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PATHWAYS ACROSS THE AUSTRALIAN CURRICULUM

This work was researched and written by Dr Bronwyn Stuckey.

Acknowledgements

Bron has been engaged in educational community and games in learning for the past 17 years. She earned her PhD researching the core factors supporting successful online communities of practice. That PhD led her to understand the possibilities for transformational learning that might be gained through game-based learning practices. She champions Minecraft as a learning space and environment for the lived curriculum of digital citizenship. Bron is a Global Minecraft Mentor and advocate for the next wave of teacher uptake of Minecraft: Education Edition.

This work has been created in consultation with leaders in education across the country.

Joachim Cohen, Schools Technology Innovation Lead -Technology for Learning Team | Information Technology Directorate

Laurens Derks, Learning Designer – STEM Share Program | Information Technology Directorate

Ashleigh Smith, Manager | Information and Technologies Branch
Department of Education

Paula Lammers, Senior Information Resource Officer | Information and Technologies Branch, Department of Education

Brooke McNamara, Acting Manager, Digital Tools and Systems Unit/Virtual Learning | Learning and Teaching Branch

Stephen Elford, Senior Project Officer, Digital Learning Coach | Digital Practice Unit | Learning and Teaching Branch

Where do I start?

There are many pathways into the curriculum for Minecraft: Education Edition. You might start with a club, focus on an event or competition and move more mainstream over time as everyone gains confidence and skill. Or you might develop a specific vision for Minecraft's role in a unit of work and step straight into a full curriculum integration pilot. You do need to acquaint yourself with the in-world environment. You do need to tinker in Minecraft worlds to at least get a feel and create a vision for where you might take it.

> *"The teachers who benefitted the most from the Minecraft curriculum were those, who were willing to engage themselves in understanding the game and identify, communicate and assess relevant curricular aims." (Hanghøj & Hautopp, 2016)*

As a teacher, you don't need to be the expert in Minecraft's game technology to create engaging and worthwhile learning experiences. You will likely never be as expert with the technology as your students. And that's OK. Learning is best served when teachers act as pedagogical game master and a co-learner to their students (DEECD, 2011), establishing an environment where risk taking is supported for all. Be prepared to 'follow the learning' (Malmstrom, 2014) by leaving room in your plans for students to surprise you. They will take the game places you might never have considered.

Three suggested ways to get things going for you and your classroom:

1. Kickstarter for teachers totally new to Minecraft (build your confidence and mojo)
2. Invest in a challenge-based approach (club or class based)
3. Take the Deep Dive (full curriculum alignment and integration).

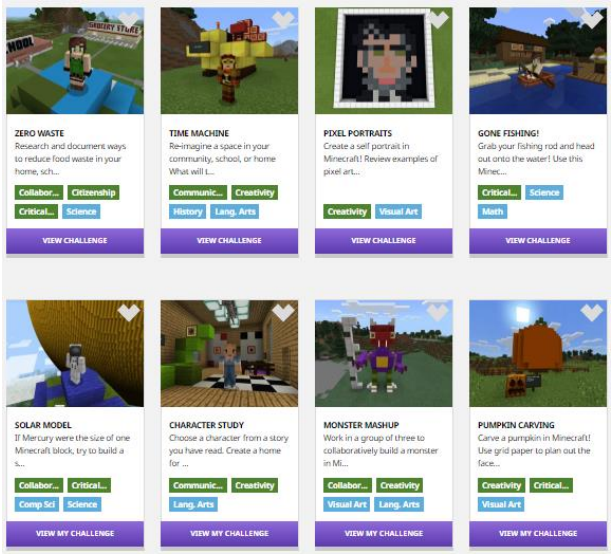
1. Minecraft Teacher Kickstarter

Teacher Kickstarter *<link to be added here >* offers teachers new to Minecraft (even teachers sceptical of its value) five gentle steps to gain confidence with the game and build their own vision for its use. It's a chance to 'dip your toes' and evaluate Minecraft's value in your classroom context. The starter represents less than 1.5 hours in total; 45 minutes of hands-on teacher fun and 30-45 minutes of engaging class time activity. *A version is also available to kickstart teacher teams. *<link to be added here >*

2. Challenge Based Development

Minecraft can be something you dive into in regular small bite-sized activities or it can be a deep immersive dive. Build Challenges can be a great way for a teacher to see how students embrace the tools and by observation and participation improve her/his own skills.

You might pull from the Minecraft: Education Edition Build Challenges, the growing list of globally crowd sourced challenges in 101 Minecraft Challenges, or the gamified series of challenges in the Minecraft Survival Quest Challenge from USA educator Lucas Gillispie.



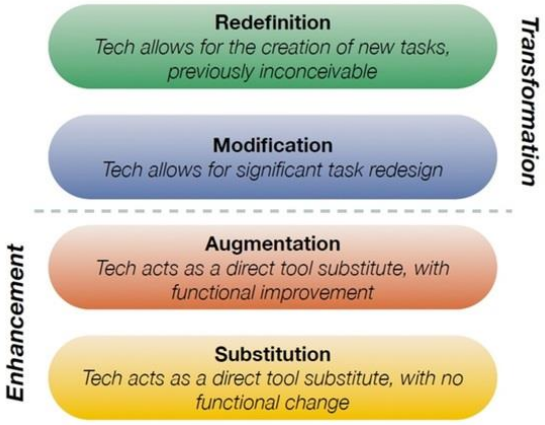
Starting from a framework of challenges can be very useful. These challenges can be used for a low stakes introduction or proof of concept/fit for purpose right through to formative and summative assessment tasks. Peruse them regularly to see what has been added and contribute your own (and your students challenge ideas) to the mix. These challenges serve as your preparation for taking the curriculum deep dive and as a fun way for everyone to develop their skills. Establish a regular time for classroom challenges. Sarah Guinan in South Australia very successfully ran Challenge Friday in her school where students across the school engaged in the same challenge. Create a win or reward state where winning students can select the challenge for the following week. Join a team yourself or create a teacher team and join in the fun!

You and your students can create and contribute your own challenges to the existing resources, thereby sharing them for others to benefit.

3. Take the curriculum deep dive

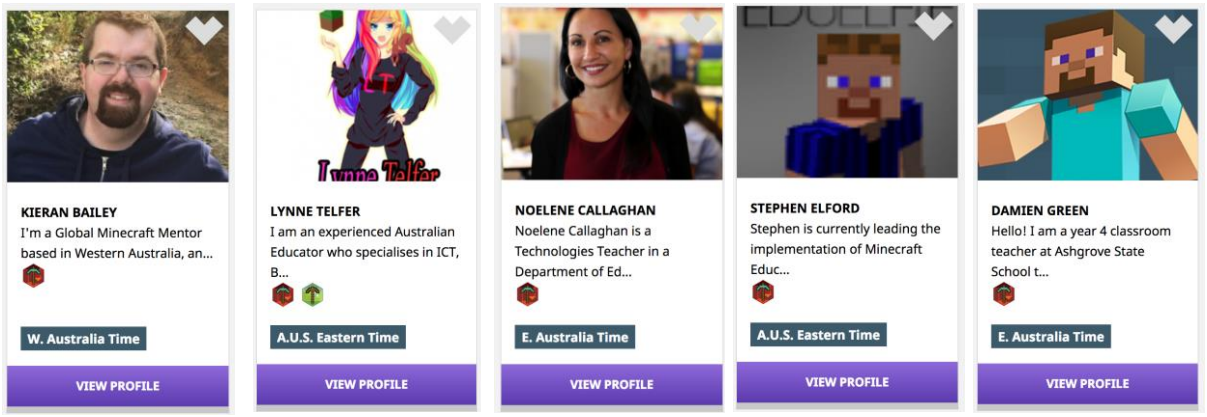
The lesson ideas that follow represent levels of the deep dive curriculum relationship that is possible in Minecraft. They are all tried and tested lessons from innovative educators across Australia and around the globe. For each lesson possibilities for effective use in the Australian Curriculum with suggested key ACARA (2017) learning areas, year levels, strands and content descriptions have been identified.

Each lesson also reflects a thoughtful opportunity for pedagogical enhancement and transformation as identified by the SAMR Model (Puentedura, 2013).



Look at upcoming curriculum and the places that might call out for a new approach. These are the places where we know we are not reaching our students or not serving them well with more traditional practices. Once you know where to start, think about how. Minecraft: Education Edition has been employed effectively across most curriculum areas and is the kind of tool that you will want to harness throughout the school year.
It serves to immerse learners equally in living through an historical/social event, designing new art forms or applying mathematics or science to demonstrate knowledge. It can kick off a program of work or be used as an assessment task. If student accounts have been established, and they are continually growing in skills, they will be able to jump into a new integrated task or challenge with very little lead in. Minecraft's value is critically dependent on teacher creativity and purposeful placement in the learning context.

You are not alone! Minecraft: Education Edition is supported by a vibrant community of educators from about the globe. Some are just getting started and others are steeped in its educational use. In 2018 there were over 300 Global Minecraft Mentors, many in Australia, available to support your planning and assessment for classroom implementation of Minecraft.



These are just some of the dedicated Australian educators you can locate through the Global Mentor site. The online community also includes classroom educators local in your state, in Australia or globally, sharing ideas and willing to support your efforts. You will be introduced to some of those educators and community spaces through this resource.

Create community in your school

While it is undeniably valuable for a single teacher to embrace Minecraft's affordances, the curriculum is better served when cohorts or teams of teachers innovate together. Year/Stage/Learning Area teams or school wide groups can create grounded evaluations (a chance for evidence-based practice) of Minecraft: Education Edition's value for the local context. Finding out where, for whom and when it best fits is vital to serving student learning needs. Pilots in Minecraft should be used for grounded classroom investigations and could benefit when tied, formally or informally in various research methods; Action Research (Mills, 2006), Design Based Research (DBR) (Wang & Hannafin, 2005), Design Based Implementation Research (DBIR) (Fishman et al, 2013) and Action Learning (Revans, 2011) for teacher professional learning.

