



Charles Sturt  
University

# The values, principles and practices of STEM

How Little Scientists aligns with the  
EYLF, NQS and the Australian  
Curriculum

Associate Professor Lena Danaia

# Overview

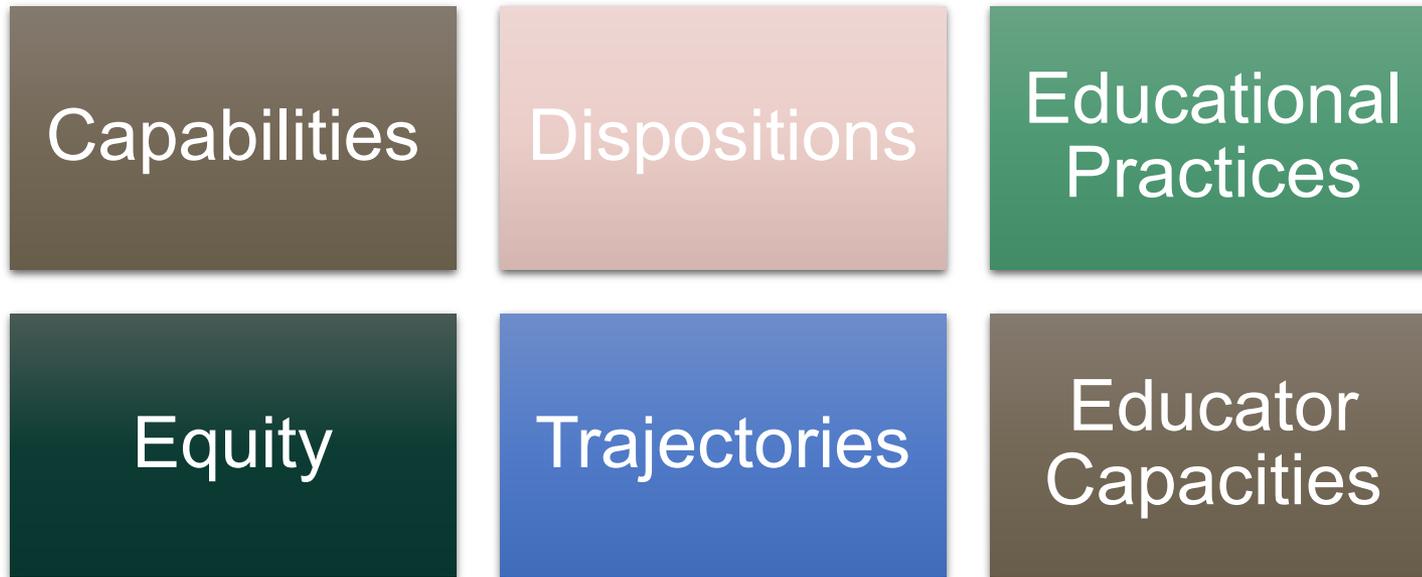
- STEM in Early Childhood Settings
- Elements of effective STEM Education
- Two-year evaluation of *Little Scientists*
- Mapping of *Little Scientists* to:
  - National Quality Standards
  - Australian Professional Standards for Teachers
  - Early Years Learning Framework
- Group mapping exercise for Acoustics
  - EYLF and the Acoustics Materials
  - Australian Curriculum

# Background

- Growing interest in STEM in early childhood education
- Early childhood years lay the foundation for future learning in STEM
- Early childhood educators are **key** to provision of early STEM education:
  - Educators' beliefs, attitudes, and perceptions impact the delivery of a STEM curriculum
  - Known issues around educators' confidence and capacities
  - Effective professional development in STEM is critical

*Little Scientists* contributes to an area of need in early childhood education.

# Elements of effective STEM Education



Murphy, S., MacDonald, A., Danaia, L., & Wang, C. (2018). An analysis of Australian STEM education strategies. *Policy Futures in Education*. DOI: 10.1177/1478210318774190

# Evaluation team



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**Dr Shukla Sikder**

Associate Lecturer  
in Learning and  
Teaching

+ **Dr Kate Highfield** in the early stages of the project

Responsible for a two-year evaluation of the *Little Scientists* program

# Content analysis and curriculum mapping

Part of the evaluation involved:

- Identifying the key concepts from each of the STEM disciplines covered by the *Little Scientists* program.
- Mapping *Little Scientists* workshops and resources to
  - National Quality Standards
  - Australian Professional Standards for Teachers
  - Australian Curriculum (Learning Areas, General Capabilities, Cross-Curriculum Priorities)
  - Early Years Learning Framework (Principles and Practices, Learning Outcomes)

# National Quality Standards (NQS)

1. Educational program and practice
2. Children's health and safety
3. Physical environment
4. Staffing arrangements
5. Relationships with children
6. Collaborative partnerships with families and communities
7. Governance and leadership.

