Careers with STEM
Game-changing jobs of tomorrow

TERM 4 2017

Teacher Notes

For Digital Technologies, TAS, PDHPE, Science and Maths Years 7-10

Read the magazines online for FREE

About Careers with STEM

The *Careers with STEM* series includes four quarterly magazines, along with website articles, teacher resources and videos across four *STEM* areas: science, technology, engineering and mathematics. The focus is on independent inquiry and constructivist learning.

Each magazine issue provides inspiring stories, statistics and up-to-date information on the careers of the future, and is based on the premise of discovering new areas of innovation through STEM + X – where X is another field of study, a personal passion, or a world changing goal.

To order additional copies for events, clubs or classrooms, or for annual subscriptions and additional resources, career stories and videos go to: CareerswithSTEM.com

Who are these notes for?

The *Careers with STEM* Teacher Notes are for teachers, careers advisors, parents, STEM-based institutions, or mentors that could use the guides to expose and inspire students towards STEM careers. For teachers, they are ideally suited to the Years 7–10 high school classroom.

These activities are designed specifically for students to gain insight into a variety of STEM careers across a range of topics, as well as, meet specific content based curriculum outcomes. In the classroom, most of the activities will allow teachers to link to industry and skills based curriculum outcomes, for example:

Science
Science as a Human Endeavour
• Solutions to contemporary issues that are found using science and technology, may impact on other areas of society and may involve ethical considerations (ACSHE135)

• People use science understanding and skills in their occupations and these have influenced the development of practices in areas of human activity (ACSHE136)

• People use scientific knowledge to evaluate whether they accept claims, explanations or predictions, and advances in science can affect people's lives, including generating new career opportunities (ACSHE160)

• Advances in scientific understanding often rely on developments in technology and technological advances are often linked to scientific discoveries (ACSHE158)

Scientific Inquiry Skills
• Identify questions and problems that can be investigated scientifically and make predictions based on scientific knowledge (ACSIS139)

• Formulate questions or hypotheses that can be investigated scientifically (ACSIS164)

Technology
Years 7/8
Knowledge and understanding
• Investigate how digital systems represent text, image and audio data in binary (ACTDIK024)

Processes and Production
• Acquire data from a range of sources and evaluate authenticity, accuracy and timeliness (ACTDIP025)

• Analyse and visualise data using a range of software to create information, and use structured data to model objects or events (ACTDIP026)

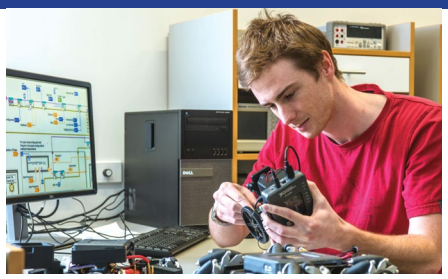
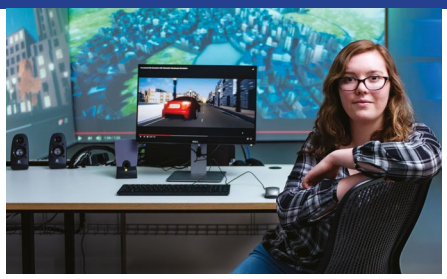
• Define and decompose real-world problems taking into account functional requirements and economic, environmental, social, technical and usability constraints (ACTDIP027)

• Design the user experience of a digital system, generating, evaluating and communicating alternative designs (ACTDIP028)

• Design algorithms represented diagrammatically and in English, and trace algorithms to predict output for a given input and to identify errors (ACTDIP029)

• Implement and modify programs with user interfaces involving branching, iteration and functions in a general-purpose programming language (ACTDIP030)

• Plan and manage projects that create and communicate ideas and information collaboratively online, taking safety and social contexts into account (ACTDIP032)

Years 9/10
Processes and Production

• Analyse and visualise data to create information and address complex problems, and model processes, entities and their relationships using structured data (ACTDIP037)

• 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)

• Contexts include reflection of 'national priorities including workforce needs'.

Maths

• Money and financial mathematics in the Number and Algebra content descriptor across all years

Additional resources

Are you new to programming and computer science? If so, you may find the websites below useful to access tools and ideas to get started:

• A range of non-computer based classroom activities designed for young learners and those new to computational thinking. bit.ly/CSUnPlugged

• A hub of activities for students and teachers to assist the integration of the Australian Curriculum: Digital Technologies (K-10), presented by Education Services Australia. www.digitaltechnologieshub.edu.au/

How to use the STEM + X activities grid

The STEM + X activities grid aims to provide a variety of student activities across a wide range of 'X' categories, while developing different skill-sets required for flexible career options. This term, the focus is on Engineering.

STEM + X rows – and what they mean

S	T	E	M
Science and everything experimental and inquiry-based	Includes computational thinking and digital technologies	Maker space and design thinking tasks; building or making something to solve a problem	Anything related to numeracy that is accessible and/or applied

STEM Integrated
– a combination of two or more STEM skills

STEM + X columns – and what they mean

DOING AND USING CODING
Students are given an actual activity to do.

CREATING AND MAKING WITH CODING
Students are given an idea for an activity, but they must design and carry it out themselves in a constructivist manner.