Try one of these fun ideas to scaffold a team or whole school uptake of Minecraft:

- Host a pizza and play afternoon – Happy Hour if you like, where teachers can play, have a laugh together, gain confidence while they chat about possible curriculum alignments. You'll be surprised how effective this can be at breaking down barriers.

- Encourage colleagues to allow Minecraft: Education Edition as an option for students in design, creative or presentation tasks. Seeing where students can take this often creates a new vision for their teachers.

- If you are the 'lone ranger' experienced in Minecraft, open your classroom and invite other teachers to visit, to join in, sit and talk with your students. Create time for the visiting teachers to discuss what they saw and what they think they might apply.

- Take part in a staff development day or staff meeting to initiate the Teacher Team Kickstarter* <link here> activity. This is a total of 1.5 hours of activity for teachers carried out together and separately within classrooms. Teachers all teach the same small challenge. Try to visit each other's classrooms while this challenge lesson is being completed. From the debrief of a shared experience teachers can discuss the outcomes and make plans for further integration.

- If your class has been in Minecraft for some time, have your students design projects for other classes and teachers. Canvas what teachers might have coming up in their curriculum and then set each required topic as a PBL project for student teams. They might design worlds, questions and challenges to give teachers a creative head start. This idea is adapted from Jung Koo's project for Minecraft roll out at Chatswood Public School.

- Host a lunch time student Minecraft club with monthly challenges. Use staff meetings to collectively generate a challenge topic (and report results) and rotate through different curriculum learning areas. This way you give other teachers a vested interest in the club activity and the performance of students.

- If teachers have some experience, select a challenge from the Minecraft: Education Edition Build Challenges and host a monthly or term-based challenge competition across the school/learning area. Celebrate how diverse and creative the solutions are. Publish designs and results in the school news for parents to share in the fun.

Assessment and Evaluation Considerations

Parents very often ask “My child plays Minecraft for hours at home, why should they play this at school?” Educators can address this concern by having a clear focus for game integration and effective strategies for its assessment and evaluation. Clear learning goals are required from the outset and to make informed and evidence-based decisions. Consider each new Minecraft project/pilot as an opportunity to add to that evidence-based practice by acting as a ‘teacher researcher’ and create evidence.

Use a multidimensional assessment strategy. While Minecraft can often be about creating a product, it is important to not purely focus on that product or artefact. We need to be able to articulate Minecraft’s contribution to gains in curriculum learning areas.

Focus on formative practices:

- Rubrics to assess the learning intentions
- Observation of play, discussion and collaborations, ask questions, track student moves, have them evaluate their choices
- Take notes of breakthroughs and struggles during play
- Minecraft camera and portfolio tools for students to choose their own points of assessment
- Make reflection sessions part of every play experience as an opportunity for student articulated learning
- Written and oral reflections
- Student presentations and reporting
- Pre- and post-play content knowledge tests and tasks
- Built in assessment tasks strategically placed in-game
- Create awards and rewards to track and motivate successful completion of project milestones
- Individual and team assessment, peer assessment
- Providing continual and effective feedback.

Tools built into Minecraft: Education Edition like the camera and portfolio readily lend themselves to student-engaged assessment (Bergen, Rugen & Woodifin, 2013) and student-articulated learning (Hattie, 2012). Students can nominate their own points of assessment in-world, to reflect on and explain why the stages or breakthroughs identified were significant (cognitive) for them and what they represented in their learning (metacognitive). The Minecraft: Education Edition Community further offers assessment ideas and peer support.

Technological Considerations

Get into map making

- Use Seeds Benjamin Kelly (UK) @bbtnb offers great advice and sample SEEDS (starters to new worlds) to be used in world building.
- If you want to get into map making, then look at @MapMakingMag
- Convert existing maps Joel Mills (UK) @iLearningUK has created a series of video guides to help conversion of existing maps for use in Minecraft: Education Edition.
- Make templates of worlds Matt Coia (USA) @coiascience has a video to support for creation of templates of existing or pre-created Minecraft worlds.

Explore tool and media integration

- Graph paper and/or Lego to design, test ideas and then realise them in Minecraft
- *Code Builder* is a tool built into Minecraft that allows students to program agents externally to build in-world from their coded instructions
- Export *Google Sketchup* into/or design in *TinkerCad* importable 3D models (Minecraft) and take them out through *MCedit* (for Minecraft: Education Edition).
- *Use FAWE or MCCToolChest PE to* convert worlds to be *Minecraft: Education Edition* compatible.

Companions to Minecraft in-world

- *Minecraft Classroom Mode* is a companion app that allows teachers to manage in-world activity from outside the actual Minecraft: Education Edition game
- The built-in *Minecraft Chemistry Resource Pack* allows experiments with elements and compounds.
- The built-in Update Aquatic now allows for aquatic worlds and lessons
- *OneNote*, Wikis and blogs for PBL are excellent for hosting discourse, files, and sharing all forms of student differentiated evidence of learning
- *BreakOutEdu* has downloadable worlds that integrate with Minecraft: Education Edition and employ the *BreakoutEdu* process of unlocking in-world challenges.

Take Minecraft beyond the game

- *Microsoft Sway*, *FlipGrid*, or *Powtoon* to share and showcase projects and their impact
- Storytelling tools like *Comic Master* or *Storybird* to create visual or text based narrative experience from Minecraft projects
- Screencast tools like *Adobe Captivate* or *Jing* can be used to capture evidence and document building, construction journeys or create machinima
- Export, render and 3D print Minecraft models with *Mineways* or *Tinkercad* or *Sketchfab*
- Create mixed reality or virtual reality immersive experiences with *Microsoft Mixed Reality* or (*Win10*) *Microsoft HoloLens* and *SketchUp Pro*.

Curriculum roundup

What follows is a collection of some of the most successful implementations which have been mapped across the Australian Curriculum (ACARA, 2017). Most of these activities were devised by practicing classroom teachers. This is important to note, because Minecraft not only provides opportunity for student creativity but, as many teachers report, it's a place where they are unleashing their own creativity. You might take up these ideas, tweak them for your own learning areas or they may inspire you to create a new lesson of your own. Do share your creativity in the ever-expanding collection of lessons in the Minecraft: Education Edition Community.

ENGLISH

Minecraft as a design tool can allow students to convert imagination into a tangible reality, to make the tacit explicit. Linking textual, visual and virtual creations can be not only a great stimulus for content discussion, but an opportunity for students to articulate emotions, attitudes, understandings and values. Minecraft can be applied across all language modes of Reading and Viewing, Writing, Speaking, and Listening. Here are some of those ways.

Creating scenarios (SAMR)

Playing in survival mode students imagine a scenario that placed them in this hostile dangerous world. (e.g. boat wreck, plane crash) and write a daily journal/diary of their experience. Play sessions need only be 20 minutes then briefly journaling their reflections and imaginings in the role play experience. Year Levels 2-6 Literature: Creating literature, Literacy: Creating texts.

Fairy Tale Re-Imagined (SAMR)

Students working in groups re-create a favourite fairy tale or children's story in Minecraft. Students build the world and incorporate narrative. Students employ in-world narrative tools such as the slate, poster, board, sign, or Non-Player Character (NPC) As an extension activity, more experienced students can add elements using Redstone and other tools to create a more interactive experience for the 'reader'. Add a twist by having the students reimagine the story in a totally different time or context (2018, Outback Australia, as characters on TV). Original lesson designed by Steve Isaacs (USA). Year Levels 3-6 Literature: Creating literature, Literacy: Creating texts. Year Levels 2-6 Media Arts: Explain how the elements of media arts and story principles communicate meaning by comparing media artworks from different social, cultural and historical contexts.

Avatar backstories (SAMR)

Students select a Minecraft avatar or 'skin' and create a back story. Take the avatar into a world. Depending on the scenario and world chosen students might consider; How did they get to the land? What do they want to achieve (e.g. get rich mining for gold or create an amazing monument)? Who will be their allies in the world? What is their story? Share stories orally then record using the camera and portfolio to capture the avatar in-world and write the accompanying backstory. Year Levels 3&4 – Literature: Creating literature, Literacy: Creating texts.

Create the setting (SAMR)

To enhance student discussion on a story or book have students as individuals or groups re-create the setting in Minecraft. Students should discuss what they know or imagine and map out on paper before building in-world and include as many details as possible. This could be done for a shared single piece of literature or used to compare scenes across class literature. For instance, build the imaginary world of Terabithia or compare the bedrooms of Harry Potter, Anne Frank, or Early. Year Levels 3-6 Literature: Examining literature, Responding to literature.

Build in-world representations (SAMR)

Student created worlds can be archived for student portfolios in various other media. Students archive designs by outputting and critically selecting screen shots to create graphic novel, record video walkthroughs or flyovers to create machinima or animation products. Year Levels 3-6 Literacy: Creating texts: Digital Technologies – Year Levels 3-6 - Creating digital solutions.

Writing prompts (SAMR)

Students create imaginative environments in-world with their own backstories, then create related writing prompts for peers or younger students. They imagine the stories that could be told about this place and combine in-world designs, screen captures and a one or two sentence imaginative challenge. "*You are standing in front a massive stone castle. How did you come to be here? Share your journey*". Year Levels 4-6 Literature: Creating literature, Literacy: Creating texts.

Timelines and perspectives of characters and events (SAMR)

Have students use *Villagers and NPCs* in Minecraft to devise a timeline of historical activity, characters in class literature, or to retell or summarise a story or tell the story from a different character's perspectives. Students in creative mode can spawn villager or eggs and can add accompanying boards or book & quill to tell their story. For more advanced students, the teacher might grant *World Builder* rights to create Non-Player Character (NPC) interactive stories. Using the text dialog entry and interactive capability players NPCs can engage with players to tell their story. Or NPC stories could be published elsewhere online, the URL offered in-world by the NPC to link out.