## Quality Area 1: Educational Program and Practice

Standard	Focus	Element	Descriptor	Relationship to Little Scientists' professional development program for early childhood educators and teachers
1.1. Program	The educational program enhances each child's learning and development.	1.1.3. Program learning opportunities	All aspects of the program, including routines, are organised in ways that maximise opportunities for each child's learning.	Participants: <ul style="list-style-type: none"> <li>- Learn about how to select appropriate resources for STEM activities that encourage higher order thinking skills.</li> </ul>
1.2. Practice	Educators facilitate and extend each child's learning and development.	1.2.1 Intentional teaching	Educators are deliberate, purposeful, and thoughtful in their decisions and actions.	Participants: <ul style="list-style-type: none"> <li>- Improve their knowledge of Science, Technology, Engineering and Mathematics (STEM) through practical free exploration, demonstration and prompted exploration using discovery and research cards published by Little Scientists.</li> <li>- Learn and revise learning theories, such as meta-cognition and co-construction.</li> <li>- Reflect on which teaching strategies to select and use in different learning situations.</li> <li>- Critically reflect on their own role as a learning coach - their teaching style, the strategies they use and whether their practice is in line with the latest educational research.</li> </ul>
		1.2.2. Responsive teaching and scaffolding	Educators respond to children's ideas and play and extend children's learning through open-ended questions, interactions and feedback.	Participants: <ul style="list-style-type: none"> <li>- Create engaging teaching activities that follow the 'Inquiry Cycle' method of research.</li> <li>- Role play, and learn about, inquiry-based learning, using the 'Inquiry Cycle', to encourage problem-solving, critical and creative thinking.</li> </ul>
1.3. Assessment and planning	Educators and co-ordinators take a planned and reflective approach to implementing the program for each child.	1.3.1. Assessment and planning cycle	Each child's learning and development is assessed or evaluated as part of an ongoing cycle of observation, analysing learning, documentation, planning, implementation and reflection.	Participants: <ul style="list-style-type: none"> <li>- Create a 'STEM Action Plan' which includes a variety of teaching and learning strategies to scaffold and extend children's learning of STEM.</li> </ul>
		1.3.2. Critical reflection	Critical reflection on children's learning and development, both as individuals and in groups, drives program planning and implementation.	Participants: <ul style="list-style-type: none"> <li>- Exchange professional ideas, views and experiences with other early childhood sector colleagues in group discussions.</li> </ul>

# Little Scientists alignment to the Australian Professional Standards for Teachers

Domains of teaching	Standards
<b>Professional Knowledge</b>	1. Know students and how they learn 2. Know the content and how to teach it
<b>Professional Practice</b>	3. Plan for and implement effective teaching and learning 4. Create and maintain supportive and safe learning environments 5. Assess, provide feedback and report on student learning
<b>Professional Engagement</b>	6. Engage in professional learning 7. Engage professionally with colleagues, parents/carers and the community

Domain of Teaching	Standard	Focus	APST Standard Descriptor (Proficient Teacher stage)	Relationship to Little Scientists professional development program for early childhood educators
Professional Knowledge	Standard 2: Know the content and how to teach it	Content and teaching strategies of the teaching area	2.1.2 Apply knowledge of the content and teaching strategies of the teaching area to develop engaging teaching activities.	Participants: <ul style="list-style-type: none"> <li>- Improve their knowledge of Science, Technology, Engineering and Mathematics (STEM) through practical free exploration, demonstration and prompted exploration using discovery and research cards published by Little Scientists.</li> <li>- Create engaging teaching activities that follow the 'Inquiry Cycle' method of research.</li> <li>- Create a 'STEM Action Plan' which includes a variety of teaching and learning strategies to scaffold and extend children's learning of STEM.</li> </ul>
Professional Practice	Standard 3: Plan and implement effective teaching and learning	Use teaching strategies	3.3.2 Select and use relevant teaching strategies to develop skills, problem-solving, and critical and creative thinking.	Participants: <ul style="list-style-type: none"> <li>- Learn and revise learning theories, such as meta-cognition and co-construction.</li> <li>- Role play, and learn about, inquiry-based learning, using the 'Inquiry Cycle', to encourage problem-solving, critical and creative thinking.</li> <li>- Learn about how to select appropriate resources for STEM activities that encourage higher order thinking skills.</li> <li>- Reflect on which teaching strategies to select and use in different learning situations.</li> </ul>
Professional Engagement	Standard 6: Engage in professional learning	Engage in professional learning and improve practice	6.2.2 Participate in learning to update knowledge and practice targeted to professional needs and school and/or system priorities.	Participants: <ul style="list-style-type: none"> <li>- Critically reflect on their own role as a learning coach - their teaching style, the strategies they use and whether their practice is in line with the latest educational research.</li> <li>- Exchange professional ideas, views and experiences with other early childhood sector colleagues in group discussions.</li> </ul>

