

Aussie
STEM Stars

VEENA SAHAJWALLA

'Green' engineer and recycling champion

Story told by JULIANNE NEGRI



Teacher Notes

written by

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ABOUT THIS SERIES

Aussie STEM Stars is a fresh and unique series for children and young teens aged 9–13 years that focuses on our Australian STEM heroes. Each book is written by an award-winning children’s author and follows the real-life stories of Australia’s top scientists and inventors, chosen on the basis of their pioneering work. Themes explored in the series include childhood, school, family and formative experiences, what inspired them to pursue their chosen path, how they persevered in the face of challenges and what they have contributed to science in Australia.

Reason for studying this book

Wild Dingo Press publisher Catherine Lewis is excited about their publication. “These disciplines are more important than ever as we look to our inventors and innovators to solve contemporary problems facing humanity and the planet. Our Aussie STEM Stars series uses narrative non-fiction as a tool for educating and inspiring children – making them as enjoyable and interesting as fiction books. Our writers are passionate about doing justice to their chosen subjects – and their lives – providing teachers, parents and librarians a wonderful series aimed at encouraging children to develop an interest in STEM at a young age.”

About the author

Julianne Negri’s debut children’s novel *The Secret Library of Hummingbird House* was published in 2020 and was a 2021 CBCA Notable. Julianne works in children and youth programming for Public Libraries and has been a musician, eco-crafter, filmmaker, television host and is the mother of five children. Julianne likes to have hair the colour of the sunset – all tones of pink, orange and mauve, and her favourite thing in the world is her dog, Rocket.

About our STEM Star: Prof. Veena Sahajwalla

One person's trash is another person's treasure! Veena is revolutionising the processes to transform waste into amazing products that goes way beyond recycling, which she calls 're-forming'. She and her team have invented machines that can transform waste at a micro level!

Also, Veena has invented 'green' steel – tyres and other plastics are recycled to replace fossil fuel in steelmaking. Bonus: green steel production reduces carbon emissions and it will prevent tonnes of waste going to landfill. No wonder she's getting awards all over the place, including being named 2022 NSW Australian of the Year!

Scientia Professor Veena Sahajwalla is the founder and Director of the Centre for Sustainable Materials Research and Technology (SMaRT) at the University of New South Wales, and head of the ARC Microrecycling Research Hub.

Check out some of her talks:

<https://www.youtube.com/watch?v=S-ugZCrDiQE>

<https://www.youtube.com/watch?v=4fkbQynfSyY>

OUTCOMES

Australian Curriculum

KEY FOCUS AREAS

Literacy Stages 2–4

Science Stages 2–4

Cross Curriculum priority–Sustainability

OUTCOMES

NSW Curriculum

KEY FOCUS AREAS

Literacy Stages 3–4

Science Stages 2–4

BEFORE YOU BEGIN READING THIS BOOK

Front cover

- What do you know about Veena Sahajwalla?
- What do you know about engineers? Recycling?
- What do you think when you read the words: 'green' engineer and recycling champion'?

Back cover

- Read the blurb. What can you gather about this book from the blurb?
- Why do we need blurbs for all types of books?

Before you start reading

- Draw attention to the quote on **page iii** in the book:

I see problems as opportunities. I'm excited about all the innovative solutions I could be developing to solve our environmental challenges – anything is possible!

Write this quote on a poster as a class or small group. Ask students to write ideas around the quote as to what it might mean to them. Add to this poster as the book is studied.

- Outline the glossary at the back and how to use it.
- Who is the author of this book? Explore other books and pieces of writing Julianne Negri has written and discuss why she may have been asked to write this book.
- What is the difference between a biography and an autobiography? Explore what this book is and why it is a biography and not an autobiography. Discuss the importance of the STEM Stars series.
- What is narrative non-fiction? Could this book fit into that genre as well?

KEY PROJECTS

Key project 1: Equality

I'm going to change the image of scientists as being a man in a white lab coat. I'll show the world that women can be scientists too.

- In many fields of work and in many aspects of some people's daily lives, women are often left behind or not treated equally. Find out some other careers where there are not as many women as men and how these industries are changing so that more women feel welcome and are also joining the leadership teams.
- In the past, women did not receive the same wage or salary as men for the same job: research when it became law in Australia for men and women to be paid equally for the same work.

Key project 2: Poverty leads to ingenuity

- How can poverty lead to ingenuity? Find some other examples around the world where people have had to think differently and creatively in order to use what they have so that they can save money.
- Which inventions have been inspired by this, how have personal lifestyles changed and/or have communities taken action in different ways?