Year Levels 4-6: Literature: Examining literature, Responding to literature, Language: Expressing and developing ideas; Year Levels 4-6 Digital Technologies: Creating digital solutions.

Exaggeration (SAMR)

The students think of an autobiographical event in their life, exaggerate a part of the story to make it larger than life. Roald Dahl does this for his own story *Boy* and in *The Great Mouse Plot*. Both could be used as examples to read and discuss how exaggeration was used. Students will storyboard and create their story in Minecraft. Lesson ideas and prompts on this experience have been supported by The Roald Dahl Museum in partnership with Minecraft: Education Edition. Year Levels 4-6 – Language: Expressing and developing ideas; Literature: Creating literature.

Reason to Write (SAMR)

Use Minecraft play/builds as stimulus for writing in descriptive, procedural and creative text types and employing multimodal elements (print, image, spoken text etc.). This activity was adapted from ideas from Jacqui Murray (USA) K-8 technology teacher. Here are some ideas: In free play in a survival world encourage students to collaborate to support surviving.

- Discuss why you collaborated with others in surviving this world. What did others add to your success? Write about the value of collaborations.
- Write about a new approach you used in your play that you haven't used before. Look for creativity, critical thinking, and problem-solving in action.

When building a realistic world (e.g. history, geology, geography, chemistry) students write about:

- The research they did to make the world more realistic and workable.
- A critical comparison of their build and the physical world. How much authenticity could they create?

Year Levels 4-8 Language: Language for interaction, Expressing and developing ideas Literacy: Interacting with others, Creating texts.

Recording goals and reflections of play (SAMR)

Regardless of the curriculum focus, journaling goals and reflections is an authentic and meaningful exercise. Using a journal, wiki, or chosen writing tool challenge the students to write about what they're going to do in-world today before they log in. What are their plans or goals? Are they going to learn new skills, test a new idea, help a classmate, or create a new community? Reflect on what did they accomplish and what new ideas and strategies might they try next time? Years 5&6 Levels - Language: Expressing and developing ideas, Literacy: Creating texts; Year Levels 5&6 - Critical and creative thinking.

Procedural writing (SAMR)

Students write a strategy guide for new students on carrying out a specific task in a Minecraft world (e.g. mining for gold, surviving the night, farming animals, completing a maze). They review existing game strategy guides to understand format, and then work in teams to draft and publish their own guide. Stages of the procedure should be accompanied by screen captures using the in-world camera. Year Levels 5&6 – Literacy: Creating texts.

Story visualization (SAMR)

Have students reconstruct various scenes and settings from a text and plot events. This task could be carried out while reading adding to the world as more detail eventuates. Or it could be carried out or as a point of discourse part way through reading. Students would use these recreations to give a presentation (the story so far) or make predictions (what might happen next), and then actually create the world of those predictions. These predictions could also go beyond the text. Where were the characters in 10 years' time? What if this story had taken place in another place or time? This activity could be carried out in small literature circles based on student reading ability and interest. See Kieran Nolan's (Aus.) students demonstrating their build to accompany the chapters of *The BFG*. Year Levels 5&6 – Literature: Examining Literature.

Informed by literature (SAMR)

In the novel, *The Time Machine*, HG Wells presents his vision of the future. This vision is specific but open so students have opportunity to both critique and complete this vision. Through cross-curricular studies students can utilize their knowledge of biology and political science to influence their critique and completion of HG Wells' vision of the year 802,701. Lesson created by Ben Spieldenner (USA). Year Levels 7-9 Literature: Responding to literature; Literacy: Creating texts.

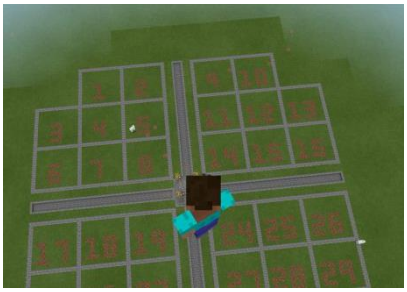
Argumentative essay (SAMR)

Consider what happened years after the deaths of Romeo and Juliet? Did the inhabitants of Verona truly forgive one another? The Shakespeare classic, Romeo and Juliet, leaves readers with a city previously plagued by the constant fighting of two powerful families. If the fighting ends abruptly how does Verona begin to function in this new peace? Students explore these ideas through an adventure, collecting evidence as they go, that ultimately leads to an argumentative essay in which they attempt to regain their freedom.*Project and downloadable world created by Simon Baddeley (UK) and Ben Spieldenner (USA). The learning experience is also supported by a video unpacking the play experience. Year Levels 7-9 Literature: Responding to literature; Literacy: Creating texts; Language: Expressing and developing ideas.

Embody a Ballad (SAMR)

Students are invited to represent their understanding of the narrative elements within a ballad through a creation in Minecraft. Working in groups they select a ballad to represent in-world, build, and then write an accompanying reflection statement that unpacks the visual choices in relation to the ballad's narrative. This could be an excellent assessment task at the close of the literary study. This activity was adapted from ideas in a lesson by Belinda Koloska (Aus.) Year Levels 7-9 Literature: Examining literature, Creating literature Year Levels 7-9 The Arts: Understand how Media Arts works.

MATHEMATICS



Minecraft allows students to know, understand and use mathematical thinking and language. Teachers need to encourage math discussions around student builds and challenges. The more the teacher can encourage the use of mathematical language while students are describing their builds in Minecraft, the deeper their understanding of the math ideas will be (Curran & Kersaint, 2015, p. 2).

Mathematics Subject Kit (SAMR)

The Mathematics Subject Kit is a compilation of Year 3 and 4 suitable, mathematics sample lessons, starter worlds, training videos, and connections to other Minecraft mathematics educators. It demonstrates the variety of activities that can be carried out in Minecraft and the value of having established accounts that permit students to seamlessly dive in-world to tinker with mathematical concepts. The accompanying Alignment Guides for grade 3 and grade 4 are examples of how Minecraft activities and lessons can be aggregated to create a scope and sequence, a progression of curriculum focussed activities.

While this guide is mapped to the USA standards the activities described can readily be adapted to support ACARA Year Level 3 content descriptors:

- Numbers and Algebra: Numbers and place value, Fractions and decimals, Patterns and algebra
- Measurement and Geometry: Using units of measurement, Shape, Location and transformation, Geometric reasoning
- Statistics and Probability: Data representation and interpretation.

Ratios in Crafting (SAMR)

In Minecraft (survival mode) crafting formulae are used to produce all required resources. Your students can engage in explorations and challenges to explore the ratios of these formulae. I have 60 wooden planks. How many doors can I make? I have 64 iron ingots and 32 Redstone. How many compasses can I make? Year Levels 4-6 Number and Algebra - Patterns and algebra.

Calculation of unit rates (SAMR)

Student determine, through investigation, the relationships between fractions, decimals, percentages, and ratios. Students create objects of 10 and 100 blocks. Teacher sets time-based challenges for students to colour specific fractions, break a certain percentage, or exchange/swap blocks to complete specific ratios. The teacher could create a card deck of challenges that can randomly deliver challenges for individual or team competitions in-world. Year Levels 4-6 Number and Algebra: Fractions and decimals; Measurement and Geometry: Using units of measurement.

Dealing with Proportion and Scale (SAMR)

Working in single player mode and in creative students build in-world scale representations and models of famous three-dimensional objects (e.g. SpaceX Rocket. Tyrannosaurus Rex, Melbourne Cricket Ground, Eureka Skydeck, Wind turbine, Luna Park etc.). Students will need to research the size and dimensions (height, length, width) of their chosen object then through drawing on grid paper and discussion create a scale to build in-world. What will one block equate to? Can you estimate the number of blocks that will be used? Discussion and experimentation will emerge about how to simulate curves (dinosaur head) and angles (blades on a turbine) in a block build world. Year Levels 4-6 Measurement and Geometry: Using units of measurement; Location and transformation.

Tragedy of the Commons (SAMR)

The tragedy of the commons describes a sustainability issue caused when humans looking after themselves and out of self-interest take more than their share of a common resource making it unsustainable. In this predesigned Minecraft world students experience this concept and design mathematical approaches to keep the resource sustainable. Students take up challenges in-world, record observations and submit their responses using their in-game tools (writable book, portfolio and camera). Original lesson designed by Jung Koo (Aus.). Year Levels 4-6 Mathematics: Statistics and Probability; Year Levels 4-6 HASS – Inquiry Skills, Knowledge and Understanding: Geography; Sustainability.

Addition (SAMR)

Join the annual fishing competition and accumulate points in an intensive 3-day event. This lesson can be used for simple addition through to integers or algebra. The Lesson and predesigned world activity was created by Benjamin Kelly (UK). Year Levels 4-7 Number and Algebra: Data representation and interpretation.

Play with Spatial Measures (SAMR)

When applied in Minecraft the importance of mathematical and spatial knowledge is clearly contextualised. Establish context by creating fun challenges for students to: build in-world employing various measures of perimeter, diameter, circumference, area, volume and capacity of prisms set the challenge for students, given a set number of blocks, to explore how many shapes they can make with a specific area, or volume, or surface area.

Estimate then measure the perimeter, volume or surface area of 3D objects like prisms and pyramids. As an extension, use *Code Builder* to program agents to build prisms to specific measures or within specific limitations. Year Levels 5-7 Measurement and Geometry: Using units of measurement; Number and Algebra: Number and place value.

Coordinates Challenge (SAMR)

Extending on the 2 dimensions of the Cartesian plane to use XYZ coordinates in Minecraft you need to make sure they are turned on. Make sure the world you are in has cheats enabled. It is located under game settings, cheats, and "show coordinates". Toggle it on. In-world you can also use the command /gamerule showcoordinates true. In this lesson students will demonstrate an understanding of the coordinate system by successfully completing activities in a Coordinates Challenge and Scavenger Hunt.
The predesigned world and lesson were created by Cynthia Duncan, (USA). Students should design their own in-world games based on using coordinates, scavenger hunt is not the only game mechanic. See what they can come up with (e.g. geocaching). Year Levels 6-7 Measurement and Geometry: Location and transformation.