# Little Scientists program alignment to EYLF Principles and Practices

	EYLF Principle	EYLF Practice	Evidenced in Little Scientists workshops and support materials
Secure, respectful and reciprocal relationships	✓		potentially explored or implied
Partnerships with families	✓		explicitly explored
High expectations and quality	✓		explicitly explored
Respect for diversity	✓		potentially explored or implied
Ongoing learning and reflective practice	✓		explicitly explored
Holistic approaches		✓	potentially explored or implied
Responsiveness to children		✓	explicitly explored
Learning through play		✓	explicitly explored
Intentional teaching		✓	explicitly explored
Learning environments		✓	explicitly explored
Cultural competence		✓	potentially explored or implied
Continuity of learning and transitions		✓	explicitly explored
Assessment for learning		✓	potentially explored or implied



# Early Years Learning Framework (EYLF)

The *Little Scientists* program relates to **all** five of the EYLF Learning Outcomes:

1. Children have a strong sense of identity
2. Children are connected with and contribute to their world
3. Children have a strong sense of wellbeing
4. Children are confident and involved learners
5. Children are effective communicators.

Example:

Outcome 2: Children are connected with and contribute to their world

## OUTCOME 2: CHILDREN ARE CONNECTED WITH AND CONTRIBUTE TO THEIR WORLD

- Children develop a sense of belonging to groups and communities and an understanding of the reciprocal rights and responsibilities necessary for active community participation
- Children respond to diversity with respect
- Children become aware of fairness
- Children become socially responsible and show respect for the environment

Participation in Little Scientists workshops will assist educators to:

Provide opportunities for children to investigate ideas, complex concepts and ethical issues that are relevant to their lives and their local communities

Model language that children can use to express ideas, negotiate roles and collaborate to achieve goals

Ensure that children have the skills to participate and contribute to group play and projects

Provide children with access to a range of natural materials in their environment

Model respect, care and appreciation for the natural environment

Find ways of enabling children to care for and learn from the land

Consider the nature of children's connectedness to the land and demonstrate respect for community protocols

Share information and provide children with access to resources about the environment and the impact of human activities on environments

Embed sustainability in daily routines and practices

Look for examples of interdependence in the environment and discuss the ways the life and health of living things are interconnected

	Exploring Water	Exploring Air	Optics – Light, Colours and Vision	Engineering – Forces and Effects	Mathematics – Shape and Space	Human Body	Technology	Sustainable Development
Provide opportunities for children to investigate ideas, complex concepts and ethical issues that are relevant to their lives and their local communities	✓	✓	✓	✓	✓	✓	✓	✓
Model language that children can use to express ideas, negotiate roles and collaborate to achieve goals	✓	✓	✓	✓	✓	✓	✓	✓
Ensure that children have the skills to participate and contribute to group play and projects	✓	✓	✓	✓	✓	✓	✓	✓
Provide children with access to a range of natural materials in their environment	✓	✓						✓
Model respect, care and appreciation for the natural environment	✓	✓						✓
Find ways of enabling children to care for and learn from the land								✓
Consider the nature of children's connectedness to the land and demonstrate respect for community protocols								✓
Share information and provide children with access to resources about the environment and the impact of human activities on environments								✓
Embed sustainability in daily routines and practices								✓
Look for examples of interdependence in the environment and discuss the ways the life and health of living things are interconnected	✓	✓				✓		✓



## Group activity

Read through the Little Scientists Acoustics Research and Discovery Cards on your table.

What activities might you implement within your setting?  
(List some of these)

Using the EYLF table of outcomes (see handout), map your activities to the relevant EYLF outcomes.