Key project 3: Food

There are many types of Indian food described in this book.

- Find out more about traditional Indian food from different areas of India and plan a menu that represents one of these area.
- Compare how dishes change depending on the area of India it is from.

Key project 4: Notable people

- Explore the key characteristics Veena has that helped her to keep on working towards her goal despite the various obstacles she had to overcome.
- Why do you think she has them?
- Come up with a list of what you think a notable person needs to have in order to achieve their goals of wanting to help make the world a better place for those around them.

Key project 5: Reflection on literature

Students can fill in this table as they read to record their ideas and feelings:

Chapter	
In one sentence, explain what this chapter is about?	
What did Veena Sahajwalla do and say in this chapter? How did she feel?	
What real life events occurred? Link some dates and extra details to this event.	
New vocabulary you have learnt in this chapter	
How has the author made you feel? Think of the language used to create tension, happiness, wonder, anxiety.	

Reflect on this table after the book has been read

- How did your knowledge change throughout the book?
- How did your feelings change?
- Did the characters seem to change as you learnt more about them? Which events caused changes in their characteristics?
- What new vocabulary have you learned?

TEACHING AND LEARNING ACTIVITIES

Chapter 1

- Where is Mumbai? Find this city on a map and work out how far it is from where you live.
- List the descriptive language used to describe how Veena is feeling as she rides on the scooter with her father.
- Find an image of a sari. How is this dress different from some other traditional dresses you might know in other cultures?
- What does the author mean and also suggest about Veena's personality when she refers to Veena as having a megawatt smile?

Chapter 2

- Why do you think Veena sees her parents' jobs as very important? How do these jobs help society?
- What is a *paratha*? How is this different from your breakfast?
- Why does Veena like going to her mother's surgery?
- What is a dutiful older sister?
- How might living in an apartment like Veena's be fun for children? And how might it be harder for children than living in a house with its own garden?
- Who is Bipasha?

Chapter 3

- What is a Sherlock Holmes' mystery?
- How can words dance on a page?
- Write some of your own knock-knock jokes that play on words to make the joke.
- Write down the different steps Veena took to try and smash the coconut and what she discovered along the way.
- Why weren't Veena's parents angry with her for breaking the sink?
- Have you ever shown tenacity? Where do you think you could show this more often?

Chapter 4

- How is Sonali's lunchbox different from yours? Are there any similarities?
- Why do you think people always ask children what they want to be when they grow up?
- Why would other children assume Veena wants to be a doctor?
- Create a script for a performance you and a few friends could perform in front of an audience about future careers and dreams.

Chapter 5

- Why would 'good teacups' make the tea taste better?
- How is knowing about the tea party with Sonali important to this book?
- What do you think about Veena fainting when she saw blood? Has that ever happened to you or someone you know? How might this affect her choices in the future?
- Try your own investigation of a piece of equipment or device (check first with your parents to make sure it's fine by them!) by pulling it apart and putting it together again. Draw a diagram of the different parts of the object and how they all play a role to make it work.
- What role did Veena's doll play for her? Do you have a favourite toy or pet that has a similar role in your life?

Chapter 6

- When you first read about Veena going to collect the milk, what did you think? How is collecting milk different from what you do? Which method do you think works better? Which has a better outcome for people?
- List some things that Veena discovered as she walked through the slums.
- Have you seen any of this happening where you live? Do you think it should?

Chapter 7

- Why do you think Veena's mother makes Veena's clothes when she could buy them from a shop?
- How can a performance be both exhilarating and exhausting?
- What skills and personal attributes do you need to be a performer on stage? Can anyone learn these?
- What does 'fruition' mean?

Chapter 8

- How might dissecting a frog be good practice for being a doctor?
- Why do you think many high school students are asked to dissect frogs in science lessons?
- What is a scalpel?
- If Veena's parents hadn't been supportive of her, how might this have affected her future choices?

Chapter 9

- Where is the Indian Institute of Technology? How far is it away from Mumbai?
- The writer says that Veena was 'squashed like a sardine' in the bus. Where does this saying come from? Hint, the saying is actually: 'packed like sardines', and it is not an English or Indian saying!
- What do you think Veena is thinking when she considers: '*She thought about how engineering could influence how we live through how we make the world*'.
- Why did Panna choose not to sit the exam? Consider all of the different factors that went into her decision.
- Rewrite the moment Veena opened the letter from IIT from Veena's perspective. Consider all of the different emotions going through her mind.