Roller coaster design (SAMR)

Study roller coaster design parameters in the physical world. What are their requirements and limitations? Watch videos of roller coaster builds in Minecraft. How much do they replicate what we know of the physical world? How steep can we make the roller coaster? What is the math we can use to express the angles, inclines and declines? Have the students create a set of build guidelines/tolerances then build a roller coaster with those specified mathematical parameters, using carts and Redstone components. Year Levels 6-8 Measurement and Geometry: Geometric reasoning; Year Levels 6-8 Science Understanding: Physical sciences.

Crack the Code (SAMR)

Students are shown the video of an in-world agent building a teacher prepared shape. They identify the shape and deconstruct the build steps and coding used to create them. Forming into teams, students then use *Code Builder* in a challenge to program the agent to exactly replicate the shape. After demonstrating then build students can compare code to discuss issues, elegance and efficiencies. Students then create their own 3-dimensional building (one or a combination) in-world manually first, and then programming the agent to build. Video capture the agent building and pose the challenge for peers to solve the code. Some possible 3-dimensional shapes to consider:

polyhedron	triangular pyramid	square	pyramid
cone	cylinder	pentagonal pyramid	torus
sphere	cube	octahedron	tetrahedron
dodecahedron	icosahedron	helix	

Year Levels 6-8 Measurement and Geometry: Using units of measurement; Year Levels 6-8 Digital Technologies: Creating Digital Solutions.

Add Aquatic lessons (SAMR)

https://education.minecraft.net/aquatic/

You can download predesigned worlds for content for reef studies, shipwrecks or monuments and design your own learning challenges to be carried out within them. Outlines for Aquatic Activities which are either in-world challenges or stimulated by the in-world explorations are offered by Minecraft: Education Edition. They represent activities across the years and curriculum. Here is one of those lessons adapted to be relevant to our Australian Curriculum.

Gone Fishing (SAMR)

Understand that a set of data collected to answer a statistical question has a distribution which can be described by its centre, spread, and overall shape. Grab your fishing rod and head out onto the water. Students track their fishing success; record what they caught and within what time frame, then combine the numbers to and work to determine the probability of catching fish, junk, or treasure. Extend the activity further into scientific method by having students develop and test their own hypotheses.
Does the weather affect fishing? Does the type of biome change what you'll catch? Discuss if this was fishing in our local area, what fish would we catch? What types of junk would be most prevalent? What message should we take from the ratio of junk to fish? Can you use Minecraft create a way to share that message? Year Levels 6-9 Statistics and Probability: Chance, Data representations and interpretation. Year Levels 6-9 Science – Science understanding: Biological sciences.

Probability (SAMR)

Students enter a predesigned world and using spreadsheets carry out activities to determine tree farming probabilities (the probability of receiving a sapling in-world when you destroy a tree). Students chop tree leaf blocks for several kinds of tree and determine the probability for each and their average. Students can, after determining their results, research and compare the actual ratio programmed into Minecraft. The original lesson and accompanying resources were designed by iGamer2003 (USA). This lesson could integrate with a renewable resource lesson where students can determine sustainability for reforestation after land clearing. Stephen Elford's Sheepish Probability lesson explores probability of spawning animals and mobs while designing your own fair experiment. Year Levels 7-8 - Statistics and Probability: Chance, Data representation and interpretation.

3D models and transmedia explorations (SAMR)

Examine interesting mathematical or geometrical landmarks both physically and virtually. Use Google Cardboard to further visualise the landmarks simply using a mobile phone, Google Maps Street View and cardboard. If local, visit them and physically measure or use Google Maps to virtually measure around them. Use Lego bricks or other modelling materials to begin to develop proportional reasoning and concepts of scale. Estimate how many blocks might be used to build this landmark in Minecraft.

Use *Code Builder* to program the in-world creation of the landmark. Have the coded agent build in Minecraft. Use photographs of the landmark in each media used to compare for fidelity to the original. Adapted from original lesson idea courtesy of Brian Aspinall (Can). Year Levels 7-9 Measurement and Geometry: Using units of measurement; Year Levels 7-9 Digital Technologies: Creating Digital Solutions.

Minecraft Boolean Logic (SAMR)

Redstone can be extended beyond simple circuits using Boolean logic and Minecraft logic gates. Simon Johnson (UK), created a predesigned world and a series of guided tasks that will support to student experience in building and combining logic gates. The challenge activities require students to explore and complete truth tables for each type of gate. Following the original lesson students should complete challenges by building a Redstone powered device and explain how and why logic gates were used. Mastering Redstone Logic Gates will prove very useful. Year Levels 7-9 - Number and Algebra: Patterns and algebra; Year Levels 7-9 Science Understanding: Physical sciences.

SCIENCE

The latest versions of Minecraft: Education Edition, resource packs, and shared worlds are advancing science exploration. The capacity for coding, chemistry, and circuitry extends the possibilities for student hypothesising, experimenting, and simulating physical world processes and systems. Teachers can also leverage the aspects where Minecraft does not quite mimic the physical world to further support students articulating their understanding of those differences. (gravity, flow of lava, etc.)

Science in Minecraft (SAMR)

Students use their previous in-world experience in Minecraft to compare the science of the physical world to the science of the play space. They examine and identify differences between the way chemistry, biology and physics behaves in the physical world compared to how it behaves in Minecraft. Students research the equivalents to Minecraft science and begin to explain the differences between them. Discuss why the game designers might have used a game mechanic rather than matched the physical world. Original lesson design by Minecraft Education Team. Year Levels 4-6 Science Understanding: Biological sciences, Chemical sciences, Earth and space sciences, Physical sciences. Science Inquiry Skills: Processing and analysing data and information.

Zoo Design (SAMR)

Students visit a local zoo or animal shelter to examine the requirements for creating humane facilities for animals while making viewing possibilities of humans. This might be even more authentic if the centre visited can provide a specific problem that students can design and pitch ideas for. Students will need to research different animal space requirements, facilities, feeding and enrichment activities.

An interesting twist in this may to tie this topic to local or global natural disasters (oil spills, bush fires, floods) in the news and design the emergency enclosures for rescued animals. Year Levels 4-6 Science Understanding: Biological sciences; Science Inquiry Skills: Communicating.

Animate Cycles (SAMR)

Have students create a model or dynamic system in Minecraft as a fun way to demonstrate a cycle, process or structure in nature. This could include the water cycle, insect life cycle, food chains, plant growth, farming crops, or the processing of raw materials into goods. A large-scale example of this might be Lynne Telfer's *Fred the Human Body* lesson where as a class of students built a representation of the systems of the human body or Stephen Elford's (Aus.) tour of an animal cell and lesson. Year Levels 4-8 – Science Understanding: Biological sciences, Earth and space sciences.

A grand outdoor adventure (SAMR)

Create an outdoor activity based on the Minecraft experience of your students. This involves teachers creating an outdoor/environmental education lesson in the outdoors that capitalizes on elements of Minecraft play. Students carry out outdoor team challenges based on those they might have accomplished in-game (craft tools, collect from chests, prepare to survive the night etc.) Imagine this as an innovative way to explore local environs or to acclimate for a school camp. Original activity designed by Woodland Classroom. The mantra for the experience was *"Using the computer game itself to get the kids off the screen and outdoors!".* Year Levels 4-6 Science Understanding: Biological sciences, Science Inquiry Skills. Year Levels 4-6 Health and Physical Education: Outdoor learning.

Renewable and sustainable development (SAMR)

This scenario could begin in a teacher designed (or senior student designed) world with severely limited or degraded resources where students playing in survival mode try to eke out a living. Students then create a plan and timeline to rebuild in a way that supports renewable energy and focusses on sustainable development. A well-structured and scaffolded version of this scenario can be seen in Rebecca Martin's Aurora56Y Minecraft project. Year Levels 5&6 – Science Understanding: Science as human endeavour; Science inquiry skills: Communicating; Sustainability.

Sensory Garden (SAMR)

Students investigate the benefits of a self-contained sensory garden, a garden with appeal to all five senses. Student look to the school playground as an area to redevelop and in Minecraft develop alternative designs for the sensory garden. They generate inquiry questions about the adaptations of living things to their local environment and research conditions needed for plants to grow and survive in a certain environment. Using mathematical understandings of number, length, area, and data, making problem-solving decisions they measure and design for the outdoor space, calculate budgets and present

their findings. Host an expo where designs can be voted on by students across the school and then build the selected design, as a class or whole school project. Original Lesson designed by Zoe Lee (Aus.). Year Levels 5-7 Science Understanding: Biological Sciences, Use and influence of science; Year Levels 5-7 Mathematics – Measurement and Geometry: Using units of measurement, Location and transformation.

Chemistry (SAMR)

The Minecraft Chemistry Update (launched Feb 22nd 2018) allows students to explore in-world chemical 'crafting' to bring to life aspects of chemistry such as:

The Periodic Table	Properties of matter	Chemical reactions
Elements and compounds	Atomic structure	Scientific method

The four crafting stations in the chemistry update support ways to combine and reduce materials:

- **Element Constructor** create 118 elements from the Periodic Table and 400 stable isotopes.
- **Compound Creator** for 30 compounds luminol and hydrogen peroxide to charcoal and soap
- **Lab Table** allows you to create Minecraft items by combining elements and compounds
- **Material Reducer** reduces a block to its component elements.

Download the supplementary Chemistry World and Teacher Lab Book. New lessons are being continually being added to the MCEE community lesson repository.
Year Levels 5-8 - Science Understanding: Chemical sciences. Science Inquiry Skills: Questioning and predicting, Planning and conducting, Processing and analysing data and information, Evaluating, Communicating.