	DOING AND USING CODING	CREATING AND MAKING WITH CODING
S	**CODING + DRONE ECO-SCIENCE** Use a single sensor attached to a drone to collect data that will provide useful information about your local environment. Will your drone swim, crawl, drive or fly? Quite a few people in the Careers with Code magazine code to collect data; such as Yaya's wheelchair on p24 or Ross Campbell's portable companion robot that can take children's temperatures shown on p47. Create and write a plan for your drone to monitor one thing in your environment. What are the considerations you'll need to make before using the drone in public?	**CODING + BIOINFORMATICS** Design a mobile app that can be used to collect data for a citizen science project where the data can be accumulated and used by others for a purpose. Perhaps you can design something that helps keep people safe during environmental disasters, such as identifying which power lines are down after a cyclone, or which roads are open after a flood. Mobile app design is one of the tech jobs shown on p18, while Professor Nick Falkner on p33 is interesting in making cities smarter. For free app design software, go to: **marvelapp.com**
T	**CODING + ANIMATION** Use software to code your own cartoon character and then try animating it to make some simple moves. Before you start, plan your animation by drawing up a story board to outline your goals. When you have finished, reflect on how well you have achieved what you set out to achieve. If you have time, prepare an alternative design and compare the two. Read the stories on Cara Gately on p8 and Jessica D'Ali on p19 who bring their own character designs to life. Try any of these animation programs: • **tynker.com** • **scratch.mit.edu** • **alice.org**	**CODING + DESIGN PROJECT MANAGEMENT** Use two different technologies to design a new product, such as creating your own 3D object in CAD using TinkerCAD and then 3D printing it. If possible, create an app to interact with it in some way. Document the tasks needed to be carried identifying their order, the amount of time they will take, the resources needed, the name and application of the product. See the butterflies Charne Esterhuizen created in CAD to design the dress she showed at Canada's Fashion Week. Go to p22.
E	**CODING + HUMANITARIAN ART AND CULTURE** Use Unicode to translate a short famous piece of cultural text, such as a poem, proverb, mantra or slogan that is aimed to inspire and enlighten. If you have time you can code your own image to go with it. **unicode-table.com/en/** **unicode.org/standard/WhatIsUnicode.html**	**CODING + ELECTRONICS SELF-DRIVING CARS** Design and build a gadget, such as a toy, driverless car, or even part of some hardware, such as the keyboard Googler Shanika on p13 made, to carry out a particular function. You can use a commercial kit to build your gadget, or start from scratch with your own materials. When you have finished, have a go at wiring it up, and code it to perform a particular function. Read about self-driving cars on p45 with Michael Pearson. See the MakeyMakey kit for an example of creating and coding hardware. **bit.ly/Inventionkit**
M	**CODING + MATHEMATICS** Use the green operator scripts in Scratch, or any other software you are familiar with, to code a fun maths game to teach children. Maybe this is the beginning of coding a maths tutor AI such as Amy shown on p42? Before you start programming, provide a flow diagram of your algorithm. Gather information to evaluate your game and provide details on alternative designs. Michael Szewczyk codes games, see p23, and so are the Girl Gamers on p31. See AI Amy at: **amy.ac** Scratch: **scratch.mit.edu**	**CODING + FINANCE** Design an app that provides financial advice for someone and helps them improve their financial literacy. Read about the work Charisse Co is doing at her job in banking on p25 or Jesse Arundell's job on p35.
STEM Integrated	**CODING + GETTING INVOLVED** Participate in at least one of the activities on p48 and p49 by preparing a competition entry or undertaking a course or other event. Blog about your experience to help encourage and enlighten future coders. Or take a computer programming course at the Kahn academy. **bit.ly/KhanProg**	**CODING + INNOVATION** Produce an entry for Microsoft's Imagine Cup by designing and building an invention of your own and then coding it. Will you work on an insideable (p46), or something cultural (p26)? Write the pitch for your invention that could be used on an entry form. Kailun Zhang, Kuan (Jack) Qian and Matilda Stevenson represented Australia in the finals of Microsoft's Imagine Cup competition. Read about their experience on p44.

Reflection

What is the different between a job in coding and a job in computer science? Can you distinguish the two? Organise your thinking into the table below by using the *Careers with Code* magazine, and your own research to define the following terms in relation to each career.

TERMS	COMPUTER SCIENCE	CODING
Hardware		
Computer chips		
Circuits		
Processors		
Storage		
Languages		
Patterns		
Algorithms		
Logic loops		
Qt interfaces		
Distinguishing summary of each careers job statement		

Turn to the the Directory on pages 50–52 and find which courses are offered near you?

S

CODE+SCIENCE

How does a love of gaming and the determination to change the status quo make you a game-changer?

Lisy Kane

T

CODE+TECHNOLOGY

What coding career can help you solve some of the unique challenges faced by regional communities.

Bryce Eldridge

E

CODE+ENGINEERING

How does a passion for coding and building things result in a software engineering career at Google?

Shanika Kuruppu

M

CODE+MARKETING

What coding role involves helping Indigenous entrepreneurs make their business dreams a reality?

Dean Foley

For more career profiles, information and quizzes go to CareerswithSTEM.com

Supported by the Australian Government Department of Education and Training.