Digital Technologies – 9 Managing a group project: Augmented Reality

DIGITAL TECHNOLOGIES HUB

STRAND	Knowledge and understanding				Processes and production skills						
	Digital Systems	Representation of data	Collecting, managing and analysing data		Creating Digital Solutions by:						
					Investigating and defining	Generating and designing		Producing and implementing	Evaluating	Collaborating and managing	
Content Description	Investigate the role of hardware and software in managing, controlling and securing the movement of and access to data in networked digital systems (ACTDIK034)	Analyse simple compression of data and how content data are separated from presentation (ACTDIK035)	Develop techniques for acquiring, storing and validating quantitative and qualitative data from a range of sources, considering privacy and security requirements (ACTDIP036)	Analyse and visualise data to create information and address complex problems, and model processes, entities and their relationships using structured data (ACTDIP037)	Define and decompose real-world problems precisely, taking into account functional and non-functional requirements and including interviewing stakeholders to identify needs (ACTDIP038)	Design the user experience of a digital system by evaluating alternative designs against criteria including functionality, accessibility, usability, and aesthetics (ACTDIP039)	Design algorithms represented diagrammatically and in structured English and validate algorithms and programs through tracing and test cases (ACTDIP040)	Implement modular programs, applying selected algorithms and data structures including using an object-oriented programming language (ACTDIP041)	Evaluate critically how student solutions and existing information systems and policies, take account of future risks and sustainability and provide opportunities for innovation and enterprise (ACTDIP042)	Create interactive solutions for sharing ideas and information online, taking into account social contexts and legal responsibilities (ACTDIP043)	Plan and manage projects using an iterative and collaborative approach, identifying risks and considering safety and sustainability (ACTDIP044)

Sequence of Lessons / Unit	Approx. time rq'd	Year	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #
Managing a group project: Augmented Reality	20	9	☐		☐		☐		☐		☑	4	☑	5	☐		☑	6	☑	9	☑	3	☑	3

Years 7 and 8 Achievement Standard	Years 9 and 10 Achievement Standard	
By the end of Year 8 • Students distinguish between different types of networks and defined purposes. (1) • They explain how text, image and audio data can be represented, secured and presented in digital systems. (2) • Students plan and manage digital projects to create interactive information. (3) • They define and decompose problems in terms of functional requirements and constraints. (4) • Students design user experiences and algorithms incorporating branching and iterations, and test, modify and implement digital solutions. (5) • They evaluate information systems and their solutions in terms of meeting needs, innovation and sustainability. (6) • They analyse and evaluate data from a range of sources to model and create solutions. (7) • They use appropriate protocols when communicating and collaborating online. (8)	By the end of Year 10 1. Students explain the control and management of networked digital systems and the security implications of the interaction between hardware, software and users. 2. They explain simple data compression, and why content data are separated from presentation. 3. Students plan and manage digital projects using an iterative approach. 4. They define and decompose complex problems in terms of functional and non-functional requirements. 5. Students design and evaluate user experiences and algorithms. 6. They design and implement modular programs, including an object-oriented program, using algorithms and data structures involving modular functions that reflect the relationships of real-world data and data entities. 7. They take account of privacy and security requirements when selecting and validating data. 8. Students test and predict results and implement digital solutions. 9. They evaluate information systems and their solutions in terms of risk, sustainability and potential for innovation and enterprise. 10. They share and collaborate online, establishing protocols for the use, transmission and maintenance of data and projects.	

Managing a group project: Augmented reality

There is a movement away from the containment of information in devices such as smartphones and tablets to information everywhere, information around us, displayed on the world and able to be interacted with in a different way. Augmented reality (AR) is a technology that enables us to do just that. 'Augmented' means to add or enhance something. In the case of AR, graphics, sounds and touch feedback are added to our natural world to create an enhanced user experience. AR uses the existing natural environment and overlays virtual information on top of it.

In this collaborative project, students plan, implement and monitor an AR project. They develop project management skills, collaborate with others and undertake a specific role.