The Mars Generation Project (SAMR)

Students live together trapped in a biodome on the Martian surface with limited resources. Can they collaborate creatively and thrive? This is a fully challenge-based program for students with daily tasks and requirements for collaboration in a predesigned biodome world. It combines science with critical thinking and English. Original lesson created by Benjamin Kelly (UK). Year Levels 5-8 – Science Understanding: Science as human endeavour, Earth and space sciences.

Engineering challenges (SAMR)

Players can readily mine materials such as Redstone and create simple circuits putting Redstone between a torch and a switch. Extend the challenge of circuitry to include switches, diodes, pistons to create power doors, timers, trapdoors, a TNT cannon or launcher, an elevator, a computer, calculator or disco lights. Year Levels 5-8 – Science Understanding: Physical sciences.

Build a Rube Goldberg machine (SAMR)

Students individually build a simple Rube Goldberg machine using initially the only mechanical and physics properties of inventory in Minecraft (water, lava, ramps, gravity). They form small teams and each demonstrate machines to their team. Now as a team combine electrical properties (Redstone, switches, circuits and pistons) and collaborate to build on one of the simpler machines make a more complex machine. Students record or demonstrate the action of the machine explaining the physics properties they employed to create the motion. And discuss the question could this machine exist in the physical world? Year Levels 5-8 – Science Understanding: Physical sciences; Science Inquiry Skills: Communicating.

Hypothesis and the Scientific Method (SAMR)

Students teams create hypotheses about the in-world behaviours of objects, codes and systems in Minecraft. For instance, "How fast can minecarts go in Minecraft?" Issues of how to create and describe scale, measurement and rates, number of repeat tests, and angles of track will all have to be discussed and decided. Student teams devise Redstone powered tracks to experiment and test and data tables to collect and analyse data while following principles of the scientific method. Students may want to test further variables such as changes in angle, track shape or empty verses occupied carts. As an extension, students might relate findings back to the physical world and equate findings to the speed of similar physical world objects. The Original lesson was developed by Bob Kahn (USA). Year Levels 6-8 – Science Inquiry Skills: Questioning and predicting, Planning and conducting, Recording and processing, Analysing and evaluating, Communicating.

Mendelian Genetics (SAMR)

Talk about DNA and how traits like hair colour, height and earlobes can be passed on by our parents. Introduce the term **phenotype** (visible trait). In creative mode, students need to construct a pen, spawn 2 sheep in each pen. Pick a colour and dye the wool of both sheep that colour. Have the students hypothesise the colour of the wool or phenotype of offspring. Then breed the sheep (the right food will do it) and see the result. Students should lead the discussion to consider what happens when the colours of the sheep are not the same and then plan experiments to test their hypotheses. Issues of dominant, recessive, inheritance, genes and alleles will be surfaced in the ensuing discussions. Original lesson designed by Bob Kahn (USA) Year Levels 6-8 - Science Understanding: Biological sciences; Science Inquiry Skills: Questioning and predicting, Planning and conducting, Recording and processing, Analysing and evaluating, Communicating.

Electricity - Demand Load Calculations (SAMR)

Design in Minecraft a residential dwelling based on modern urban or local examples using online plans available home building companies. Apply Energy Safe Victoria rules and guidelines and using the something like the Wiring Rules Demand Calculator determine the amount of electrical current that would be required based on standard installations.

Original lesson design by Kent Brewer (Can). Year Levels 7-9 Science Understanding: Physical Science, Science as a human endeavour.

Flaming Torches (SAMR)

Different chemical compounds emit different waves lengths of light when burned. This effect can be simulated in Minecraft using the Chemistry Update. Students can make a range of torches in Minecraft by creating the required elements in the element constructor, then making compounds in the compound creator. These chloride salts can then be crafted with torches to provide torches with different colours of flames. These torches can be replicated in the physical world by using cotton wool wrapped around glass rods. 'Common salts' that produce coloured flames such as Copper Chloride - Blue. Copper sulphate - Green. Borax - Orange. Sodium chloride (table salt)- yellow, can easily be picked up in supermarkets or pharmacies. Students discuss the cause of these effects: that different electron arrangements on elements result in different emission spectra (coloured flames). Original lesson by Rachel Chisnall (NZ) Year Levels 7-9 Science Understanding: Chemical Sciences, Science Inquiry Skills: Questioning and predicting, Planning and conducting, Processing and analysing data and information, Evaluating.

THE HUMANITIES AND SOCIAL SCIENCES

Integrated units of work will serve the humanities and other learning area requirements. Many of the same lessons also serve to powerfully embody *Personal and social capability* and *Critical and creative thinking* in ways that may not be achievable in more traditional teaching practices. Many units of work in Minecraft represent a chance for students to live past/historical events. This switches from **learning about** to **learning in** significant events. Here are some successful examples of learning in contexts that you might take up or that might trigger integration ideas.

My Place (SAMR)

Students study My Place by Nadia Wheatley and form teams to negotiate their favourite decade from the text. They work to plan a 2D map using paper or software to plan out their environment and then and build the 3D world in Minecraft. Students use the resources of Minecraft to create textures and features that evoke the mood of the chosen time. Original lesson (to be published), created by Bianca Audet (teacher) and Archie Audet (aged 10) (Aus.). Year Levels 4-6 HASS – Inquiry Skills: Communicating, Knowledge and Understandings: History; Year Levels 4-6 The Arts - Media Arts: Explore representations, characterisations and points of view of people in their community, including themselves, using settings, ideas, story principles and genre conventions in images, sounds and text.

See the Consequences (SAMR)

2016 The Great Fire of London was launched from The Museum of London. The project offers three worlds to download that cover London before the fire, the four days of the Great Fire itself and after the fire. Inside each world are activities and challenges designed to immerse the player in the events of the time; to enjoy 1666 London to helping to rebuild after the fire. This world would need to be converted to be used in MCEE. Conversion aside it is this model that Australian teachers could follow in their own designs. Building worlds that are before and after significant historical events and natural disasters like the Gold Rush, Black Saturday 2009 Victorian bush fires, bleaching of the Great Barrier Reef. Such builds would involve research, skill in building topographical maps and landscapes and creating in-world challenges and activities. Students engage in sequencing chronology, using historical sources as evidence, identifying continuity and change, analysing cause and effect, and determining historical significance. Year Levels 5-8 Knowledge and Understanding: History, Inquiry Skills: Questioning, Researching, Analysing, Evaluating and reflecting, Communicating.

Game Design (SAMR)

Design a mini game in Minecraft to immerse the players in a time in our history, culture, or inventions. There are many ways that Minecraft capability can be used to design mini games. Have students consider the game mechanics that have been be used in the mini game examples, how they can be achieved in Minecraft and then think about how they could design and or code their own game in relation to an aspect of the period they have been studying. Year Levels 5-8 Design and Technologies: Design thinking, Creating Digital Solutions; Year Levels 5-8 Humanities: Historical significance, Historical Knowledge; Year Levels 5-8 Digital Technologies: Creating Digital Solutions.

Relive the Gold Rush (SAMR)

Create a world simulation for the gold rush where students immigrate to the new land to strike it rich. They are distributed across different classes that represent those in the gold fields. Research data is readily available about the makeup of the Victoria Goldfields in the 1850's. Students will mine for gold in Minecraft as if they were gold miners of the time (rich and poor). Their research will advise them on how they might behave and to write the story of their characters. This lesson is adapted from Laurens Derks' (Aus.) *Gold Rush*. Laurens commented that "*Rich miners were provided with high quality tools and inventory to help them with their mining – and we found that the students started to demonstrate real life behaviours whereby they would cluster in class groups, plan acts of theft and even sabotage other 'richer' players in order to survive in simulation."* This level or role identification is often reported by teachers who design roleplay experiences in Minecraft. Year Levels 5-8 History - Identifying continuity and change; Critical and Creative Thinking - Questions and Possibilities, Reasoning; Personal and Social Capability - Self-Awareness and Management, Social Awareness and Management; Ethical Capability - Understanding concepts.

Civic Efficacy (SAMR)

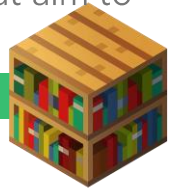
Use the virtual world of Minecraft to make change in the physical world. School students in Scotland were involved in the plans for the Dundee Waterfront Redesign. A Minecraft world was created mimicking the waterfront as it was in 2015 and student teams set out to redesign it. First, they researched to identify who the stakeholders were and what uses the waterfront was put to. They interviewed people, did research in historical documents and began to imagine what should be there. City council members visited the expo where students showcased their final designs. Officials could 'walk' about in each new waterfront and hear the student rationales for their designs. This kind of civic engagement could happen in almost any community. It serves to not only create new ideas but empowers youth to engage in local civic and social issues. This work was spearheaded by educator Derek Robertson (UK). Year Levels 7-9 Personal and Social Capability - Social Awareness and Management; Year Levels 5-8 Humanities – Geography – Interconnection, Year Levels 5-8 Change; Intercultural Capability - Cultural Practices, Year Levels 5-8 Humanities – Civics and citizenship, Government and Democracy, Citizenship, Diversity and Identity.

Exploring the First Fleet (SAMR)

Using authentic passenger inventories students adopt some personas as passengers in the First Fleet (convicts, soldiers, officials, free settlers or wives and children of soldiers or officials). Students build a shelter using only materials they can find and craft located in historically accurate locations. The teacher's role is as Governor Phillip assigning rations and equipment from the Government storehouse. Convicts may be forced to work on designated building tasks, settlers will have specific tasks to complete, soldiers may need to make sure convicts are in the right place. Screenshots are taken of the changing landscape; before the Fleet arrived, after clearing on Day 1, after some buildings have been established, after the Colony expands, etc. Students use these images from the world as reference for discussion about the impact on the environment and the indigenous landowners. Original lesson (to be published), and accompanying role play resources created by Edwin Tomlins (Aus.). Also see Sydney Cove 1788 lesson by Nathan Quan (Aus.). Year Levels 4-6 HASS – Knowledge and Understanding: History, Geography; Aboriginal and Torres Strait Islander Histories and Cultures.