Brainstorm some possible learning outcomes associated with these activities (add to the list of outcomes already included on the handout)

Group sharing

***Learning outcome: a skill, knowledge or disposition that educators can actively promote in early childhood settings, in collaboration with children and families.***

## OUTCOME 2: CHILDREN ARE CONNECTED WITH AND CONTRIBUTE TO THEIR WORLD

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	Exploring Water	Exploring Air	Optics – Light, Colours and Vision	Engineering – Forces and Effects	Mathematics – Shape and Space	Human Body	Computer Science	Chemical Reactions	<b>Acoustics</b>	Design and Technologies
Provide opportunities for children to investigate ideas, complex concepts and ethical issues that are relevant to their lives and their local communities	✓	✓	✓	✓	✓	✓	✓	✓		✓
Model language that children can use to express ideas, negotiate roles and collaborate to achieve goals	✓	✓	✓	✓	✓	✓	✓	✓		✓
Ensure that children have the skills to participate and contribute to group play and projects	✓	✓	✓	✓	✓	✓	✓	✓		✓
Provide children with access to a range of natural materials in their environment	✓	✓								
Model respect, care and appreciation for the natural environment	✓	✓								
Find ways of enabling children to care for and learn from the land										
Consider the nature of children's connectedness to the land and demonstrate respect for community protocols										
Share information and provide children with access to resources about the environment and the impact of human activities on environments										
Embed sustainability in daily routines and practices										
Look for examples of interdependence in the environment and discuss the ways the life and health of living things are interconnected	✓	✓				✓				



## OUTCOME 4: CHILDREN ARE CONFIDENT AND INVOLVED LEARNERS

Children develop dispositions for learning such as curiosity, cooperation, confidence, creativity, commitment, enthusiasm, persistence, imagination and reflexivity

- Children develop a range of skills and processes such as problem solving, enquiry, experimentation, hypothesising, researching and investigating
- Children transfer and adapt what they have learned from one context to another
- Children resource their own learning through connecting with people, place, technologies and natural and processed materials

Participation in Little Scientists workshops will assist educators to:

Provide learning environments that are flexible and open-ended

Encourage children to engage in both individual and collaborative explorative learning processes

Listen carefully to children's ideas and discuss with them how these ideas might be developed

Provide opportunities for children to revisit their ideas and extend their thinking

Model inquiry processes, including wonder, curiosity and imagination, try new ideas and take on challenges

Plan learning environments with appropriate levels of challenge where children are encouraged to explore, experiment and take appropriate risks in their learning

Recognise mathematical understandings that children bring to learning and build on these in ways that are relevant to each child

Provide experiences that encourage children to investigate and solve problems

Provide opportunities for involvement in experiences that support the investigation of ideas, complex concepts and thinking, reasoning and hypothesising

Model mathematical and scientific language

Support children to construct multiple solutions to problems and use different ways of thinking

Draw children's attention to patterns and relationships in the environment and in their learning

Provide sensory and exploratory experiences with natural and processed materials

Introduce appropriate tools, technologies and media and provide the skills, knowledge and technologies to enhance children's learning

Provide opportunities for children to both construct and take apart materials as a strategy for learning

Develop their own confidence with technologies available to children in the setting

	Exploring Water	Exploring Air	Optics – Light, Colours and Vision	Engineering – Forces and Effects	Mathematics – Shape and Space	Human Body	Computer Science	Chemical Reactions	Acoustics	Design and Technologies
Provide learning environments that are flexible and open-ended	✓	✓	✓	✓	✓	✓	✓	✓		
Encourage children to engage in both individual and collaborative explorative learning processes	✓	✓	✓	✓	✓	✓	✓	✓		✓
Listen carefully to children's ideas and discuss with them how these ideas might be developed	✓	✓	✓	✓	✓	✓	✓	✓		✓
Provide opportunities for children to revisit their ideas and extend their thinking	✓	✓	✓	✓	✓	✓	✓	✓		✓
Model inquiry processes, including wonder, curiosity and imagination, try new ideas and take on challenges	✓	✓	✓	✓	✓	✓	✓	✓		✓
Plan learning environments with appropriate levels of challenge where children are encouraged to explore, experiment and take appropriate risks in their learning	✓	✓	✓	✓	✓	✓	✓	✓		✓
Recognise mathematical understandings that children bring to learning and build on these in ways that are relevant to each child					✓					
Provide experiences that encourage children to investigate and solve problems	✓	✓	✓	✓	✓	✓	✓	✓		✓
Provide opportunities for involvement in experiences that support the investigation of ideas, complex concepts and thinking, reasoning and hypothesising	✓	✓	✓	✓	✓	✓	✓	✓		✓
Model mathematical and scientific language	✓	✓	✓		✓	✓		✓		
Support children to construct multiple solutions to problems and use different ways of thinking				✓			✓	✓		✓
Draw children's attention to patterns and relationships in the environment and in their learning				✓	✓		✓			
Provide sensory and exploratory experiences with natural and processed materials	✓	✓	✓	✓	✓	✓	✓	✓		✓
Introduce appropriate tools, technologies and media and provide the skills, knowledge and technologies to enhance children's learning				✓			✓			✓
Provide opportunities for children to both construct and take apart materials as a strategy for learning				✓			✓			✓
Develop their own confidence with technologies available to children in the setting							✓			✓

