonic activity, including the formation of geological features at divergent, convergent and transform plate boundaries and describe the scientific evidence for the theory of plate tectonics	

Shantytown & The Tsunami

Australian Curriculum Connections.



Year	Science	HaSS/DDT
8	<u>Physical Sciences</u> <u>AC9S8U05</u> classify different types of energy as kinetic or potential and investigate energy transfer and transformations in simple	<u>Design and Digital Technologies</u> <u>AC9TDE8K03</u> <u>analyse how force, motion and energy are used to manipulate and control engineered systems</u>

RRR - Extension Ideas

Science Investigation	Activity
1. Creating waves. Investigate how tsunamis are formed using a combination of playdoh, water and a displacement mechanism. How far does the tsunamis travel over the land? 2. Flooding tsunami. Create an undulating landscape using a series of topographic levels, including a port and town and identify the effects of different degrees of flooding water. What forces are involved in this activity?	1. Tsunami Generation. Create a 3D model of a tsunami caused by the deep sea displacement of converging plate boundaries. Research a historical tsunami to base the model design. 2. Create a tsunami dance. Choreograph a series of steps that represent the energy transfers and transformations, and forces involved in the movement of plate boundaries, fault types, earthquake generation, tsunami formation and its destructive impacts. Identify an appropriate song to express and communicate the scientific knowledge.

RRR - Integrated Scientific Approach

Creating your own Mine



SHE - Science Human Endeavour	Ideas
<u>AC9S3H02</u> (Y3) consider how people use scientific explanations to meet a need or solve a problem	• Research to identify problems associated with natural disasters and human occupation • Mitigation strategies for all dioramas
<u>AC9S4H01</u> (Y4) examine how people use data to develop scientific explanations	• research historical data to understand the concepts of flooding, bushfires, earthquakes and/or tsunami impact
<u>AC9S5H01</u> (Y5 & 6) examine why advances in science are often the result of collaboration or build on the work of others <u>AC9S5H02</u> (Y5 & 6) investigate how scientific knowledge is used by individuals and communities to identify problems, consider responses and make decisions	• Investigate why it requires a collaboration of scientists and engineers to manage natural environments to prevent land degradation and to maintain safety for humans and their infrastructure • Analyse data that demonstrates how teams problem-solve to make decisions for mitigations, safety and environmental sustainability

RRR - Integrated Scientific Approach

Extension Tasks.



SHE - Science Human Endeavour	Ideas
<u>AC9S7H01</u> (Y7 & 8) explain how new evidence or different perspectives can lead to changes in scientific knowledge	research and investigate how First Nations sustainability practices can be employed for environmental sustainability practices
<u>AC9S7H04</u> (Y7 & 8) explore the role of science communication in informing individual viewpoints and community policies and regulations	Understand how science fundamentally is used to explain how things happen and how solutions can be engineered for anthropogenic and environmental sustainability



Glossary

General Capabilities



Critical and Creative Thinking



Sustainability



Numeracy



Literacy



Personal and Social Capability



Intercultural Understanding



Ethical Understanding