Sustainable Antarctica (SAMR)

This lesson ties a Geography unit with the novel 'Stay' by Jesse Blackadder, liaison with the Australian Antarctic Division and a study of the expanding tourism possibilities for Antarctica. Students working in groups research, design and create in Minecraft either an eco-friendly resort or an Australian Research Station in an authentic map of the continent. All builds must meet the regulations of the International Association of Antarctic Tour Operators and the Australian Antarctic Division. Original lesson created by Robyn Robertson (Aus.). Year Levels 5-8 HASS- Inquiry Skills, Knowledge and Understanding; Year levels 5-8 Geography: exploring how a unique environment is used and managed (for example, settlement and human use of Antarctica and the practices and laws that aim to manage human impact).



Eureka Stockade (SAMR)

The Eureka Stockade was a pivotal event in Australian history and is considered by many to be the birthplace of Australian Democracy. Students research the events leading up to or during the Eureka Stockade and re-create a scene based on documented historical accounts and images (paintings). Recreation of such historical and well documented events allows students to reify their knowledge. These builds and the accompanying written materials and/or reflections make for effective assessment tasks. Original lesson (yet to be published) created by Glen Orchard (Aus.). Levels 5-8 HASS: Inquiry skills, Communicating; Year Levels 6-8 History: Historical Knowledge and Understanding.

Time Travellers (SAMR)

Create a timeline of historical events; wars, religions, cultures, inventions etc.
Students develop a way in-world to move players through time and a sequence of iconic builds that represent major events. Depending on the experience and skill of the students this could be accomplished with portals, Minecraft carts, pathways or tunnels. The builds should be as authentic as possible and should employ informative texts in the form of Non-Player Characters (NPCs) boards and signs. A fine example of what is possible can be seen in The World of Humanities by Erik W. Year Levels 5-8 HASS: Inquiry skills, Communicating; Year Levels 6-8 History: Historical Knowledge and Understanding. Year Levels 5-8 The Arts – Media Arts: Plan, structure and design media artworks that engage audiences.

Empathy Education (SAMR)

Students working in pairs or alone are introduced to several Minecraftian families who are suffering in one way or another. They will read/explore the family's situation and then creatively generate and discuss a list of possible solutions to create a NEW HOME for this family. Students choose and build the solution that they feel is technically achievable and best solves the problems the family faces. This original lesson, pre-designed world and scenario resources were developed by Benjamin Kelly (UK). Year Levels 6-8 Civics and Citizenship - Civics and Citizenship Skills: Analysis, synthesis and interpretation, Problem-solving and decision-making, Communication and reflection.

Take up Citizenship (SAMR)

Using a predesigned Utopian world or town have students ‘move in’ to create a new community. Initially allow them free range activity in the world. After one or two sessions host a town meeting to hear what the citizens are feeling about life here. Encourage the most outspoken community members to run for mayor. Mayor candidates can form parties, create policies and begin to campaign for election. Student campaigns can be run about the physical school as well as in-world. Host elections in-school or in-world and then allow the new party to settle in and see what happens. Based on a program developed by Campbell Potter (NZ). Year Levels 6-8 Humanities: Civics and citizenship, Government and Democracy, Laws and Citizens; Citizenship, Diversity and Identity; Year Levels 7&8 English: Writing – Language.

Dystopian Futures (SAMR)

Students study literature describing futuristic dystopian worlds, youth literature like *The Hunger Games, Maze Runner* and *The Divergent Trilogy*. Consider the global megatrends that might be pushing us toward one of these futures. Student teams design a world far into the future based on the trends they see as influential. They can base the world of one of these pieces of literature or imagine their own future. Students design a simulation that will involve a political system, roles and responsibilities for players, and an economy. Students present their designs and rate them; most likely to occur, most far-fetched, most apocalyptic then the class select one scenario/world to build as a simulation. Create the world and invite others not involved in the design to play through and give feedback and reflect on behaviours and events. What did this tell us about our possible future? Ethical Capability - Understanding Concepts, Decision Making and Actions; Year Levels 6-9 English – Examining literature, Responding to literature; Design and Technologies - Technologies Contexts, Creating Designed Solutions, Levels 6-9 Humanities - Civics and Citizenship - Citizenship, Diversity and Identity.

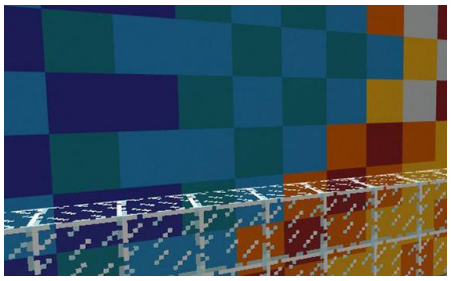
Trench Warfare (SAMR)

Students studying the First World War examine the systems devised for trench warfare. In Minecraft they model to scale trenches, possibly based on information available on actual battlefields. To accompany their Minecraft worlds, student create a challenge activities based around the design of trenches and trench parts. Classes pair up to take the challenges designed by their peers. Students spawn villagers throughout the trench system and in no man's land to act as guides through the trench system that will be used by students in other classes as a mock site study. Original lesson (to be published) designed by Wayne McGilvery (Aus.).

Architectural Greats (SAMR)

Students study the styles of famous architects like Frank Lloyd Wright, Mies Van der Rohe, Eero Saarinen, Frank Gehry or styles in architecture for instance, Persian, gothic, art deco, brutalist. Use various sources media to examine the style (works to describe the tenets of the style, VR walkthroughs, video, there is even a Lego kit for *Fallingwater*) In-world students build one famous example this architecture. For example, build *Fallingwater* by Frank Lloyd Wright. Then create an original work, applying the tenets, in the style of the architect or period that it is being studied. Host a grand exhibition to share the works. Year Levels 6-10 Design and Technologies - Technologies Contexts, Creating Designed Solutions; Year Levels 8-10 - Visual Communication Design: Visual Communication Design Practices; Year Levels 7-10 History: Historical significance.

THE ARTS



Minecraft is a digital design tool with many ways to integrate it into visual arts, media studies, music and dramatic arts. It can be the design space for iconic patterns, the space to stage a performance or to code electronic music. In its most creative uses it provides a space for redefinition of the arts as digital multisensory experiences.

Machinima: *Rowan of Rin ACARA* (SAMR)

As a summative task in an English and Media Arts unit, students were required to recreate aspects of one of the novels in the *Rowan of Rin* series by Emily Rodda, using Minecraft and the production technique of machinima students work in teams to design key locations from the novel. They then create a cartoon storyboard for their production, indicating how they would use those locations to recreate the story. This is followed by a phase in which the students use avatars to perform the story within the game. The animation can be recorded and footage edited using video editing software. Sound effects and dialogue can be added to complete the story in post-production. Lesson drawn from Australian Curriculum (ACARA) Work Samples. Year Levels 4-6 Media Arts: Use media technologies to create time and space through the manipulation of images, sounds and text to tell stories, Plan, produce and present media artworks for specific audiences and purposes using responsible media practice.

Pixel Art (SAMR)

Have students design art works using pixel art processes in Minecraft. Templates can be useful to kick off ideas for students or use graph paper to plan the work out. Or use image editing software like Gimp to place a grid over imported images and count the grid square/pixels to recreate the image in Minecraft blocks. Designs could be a new school logo, exaggerated scale versions of known art works or characters or the student's own original art designs. Consider pixel art graffiti as an integration of literary processes, protest and studies of society. Year Levels 4-8 Visual Arts: Making and Responding in Visual Arts.

Quiet on Set (SAMR)

Student use Minecraft to design a set for a performance (dance, drama or opera or other). Design in Minecraft provides students with an opportunity to experiment with scale, depth and stage real estate in a 3D environment. Students use Minecraft: Education Edition to show the potential and creativity of their stage design. The original lesson was created by Lynne Telfer (Aus.). Year Levels 5-8 Design and Technology Select and justify choices of materials, components, tools, equipment and techniques to effectively and safely make designed solutions, Year Levels 5-8 Understand how Mathematics Works: estimate and compare quantities, materials and costs using actual measurements from scale drawings.

The Weaving (SAMR)

The various coloured blocks of Minecraft used in pixel art can readily be used to represent the visual effect of tiling, weaving, tapestry or patchwork. In this lesson students examine iconic designs and symbols cultural Artefacts (costume, hangings, carpets etc.) and in Minecraft create an immersive narrative centred around these symbols. Students can use the coloured blocks, Non-Player Characters (NPCs), boards and signs to make this an interactive and immersive experience. Students all building in the same world could create this as a cultural fair. This activity is adapted from an original lesson by Cristiana Pivetta (Italy) to examine symbols in Sardinian costume. Year Levels 5-8 Band Description Students draw on artworks from a range of cultures, times and locations as they experience visual arts. Year Levels 7-9 Intercultural Understanding: Recognising culture and developing respect.

Coding a Song (SAMR)

Students use the pre-designed world to play the programmed rendition of Happy Birthday. Students play music and problem solve to deconstruct how the music has been created (Redstone and note blocks). They then create their own note block sequence for the same song and play it. Students then identify other simple iconic tunes like Happy Birthday. Teams select a tune of their own, keep it secret, program it and have other teams see if they can identify the tune. Activity adapted from the original lesson (including downloadable world) by Leticia Ahumada (Spain). Year Levels 5-8 Music: Evaluate a range of music and compositions to inform and refine their own compositions and performances, Year Levels 5-8 Digital technologies Process and Production Skills: Define problems in terms of data and functional requirements drawing on previously solved problems.