Flow of activities				
Short text	**Explore augmented reality (AR) and virtual reality (VR)** Explore differences between AR and VR, and explain some practical uses of both.	**Plan an AR experience** Plan a group project that uses an AR platform to create an AR experience in response to a problem.	**Manage the AR project implementation** Use project management methodology to define, design, implement and monitor development of the AR project.	**Evaluate the AR project** Evaluate the end product as well as the development process.
Questions to guide exploration	*What is AR and how is it used in everyday life?*	*How will your group approach solving a problem, using an AR experience as part of the digital solution? What role will each group member play? What is the solution?*	*How will your group manage the creation of the AR solution?*	*Was the solution successful and does it work as intended? How well did the group perform in completing the project?*
Australian Curriculum alignment	Evaluating (ACTDIP042)	Investigating and defining (ACTDIP038) Collaborating and managing (ACTDIP043 and ACTDIP044)	Collaborating and managing (ACTDIP043 and ACTDIP044) Investigating and defining (ACTDIP038) Generating and designing (ACTDIP040) Producing and implementing (ACTDIP041)	Evaluating (ACTDIP042) Collaborating and managing (ACTDIP043 and ACTDIP044)
What's this about?	AR and VR might sound similar but they are quite different. VR essentially places the user in another world through the use of a VR device or goggles, such as an Oculus Rift, Google Cardboard or Samsung Gear. VR blocks out the world and replaces it with a virtual world that immerses the user and heightens their senses as they experience the virtual environment.

AR adds something to the user's current reality. AR mixes the physical and the digital worlds together in new ways. It is envisaged that with expected technical advancements and broader social acceptance new opportunities for use of AR will be created.

There are three key drivers of AR use:
1. the ability to display information
2. the ability to add digital objects
3. the ability to enhance existing objects.

Smartphones and tablets are hand-held devices, and can be isolating. AR can provide new dimensions to their use. | Several AR development platforms can be used to explore the development of AR applications. Four notable platforms for building AR are HP Reveal (formerly Aurasma), Metaverse, Unity and ARkit.

HP Reveal and Metaverse are user-friendly platforms that you could use to introduce students to AR development platforms. Unity and ARkit are more high-end platforms.

In planning a collaborate project that involves a digital solution such as one that involves AR, people with different skill sets are often bought together to contribute to the project at various stages. The successful outcome of these types of projects is highly dependent on the effective management of the project and resources, and the way in which team members collaborate and execute their specific roles.

Developing project management skills, collaborating with others and undertaking a specific role are all aspects of learning that students can demonstrate and develop during this project.

Designing a solution can be supported in several ways. Once the need has been identified students can:
• collaboratively generate several potential design solutions and select or combine ideas to come up with a final design
• individually generate a design and share their ideas to combine them into one design
• brainstorm as a class potential ideas and then as groups come up with the group designs. | **Approaches** *Waterfall method:* Each process in the problem-solving methodology is completed before the next process begins.

Agile method: The Agile method does not require you to adhere to the strict order of each process. Rather, phases can be revisited and small components of the larger project can be undertaken more frequently, allowing for ongoing changes and testing. | **Product evaluation** The primary focus of product evaluation is to make sure the product does what it is intended to do.

Student performance evaluation Typically, teachers are required to report on students' performance. Digital technologies work is often project based and a variety of pieces of evidence are needed to assess students' performance. |

Experience of how the technology platform operates can assist students in the design phase.

The focus of the learning (in simple terms)			

Column 1:

Ask students to work in pairs to create a short presentation on the differences and similarities between AR and VR. The presentation should include relevant examples of existing uses of AR and VR technologies. Students could include a section on some of the potential social benefits of AR.

Texts with complimentary AR experiences have been created by book publishers, and there are also AR apps and games available for smartphones and tablets that run iOS or Android.

Ask students to provide examples of some texts, apps or games suitable for iOS or Android. Ask them to evaluate one of these texts, apps or games, and report their findings to the class. Ask them to consider:
- *What is the AR experience?*
- *Rate the success of the experience and in what ways AR enhances the experience.*

Quick response (QR) codes have been around for some time. When a QR code is scanned, specific information is made available to the user. Ask students to respond to the question *In what ways are QR codes and AR similar?*

Discuss the use and potential benefits of AR in sport broadcasts; for example:
- on-field advertisements are often not on the field but are added to the broadcast digitally
- off-side lines in soccer broadcasts and down lines in American football are added digitally
- in track and field broadcasts distance lines are added digitally in long jump and throwing events such as discus and javelin.