Chapter 10

- Why would a university need bicycles for students to get around on?
- What does rubbernecking mean?
- What is a dormitory? Who would stay in one of these?
- What does 'mortified' mean? When else might you or Veena feel mortified?
- How many different types of engineering are there? How are they the same? How are they different? What makes them all fall under the category of engineering?
- List the different emotions Veena and her family are feeling as Veena leaves for university. Give examples and your own real-life examples of what makes you know they are feeling this way.
- Why did Veena's spirits sink to her boots? Why did the author choose this phrase to describe how Veena is feeling?
- Why were there different rules for males and females? How does this make Veena think and feel? Give some examples.
- Why do we feel homesick? Do you think this is an important emotion?

Chapter 11

- After you have read this chapter, list what you have learnt about metallurgical engineering and how it is used in our daily lives. What other questions do you have about this type of engineering?
- How can the sense of isolation feel acute?
- What is an internship?
- What does 'chaperone' mean? Why would her father want to chaperone her to her placement?
- Why was it important that her parents continued to encourage Veena?

Chapter 12

- How can science be important for humanity?
- Why is working with more experienced people helpful in how you develop your knowledge? Couldn't you just read a book or look it up online?
- What is healthy competition? When can competition not be healthy?
- What is steel made of?
- Why does her mother think she will not return to Mumbai?
- Use a map to find out where Veena lived in Canada.
- How did the ice cream tub on the plate make Veena feel?

Chapter 13

- Veena tells herself to ask the right questions. What sorts of questions do you think Veena asked herself about the mountain of plastic waste?
- What does receiving a grant mean?
- Veena's research took six years. What sorts of characteristics do you think these scientists would need to keep on trying for this long?
- Why did people continue to think Veena's idea wouldn't work?
- What is a Eureka Award? Who else has won one of these awards?
- Why do you think Veena said: 'Even if you don't care about climate change and fossil fuels...' in her speech to the industry leaders?

Chapter 14

- What was The New Inventors show?
- List all of the different things and people needed to make a TV show.

- Explore some episodes of The New Inventors to find out the various inventions that people who came on the show had created. Summarise two or three of your favourite inventions that were shown on The New Inventors.

Chapter 15

- Why are people like Veena important to the future of the world? Could she have achieved what she has so far on her own? Explain your answer.
- '*Waste is an opportunity!*' How do you think waste is an opportunity? What can you do about the waste you produce at school and at home?
- Why doesn't the 'reduce, reuse, recycle slogan go far enough?
- What are filaments?
- What is a zero-waste community? How can this be achieved?
- Why do you think Veena kept on trying to improve her 'green steel'?

EXTENSION QUESTIONS FOR FURTHER THINKING

What if we didn't mine any fossil fuels. How might this impact the world?

Recycling can be helpful yet harmful. Discuss.

List objects that can be recycled to form a new and useful product. Categorise these objects into groups according to how much of this product can be re-used before ending up in landfill.

How is a rubbish pile like a gold mine?

Has the idea of re-using, re-purposing and recycling been around forever or is it a new concept brought about by the piling mounds of landfill?

If you were a scientist like Veena, which engineering problems would you like to solve?

ELABORATION OF OUTCOMES TO THE AUSTRALIAN CURRICULUM

Cross-Curriculum Priority Sustainability

OI.2	All life forms, including human life, are connected through ecosystems on which they depend for their wellbeing and survival.
OI.3	Sustainable patterns of living rely on the interdependence of healthy social, economic and ecological systems.
OI.4	World views that recognise the dependence of living things on healthy ecosystems, and value diversity and social justice, are essential for achieving sustainability.
OI.5	World views are formed by experiences at personal, local, national and global levels, and are linked to individual and community actions for sustainability.
OI.6	The sustainability of ecological, social and economic systems is achieved through informed individual and community action that values local and global equity and fairness across generations into the future.
OI.7	Actions for a more sustainable future reflect values of care, respect and responsibility, and require us to explore and understand environments.
OI.8	Designing action for sustainability requires an evaluation of past practices, the assessment of scientific and technological developments, and balanced judgements based on projected future economic, social and environmental impacts.

Literacy

STAGE 2

Discuss texts in which characters, events and settings are portrayed in different ways, and speculate on the authors' reasons (ACELT1594).

Draw connections between personal experiences and the worlds of texts, and share responses with others (ACELT1596).

Develop criteria for establishing personal preferences for literature (ACELT1598).

Discuss how language is used to describe the settings in texts, and explore how the settings shape the events and influence the mood of the narrative (ACELT1599).