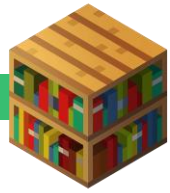
Music as Code (SAMR)

This activity involves using Minecraft's Code Builder to code activity in-world. In a predesigned world students work through three developmental projects to experiment with coding a music creation. Students use Redstone circuits, blocks and pistons in Minecraft Code Builder to program instruments and notes that make musical loops. Original lesson and downloadable world created by Samuel Wright (Austria).
This lesson uses *Tynker* as the coding tool but tasks can equally be achieved using *Microsoft MakeCode*. Year Levels 6-9 Music: Perform and present a range of music, using techniques and expression appropriate to style. Year Levels 6-9 Digital Technologies Processes and Production Skills: Design algorithms represented diagrammatically and in English, and trace algorithms to predict output for a given input and to identify errors.

Minecraft Meets Art (SAMR)

Students might build an art museum in Minecraft consider these choices:

- An innovative and new museum grand enough to house the worlds masterpieces
- Download one of the two museums already mapped



- Extend and recreate a local museum or gallery like the Museum of Contemporary Art (MCA), National Gallery, National Gallery of Victoria (NGV), Queensland Art Gallery.

Whether learning about the diversity of art styles and periods or studying specific styles or masters, students can fill their galleries with representations, Minecraft painting examples, NPCs delivering information and links out to the works online, or experiment with in-world QR codes or use the *HP Reveal* (was *Aurasma*) augmented reality tool to integrate mobile views of the art works. This lesson adapted from a lesson by Trish Cloud (USA) and Minecraft QR Code Generator by Mark Grundel (USA). Year Levels 7-9 Media Arts: Plan, structure and design media artworks that engage audiences, Year Levels 7-9 Digital Technologies Processes and Production Skills: Plan and manage projects that create and communicate ideas and information collaboratively online, taking safety and social contexts into account.

Street Art (SAMR)

Make a study of street art and learn about the way in which artists take images from popular culture. Students look at different street artists who employ appropriation and ask if this art is still original or unique? Is it still considered art in the same way as artworks hung in galleries painted by old masters? Then identify and examine the work of the French Street Artist *Invader*. Choose an artwork by Invader and recreate it in a shared Minecraft world. Then create an artwork of your own in the Invader style, creating both the virtual urban context and the artwork itself. Excerpt drawn from the original lesson by Guy Beal (Aus.). Year Levels 7-9 Visual Arts - Understand how art works: Analyse how artists use visual conventions in artworks, Practise techniques and processes to enhance representation of ideas in their art-making, Present ideas for displaying artworks and evaluate displays of artworks.

Patterns from Around the World (SAMR)

There are many designs and patterns that are distinct and represent various cultures. Student groups are given a copy of an artwork with no contextual details. They examine the work and discuss its design and where it might be from. Then using online resources, they determine where it is from, how it was created and its cultural significance. Students then experiment with ways to recreate the significant patterns using the pixel art capability of Minecraft. They start by recreating the patterns on grid paper and then create them with the coloured blocks in world. This original lesson submitted to Minecraft: Education Edition. Visual Arts Year Levels 7-9 Band Description Students draw on artworks from a range of cultures, times and locations as they experience visual arts. Year Levels 7-9 Intercultural Understanding: Recognising culture and developing respect.

Art Reimagined (SAMR)

Using artworks studied in class or viewed in galleries consider how to create in Minecraft virtual environments inspired by artworks. See how this might accomplished by students in the Tate Worlds: Art Reimagined for Minecraft project.

The Tate project offers pre-designed Minecraft maps (worlds) to engage in, however these would need to be converted to be used in Minecraft: Education Edition. The maps allow students to, "*Delve into imaginary worlds inspired by famous paintings and the real-life places they depict. Undertake challenges relating to the themes of each artwork, explore how they were made and hear the stories they have to tell.*" Students could use the Tate world examples to create art inspired imaginary world projects of their own. Year Levels 8-9 Media Arts: Plan, structure and design media artworks that engage audiences, Analyse how technical and symbolic elements are used in media artworks to create representations influenced by story, genre, values and points of view of particular audiences.

TECHNOLOGIES

Minecraft: Education Edition has application equally across both subjects described by ACARA under the Technologies banner:

- Design and Technologies, in which students use design thinking and technologies to generate and produce designed solutions for authentic needs and opportunities
- Digital Technologies, in which students use computational thinking and information systems to define, design and implement digital solutions. (ACARA, 2017)

Many lessons will integrate with other subjects and these have been identified in the appropriate sections of this resource. What follows are examples that help differentiate the two Technologies subjects and demonstrate some of the ways Minecraft can be effectively harnessed in both.

The Computer Science Subject Kit (SAMR)

The Computer Science Subject Kit offers curriculum readily adaptable for students in years 3-6 and years 7-10. It is offered as two sequences of lessons and activities.

1. Computing with Minecraft (students aged 8-10)
   This curriculum is downloadable as a OneNote Notebook, has 5 graduated units beginning with basic coding for an agent in Minecraft using Microsoft MakeCode coding editor and the in-game Code Builder feature. Working from coding the agent to move, use inventory or build, through to combining mathematics and coding to create loops, complex combinations for animations and moving systems.

   Students do this through using block code and/or JavaScript). Year Levels 5-8 Digital Technologies Processes and Production Skills: Design, modify and follow simple algorithms involving sequences of steps, branching, and iteration, Implement digital solutions as simple visual programs involving branching, iteration (repetition), and user input; ICT - Creating with ICT: generate solutions to challenges and learning area tasks.

2. Coding with Minecraft (students aged 11-16)
   Learn conditionals, functions, coordinates and more with this 30-hr comprehensive set of materials based on CSTA standards. This curriculum is downloadable as a OneNote package offering lessons in foundational Computer Science concepts and support for developing computational thinking skills. Year Levels 7-9 Digital Technologies Processes and Production Skills: Design algorithms represented diagrammatically and in English, and trace algorithms to predict output for a given input and to identify errors; ICT - Creating with ICT: generate solutions to challenges and learning area tasks. Year Levels 8-10 Digital Technologies – Processes and Production Skills: Implement modular programs, applying selected algorithms and data structures including using an object-oriented programming language.

Build with the Agent (SAMR)

This is a great place to start using the coding capacity of Minecraft: Education Edition. This lesson teaches how to program the Minecraft agent to build structures. There are 10 exercises starting very easy and getting progressively harder. The exercises used the built-in Code Builder feature which allows you to employ code editors like MakeCode and Tynker. Use these instructions for setting up MakeCode. These lessons were designed by Tor E. Enne (Norway). Year Levels 5-8 Digital Technologies Processes and Production Skills: Design, modify and follow simple algorithms involving sequences of steps, branching, and iteration, Implement digital solutions as simple visual programs involving branching, iteration (repetition), and user input; ICT - Creating with ICT: generate solutions to challenges and learning area tasks.

Function Reefs (SAMR)

Four types of coral reefs exist on earth; fringing, barrier, atoll and patch reefs. Students study the different reefs and their respective environments through specific examples. Students will use Minecraft: Education Edition and MakeCode (code editor) to build several clusters of coral and label each cluster with a function name. They then combine those functions to program the Agent to create their unique reef in-world. *This lesson demonstrates the ways in which coding can be made meaningful for students when it integrates design thinking (designing a reef), computational thinking (coding) within learning in another area (science). Original Lesson designed by the Minecraft Education Team. Year Levels 5-6 Digital Technologies Processes and Production Skills: Design, modify and follow simple algorithms involving sequences of steps, branching, and iteration; Year Levels Science – Science Understanding: Biological sciences.

Build a Zombie (SAMR)

The exercises use the built-in Code Builder which allows you to employ code editors such as MakeCode. Students use code to program the Agent to build a zombie in-world. This lesson Yr 7 lesson was created by Kieran Bailey (Aus). Watch Kieran's video unpacking How to Build a Zombie. Year Levels 7-9 Digital Technologies Processes and Production Skills: Design algorithms represented diagrammatically and in English, and trace algorithms to predict output for a given input and to identify errors; ICT - Creating with ICT: generate solutions to challenges and learning area tasks.

Year 7 Orientation (SAMR)

Students build a scaled Minecraft version of their high school with a view to it being used by primary school students considering coming to the school. Students across years 7&8 can form teams to measure, map and design various parts of the high school and build them in-world. Builds can be manual or coded using Code Builder. It is important that the design is accurate and the buildings, signage and boards make the parts of the school readily recognisable to the prospective students (and parents) when visiting. The world is made available to the local primary schools towards the end of year in preparation for high school choices. *Note this is a large (iterative) undertaking and the first versions shared might only include selected parts of the school most relevant to incoming year 7's. Original lesson (to be published), designed by Brendan Jones (Aus.). Year Levels 7-9 Digital Technologies Processes and Production Skills: Design algorithms represented diagrammatically and in English, and trace algorithms to predict output for a given input and to identify errors, Design the user experience of a digital system, generating, evaluating and communicating alternative designs. ICT - Creating with ICT: generate solutions to challenges and learning area tasks.

Alien Invasion Game (SAMR)

Make a game using Minecraft blocks to simulate the iconic pixelated appearance of older video games. In this lesson students download the pre-designed world and play the coded loop version of a classic arcade game. They play this basic version and then through a sequence of challenges extend the design to add game elements like the win and loss states and then customize the coding to make the game their own. Original Lesson designed by the Minecraft Education Team. Year Levels 7-9 Digital Technologies Processes and Production Skills: Design algorithms represented diagrammatically and in English, and trace algorithms to predict output for a given input and to identify errors, Design the user experience of a digital system, generating, evaluating and communicating alternative designs.

Using Excel to Solve Problems (SAMR)

Working in a pre-designed world with divided build plots students design and build a house. The resources for this lesson provide restrictions, dimensions, materials and costs permitted for building. Once the exterior has been completed students work on the interior. Students submit costings worksheets for their build using appropriate spreadsheet functions, calculations and formatting. Through planning and costing a house build using Microsoft Excel Pupils will be introduced to formatting, formulas, modelling and creativity. Original lesson designed by Paul Watkins (UK). Year Levels 7-9 Digital Technologies Processing and Productions Skills: Analyse and visualise data using a range of software to create information, and use structured data to model objects or events, Year Levels 9&10 Design and technologies knowledge and understanding: Establishing materials and equipment needs using digital technologies such as spreadsheets.