Column 2:

HP Reveal is an appropriate platform for students to begin their exploration of AR experiences. Once HP Reveal has been installed on smartphones or tablets, students can access the tutorials to learn how to create AR.

Alternatively, they can use a different platform with relevant tutorials and a comparable difficulty level.

Ideas for an AR activity that adds additional elements to the user's experience include:
- assisting another student to understand a mathematics or science concept
- enhancing the experience of school visitors to view student exhibitions; for example, artworks or designs
- providing promotional information for visitors to the reception area at the school
- providing overlay information for a recent geography field trip
- overlaying information to explain the way a smart garden operates
- providing background data to a science experiment to assist predictions or explanations.

Each team can create a project plan for one or more AR ideas.

Discuss suitable ways the team can be structured. Suggested team roles could include:

Role	Example responsibilities
Technical helper	Assist teacher and students to install the app on devices (including iOS and Android phones and tablets and Windows and Mac computers).
Content manager	• Track content development. • Lead content choice discussions.
Content creators	• Create video clips. • Create PowerPoint content and export to video. • Take photographs. • Create posters.
Graphic designer	Design splash screens and trigger cards.
Test case manager	Generate test cases to ensure that the products work as expected across platforms and devices.

Column 3:

How does AR work?
Generally, an AR experience has a *trigger* that generates an *overlay* or *aura*.

Trigger
A trigger could be, for example, a photograph, poster or object.

Overlay (aura)
An overlay (known as an aura in HP Reveal) occurs when the trigger has been registered. Triggers are associated with overlays. When the user points the camera at the trigger, the overlay displays.

As a first lesson students could be challenged to create a one-step AR experience just to get familiar with the process. They can then undertake a more complex group project.

Using HP Reveal Studio
Simple one-step AR activities can be created using HP Reveal Studio on a smartphone or tablet. HP Reveal Studio also provides the option to add additional overlay actions to a trigger to create a sequence of actions.

AR solution
Once each group of students has selected the focus for their AR solution, they need to define the problem in terms of its data, functional and non-functional requirements and design how the solution will operate. Using their selected platform, they can implement their solution.

Define, design and implement the AR solution
Ask students to consider the following.

- What is the problem?
- How will AR be used in the digital solution?
- Generate at least three designs. Decide on a final design and create a design plan.
- What information, data or other assets are required?
- What are the functional and non-functional requirements?
- What are the social considerations?
- What platform are you using to implement the solution?

Project plan
Complete a checklist that helps with planning, carrying out and monitoring the project.

☐ Design plan
☐ Team structure and roles
☐ Timelines
☐ Resources required
☐ Feedback and review

Column 4:

Solution evaluation
Does the final solution do what was set out in the solution design?

Student performance evaluation
How can you plan to evaluate students' work throughout the project development process?

Student-guided rubrics
These represent a meaningful assessment exercise, designed to engage students not in the content that they are learning but also the reasons why they are learning it.

Students may, as a class, list characteristics of what would make a good project and a project plan. For example, when considering their digital technologies project, students might consider what would make a good presentation of a requirements specification. For the project plan, how can the individual tasks and the allocated time for each be best shown? How can you tell if the project is on schedule?

While **peer review** is often fun and engaging, it can also present problems in that students need to be guided as to how best to use the process as a learning opportunity. In an example of formative assessment, students could be asked to test each other's AR creations and provide feedback (for example, they could provide the top three best features of the app, as well as the top three issues).

Think aloud is a learning and assessment strategy designed to assist students to articulate their thought processes, and to help foster a supportive environment for learning.