Create imaginative texts based on characters, settings and events from students' own and other cultures using visual features, for example perspective, distance and angle (ACELT1601).

Listen to and contribute to conversations and discussions to share information and ideas and negotiate in collaborative situations (ACELY1676).

Use comprehension strategies to build literal and inferred meaning and begin to evaluate texts by drawing on a growing knowledge of context, text structures and language features (ACELY1680).

Make connections between the ways different authors may represent similar storylines, ideas and relationships (ACELT1602)

Discuss literary experiences with others, sharing responses and expressing a point of view (ACELT1603).

Discuss how authors and illustrators make stories exciting, moving and absorbing and hold readers' interest by using various techniques, for example character development and plot tension (ACELT1605).

Identify characteristic features used in imaginative, informative and persuasive texts to meet the purpose of the text (ACELY1690).

Use comprehension strategies to build literal and inferred meaning to expand content knowledge, integrating and linking ideas and analysing and evaluating texts (ACELY1692),

STAGE 3

Recognise that ideas in literary texts can be conveyed from different viewpoints, which can lead to different kinds of interpretations and responses (ACELT1610).

Make connections between students' own experiences and those of characters and events represented in texts drawn from different historical, social and cultural contexts (ACELT1613).

Analyse and evaluate similarities and differences in texts on similar topics, themes or plots (ACELT1614).

Identify, describe, and discuss similarities and differences between texts, including those by the same author or illustrator, and evaluate characteristics that define an author's individual style (ACELT1616).

Clarify understanding of content as it unfolds in formal and informal situations, connecting ideas to students' own experiences and present and justify a point of view (ACELY1699).

Navigate and read texts for specific purposes applying appropriate text processing strategies, for example predicting and confirming, monitoring meaning, skimming and scanning (ACELY1702).

Analyse how text structures and language features work together to meet the purpose of a text (ACELY1711).

Use comprehension strategies to interpret and analyse information and ideas, comparing content from a variety of textual sources including media and digital texts (ACELY1713).

STAGE 4

Identify and explore ideas and viewpoints about events, issues and characters represented in texts drawn from different historical, social and cultural contexts (ACELT1619).

Reflect on ideas and opinions about characters, settings and events in literary texts, identifying areas of agreement and difference with others and justifying a point of view (ACELT1620).

Compare the ways that language and images are used to create character, and to influence emotions and opinions in different types of texts (ACELT1621).

Recognise and analyse the ways that characterisation, events and settings are combined in narratives, and discuss the purposes and appeal of different approaches (ACELT1622).

Recognise, explain and analyse the ways literary texts draw on readers' knowledge of other texts and enable new understanding and appreciation of aesthetic qualities (ACELT1629).

Science

STAGE 2

A change of state between solid and liquid can be caused by adding or removing heat (ACSSU046).

Natural and processed materials have a range of physical properties that can influence their use (ACSSU074).

Science involves making predictions and describing patterns and relationships (ACSHE050 & ACSHE 61).

Science knowledge helps people to understand the effect of their actions (ACSHE051 & ACSHE62).

With guidance, plan and conduct scientific investigations to find answers to questions, considering the safe use of appropriate materials and equipment (ACSIS054 & ACSHE64).

STAGE 3

Solids, liquids and gases have different observable properties and behave in different ways (ACSSU077).

Changes to materials can be reversible or irreversible (ACSSU095).

Scientific knowledge is used to solve problems and inform personal and community decisions (ACSHE083, ACSHE100).

Identify, plan and apply the elements of scientific investigations to answer questions and solve problems using equipment and materials safely and identifying potential risks (ACSIS086, ACSIS103).

Science involves testing predictions by gathering data and using evidence to develop explanations of events and phenomena and reflects historical and cultural contributions (ACSHE098).

STAGE 4

Mixtures, including solutions, contain a combination of pure substances that can be separated using a range of techniques (ACSSU113).

Chemical change involves substances reacting to form new substances (ACSSU225).

Scientific knowledge has changed people's understanding of the world and is refined as new evidence becomes available (ACSHE119, ACSHE134).

People use science understanding and skills in their occupations and these have influenced the development of practices in areas of human activity (ACSHE121, ACSHE136).

Identify questions and problems that can be investigated scientifically and make predictions based on scientific knowledge (ACSIS124, ACSIS139).

Collaboratively and individually plan and conduct a range of investigation types, including fieldwork and experiments, ensuring safety and ethical guidelines are followed (ACSIS125, ACSIS140).

Science knowledge can develop through collaboration across the disciplines of science and the contributions of people from a range of cultures (ACSHE223, ACSHE226).