Wall Follower Algorithm (SAMR)

The goal of this lesson is to implement a simple wall follower algorithm using Code Builder in conjunction with a chosen code editor (MakeCode, Tynker etc.). The 'wall follower' is a rule for solving mazes by keeping one hand in contact with one wall of the maze. In this lesson students are set the challenge to create a program that would implement this rule and guide an agent to escape a maze. The implementation is then iteratively tested in-world with the agent. Original lesson and downloadable world designed by Philip Golden, (UK). Year Levels 8-10 Digital Technologies – Processes and Production Skills: Implement modular programs, applying selected algorithms and data structures including using an object-oriented programming language.

But wait there's more...

Some Technologically Advanced Ideas to explore for Creating Minecraft Worlds:
Export 3D Sketches Export Google Sketchup into/or design in *TinkerCad* importable 3D models (Minecraft) and take them out through MCedit (for Minecraft: Education Edition).
Use Satellite topographical data making Minecraft Maps from Satellite Topographic Data, Adam Clarke @thecommonpeople
Use Google Earth topographical data making Minecraft Maps from Google Earth Topographic Data, Adam Clarke @thecommonpeople

HEALTH AND PHYSICAL EDUCATION

It may at first seem impossible for students to employ Minecraft in a learning area that is so rooted in the physical world. There are many ways for students to relate to that physical world through their digital creativity in Minecraft. It can become the design space, proving ground, stimulus or social space that immerses learners in health and physical education content. Integration is achieved when students for instance, create a media health campaign or after an in-world challenge reflect on their own resilience.

Healthy Town (SAMR)

Have students consider what it takes to make a community healthy and safe. Think about, discuss and list what we have in our community that helps us stay healthy and safe. Take a walk or two about the local community to see what's there and photograph important aspects. (homes, fresh food, parklands, community centres, places to exercise, places to play, access to healthcare, police etc.). Students as a class build in-world, a new suburb or town that that could support the healthy living of **all** its citizens. Now take a 'walk' as citizens around this town, take screen shots and compare against the photos taken of the local community. Year Levels 5&6 Health - Personal, Social and Community Health: Being healthy, safe and active, Contributing to healthy and active communities.

Healthy Eating (SAMR)

In a predesigned world students learn about and experiment with planting seeds and farming in Minecraft. Working in groups students design a farm and plant seeds and plants. This opens up an opportunity to discuss healthy eating and why vegetables and fruits are good for us. Older students can use CodeBuilder and MakeCode to program the agent to create a farm. Build the specific areas for the farm based on the answers to the math problems. Early years farm lesson created by Andy Turner (UAE) Extension integrated lesson Build a Farm with Code and Maths. Year Levels 5-8 Health - Personal, Social and Community Health: Being healthy, safe and active, Contributing to healthy and active communities; Year levels 5-7 Mathematics: Measurement and Geometry. Year levels 5-8 Digital Technologies Processes and Production Skills.

Outdoor play area (SAMR)

Design in-world a game for a specific outdoor school space. Use the specific dimensions of the school space (working with scale) and devise a game that can be played by a prescribed number of players and promotes healthy movement. Student teams work out the play space, markings, equipment and rules. Use signs and boards to explain the game area to others. Students present their games to the class for feedback and review. They are given time to revise their game spaces. Over a period of days, take the games outdoors, mark up or create the space and test the game. Adopt the most popular game and make the play space permanent in the school. Year Levels 5-7 Movement and Physical Activity: Moving our body, Understanding movement, Learning through movement; Year Levels 5-7 Design and Technologies Processes and Production Skills.

Developing a Minecraft Mindset (SAMR)

Based on Carol Dweck's tenets for a 'growth mindset', students enter a pre-designed world that has been ravaged by an earthquake and seek to rebuild the village and locate and restore the lost villagers and gems. Through these challenges' students, for whom academic engagement is often problematic, find themselves:

- seeking out and embracing challenge
- persisting in the face of setbacks
- revelling in the struggle
- taking on feedback and being inspired by the success of others.

Students carry out a reflective task to identify their strengths, things they might struggle with and how they could take their Minecraft revelations into the physical world. The task, reflective instruments and resources were designed by educational thought leader Dan Haesler (Aus.) Personal and Social Capability: Self-awareness, Self-management, Social-awareness, Social-management. Year Levels 6-8 Health - Personal, Social and Community Health: Communicating and interacting for health and wellbeing; Year Levels 6-8 Design and Technologies Processes and Production Skills.

Create a story (SAMR)

Students use Minecraft to create the scene for a healthy actions story or campaign. Students might choose a topical issue or one most relevant to them (healthy eating, exercise, road safety, smoking, alcohol etc.). Primary students might find a choice of topics in sites like Life Education (Healthy Harold). Junior secondary students might use topics relevant to teen health and welfare. Students use scripted in-world activity to create machinima (a video created by combining and recording in-world action with external audio and voice over). They develop their healthy campaigns and present to class or school community and/or share online to the relevant audience. Year Levels 6-8 Personal, Social and Community Health: Contributing to healthy and active communities, Communicating and interacting for health and wellbeing; Year Levels 6-8 Design and Technologies Processes and Production Skills.

Careers (SAMR)

Students design and build in-world a university (or TAFE) of the near future. This activity engages students in thinking about and researching careers of the future along with the spaces and resources required to learn them. It is an opportunity to open discussion around predictions for careers, career pathways and where students see themselves working. What will be the need for learning? Where will it be taught? Will it be taught in campuses or elsewhere? This activity adapted from the Uppingham Community College, (UK) university design description. Year Level 9 Work Studies - Career and Life Design: Career development and management; Year Level 9 Design and Technologies Processes and Production Skills.

LANGUAGES

Minecraft has a clear place in language learning in build tasks related to cultural elements of language study. Students can further enhance understanding and communication in the language when they apply their language skills creatively in-world. New forms of assessment and new project media (e.g. games or machinima) arise when students are invited to use Minecraft to demonstrate their learning.

Amusement Park (SAMR)

Have students design in- challenges for their peers (mazes, puzzles, games or obstacle courses) where the in-world instructions and guidance (via boards, signs, agents) are only offered in the language being studied. This should be carried out in a multiplayer world so that students can readily share, play test and tour each other's challenges. This artefact can become a teaching or assessment tool for subsequent/more junior classes. *This task is extensible across a wide range of years. Year Levels 3-10 Languages – Communicating: Creating, Translating: Year Levels 3-10 Design and Technologies Processes and Production Skills.

Cultural Studies (SAMR)

Have students build in-world significant parts of cities past and present related to their language studies. This is an opportunity for students to demonstrate their knowledge and understandings of issues related to the culture and language. Students could set up NPCs to 'speak' in the language (or program them) or link out to supportive online content (their own creation or third party). Signs and boards could be another great way to infuse foreign language concepts. Have students tour the city, narrating (in Spanish, French, etc.) for a screencast tour throughout their city. Lastly, enable students to publish their screencast to an authentic audience via YouTube or your learning management system (LMS). Activities adapted from lessons developed by Glen Irvine (USA). Year Levels 5-9 Understanding: The role of language and culture; Year Levels 5-9 Design and Technologies Processes and Production Skills.

Japanese Weather Report (SAMR)

This is an assessment task in Japanese but could be adapted for any language study. Students present a weather report in Japanese using Minecraft. Students create the in-world environment (including weather), a transcript of the report and a video of the weather report with voice recorded Japanese. Students were assessed on the written and spoken components and the creativity they used within Minecraft. Peer assessment was also used based on discussion that followed the presentation (process, what learned, challenges faced and how solved). Original lesson by Stacy Lambert (Aus.) Year Levels 7-10 Languages – Communicating: Creating, Translating; Year Levels 7-10 - Visual Communication Design - Visual Communication Design Practices

Surviving Language (SAMR)

Imagine this scenario…" Classmates are the last remaining people on earth and there is only one tree still alive. The rest of humanity is waiting for the world to be inhabitable in outer space. To win the challenge the team must repopulate the forest and make earth safe for life again. But the only way the class can alert survivors in space that earth is safe again is to send up a rocket, which they must make by smelting iron. That can only be done by burning trees to make a hot fire. The goals are at cross purposes and students have to decide the best course of action."
Now add the constraint that the discussion for this is held in second language learning. Minecraft readily lends itself to communication in foreign languages and immersing students in a wicked problem like this but only allowing them to converse in the language being studied authentically raises the stakes. Original lesson developed by Glen Irvin (USA) for teaching Spanish. Breadth Stage and Pathways Stage – Year Levels 7-10 Languages – Socialising, Creating, Translating; Year Levels 7-10 Ethical Capability - Understanding Concepts, Decision Making and Actions, Year Levels 7-10 Humanities: Geography, Environment, Sustainability, Change.

Story Paths (SAMR)

Have students write poetry or other literary forms and create story paths in Minecraft to deliver their works and create the environment for the text. John Miller (USA) used this format to have students write Japanese Tanka poems and deliver them in-world using command blocks (Redstone related blocks than carry out Minecraft commands like give inventory or teleport players). The poetry, Japanese cultural aspects and literary vision of the students is embodied in the in-world space. This integration of literary styles, arts and in-world coding has the potential to be transformative. Year Levels 7-10 Languages - Creating, Translating; Levels 7-10 - Visual Communication Design - Visual Communication Design Practices.

The city of Florence (Italy) (SAMR)

Discover the history of the beautiful city of Florence's Piazza del Duomo, Palazzo Vecchio, Santa Maria Novella, Campanile di Giotto, Ponte Vecchio in this magnificent predesigned world. Students travel about Florence and complete research, challenges, discussions and translations set for each landmark. The quality of this build will give students an idea of the scale and authenticity that is possible. Original lesson designed by Marco Vigelini (Italy) Year Levels 7-10 Understanding: The role of language and culture.; History Year Levels 7-10: Historical Knowledge and Understanding.

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