Supporting resources and tools and purpose/ context for use			
Supporting resources and tools and purpose/ context for use	The ultimate guide to AR technology This website provides a guide to AR . Eight examples of AR apps and their successful uses This blog provides opinions about useful AR apps. AR 101: Top AR use cases Explore how AR is being used in our world today. AR This video explores how AR superimposes digital information or images onto the physical world to enhance the way we view our surroundings. Evolution of AR in Pokemon Go Phil Keslin (CTO, Niantic and creator of Pokemon Go) discusses the evolution of Pokemon Go and how the game transformed into a phenomenon. The social benefits are discussed towards the end of the video. AR in ACTION Watch videos of the AR in ACTION Leadership Summit. The Summit convened some of the top minds in AR to accelerate conversation and collaboration among industry innovators, thought leaders and investors. You can also visit the conference website. **Suggested apps to explore**	**Easy-to-use platforms** **HP Reveal** Formerly known as Aurasma, HP Reveal is available for Android and iOS phones and tablets. Almost everything can be done using the phone or tablet. HR Reveal can be used in schools by teachers and students of all ages to make AR experiences. Note*: Tutorials can be found using HP Reveal or Aurasma as search terms. HP Reveal web-based studio This web-based studio allows the user to add additional features to HP Reveal. **Metaverse** Metaverse is an easy platform that allows students to create AR experiences. **High-end platforms** **Unity** Unity is a game development engine that can also be used to create AR and VR applications. There is a free version available for students and for personal use. **ARKit** ARKit is for the Mac platform only. A developer account is required. The latest version requires XCode 9.3 and iOS 11.3 to be installed. How MIT builds cities using Lego and AR MIT Media Lab is using innovation to boil efficient teamwork down to a science.	**HP Reveal (formerly Aurasma) in education** Art department In this video, students engage with AR. Aurasma for Shakespeare: AR and *Romeo and Juliet*, Act 3 Scene 5) In this video, a teacher talks about how she uses HR Reveal in her English classroom. Aurasma in the music room In this video, a teacher demonstrates how an exhibition about students' music can transform into videos of their music-making using AR. Teaching with Aurasma This video is a helpful teaching tool about how to integrate Aurasma into the classroom. HP Reveal AR example This video features projects using AR and the HP Reveal app. Aurasma Demo for Teachers This is a video demo for teachers. **HP Reveal (formerly Aurasma) tutorials** Make your own AR with PowerPoint and Aurasma This tutorial shows students how to make their own AR presentations using PowerPoint and HP Reveal. Teachers: How to use HP Reveal app This tutorial helps teachers to get started with the HP Reveal app. Aurasma step by step This is a step-by-step guide to creating AR using the HP Reveal app. Aurasma Studio tutorial: How to create a sequence aura Use various sequences to create more interactive auras for your classroom.	Evaluation and assessment: Part 1 This is an overview of assessment ideas and methods for computational thinking. Evaluation and assessment: Part 2 This second video investigates how rubrics can be used to support understanding of the problem-solving process, and discusses how ideas for students might engage with decomposition and abstraction. Grading rubric for group project This is an example rubric for a group project from Carnegie Mellon University.

Suggested apps to explore

App	Function	URL
CluckAR	Scan egg carton labels to determine if the eggs are free range, cage or barn eggs.	CluckAR website App Store Google Play
Google Translate	Translate different languages in real time by using your device's camera and the Google Translate app.	Google Translate website App Store Google Play
Sky View Lite (Free)	Point the phone at the sky and get the names of features in the sky. There is also additional information.	Sky View Lite App summary App Store Google Play
iClass Shapes	Point the phone at the net of a shape and view the augmented 3D shape on screen (iOS only).	App Store
Ikea Place	Place Ikea products in the room.	IKEA Place website App Store Google Play

Assessment			
Assessment	Students create a visual presentation of the differences between AR and VR. The presentation should include the benefits of AR and VR to individuals, groups and businesses. **Achievement standard**	Develop a plan to design an AR solution that includes requirements, target audience, user benefits and development timelines. **Achievement standard** Students plan and manage digital projects using an iterative approach.	Present completed AR solutions to the groups and the target audience. Present the project plan showing any changes that result from monitoring the project. **Achievement standard**	Completed product evaluation rubric **Achievement standard** Students evaluate information systems and their solutions in terms of risk, sustainability and potential for innovation and enterprise.

	Students evaluate information systems and their solutions in terms of risk, sustainability and potential for innovation and enterprise.	They define and decompose complex problems in terms of functional and non-functional requirements.	Students plan and manage digital projects using an iterative approach. They test and predict results and implement digital solutions.	