## OUTCOME 5: CHILDREN ARE EFFECTIVE COMMUNICATORS

- Children interact verbally and non-verbally with others for a range of purposes
- Children engage with a range of texts and gain meaning from these texts
- Children express ideas and make meaning using a range of media
- Children begin to understand how symbols and pattern systems work
- Children use information and communication technologies to access information, investigate ideas and represent their thinking

Participation in Little Scientists workshops will assist educators to:

Listen to and respond to children's approximations of words

Model language and encourage children to express themselves through language in a range of contexts and for a range of purposes

Engage in sustained communication with children about ideas and experiences, and extend their vocabulary

Include real-life resources to promote children's use of mathematical language

Draw children's attention to symbols and patterns in their environment and talk about patterns and relationships

Provide children with access to a wide range of everyday materials that they can use to create patterns and to sort, categorise, order and compare

Engage children in discussions about symbol systems, for example, letters, numbers, time, money and musical notation

Provide children with access to a range of technologies

Integrate technologies into children's play experiences and projects

Teach skills and techniques and encourage children to use technologies to explore new information and represent their ideas

Encourage collaborative learning about and through technologies between children, and children and educators

	Exploring Water	Exploring Air	Optics – Light, Colours and Vision	Engineering – Forces and Effects	Mathematics – Shape and Space	Human Body	Computer Science	Chemical Reactions	Acoustics	Design and Technologies
Listen to and respond to children's approximations of words	✓	✓	✓	✓	✓	✓	✓	✓		✓
Model language and encourage children to express themselves through language in a range of contexts and for a range of purposes	✓	✓	✓	✓	✓	✓	✓	✓		✓
Engage in sustained communication with children about ideas and experiences, and extend their vocabulary	✓	✓	✓	✓	✓	✓	✓	✓		✓
Include real-life resources to promote children's use of mathematical language					✓					
Draw children's attention to symbols and patterns in their environment and talk about patterns and relationships					✓					
Provide children with access to a wide range of everyday materials that they can use to create patterns and to sort, categorise, order and compare					✓					
Engage children in discussions about symbol systems, for example, letters, numbers, time, money and musical notation					✓					
Provide children with access to a range of technologies							✓			✓
Integrate technologies into children's play experiences and projects							✓			✓
Teach skills and techniques and encourage children to use technologies to explore new information and represent their ideas							✓			
Encourage collaborative learning about and through technologies between children, and children and educators							✓			✓

# Acoustics workshop alignment to the Australian Curriculum

Learning Area: Science

Foundation Year:

- Science involves observing, asking questions about, and describing changes in, objects and events (ACSHE013).
- Pose and respond to questions about familiar objects and events (ACSIS014).
- Participate in guided investigations and make observations using the senses (ACSIS011).
- Engage in discussions about observations and represent ideas (ACSIS233).
- Share observations and ideas (ACSIS012).

Year 1:

- Light and sound are produced by a range of sources and can be sensed (ACSSU020).
- Science involves observing, asking questions about, and describing changes in, objects and events (ACSHE021).
- People use science in their daily lives, including when caring for their environment and living things (ACSHE022).
- Pose and respond to questions, and make predictions about familiar objects and events (ACSIS024).
- Participate in guided investigations to explore and answer questions (ACSIS025).
- Compare observations with those of others (ACSIS213).
- Represent and communicate observations and ideas in a variety of ways (ACSIS029).

Year 2:

- Science involves observing, asking questions about, and describing changes in, objects and events (ACSHE034).
- People use science in their daily lives, including when caring for their environment and living things (ACSHE035).
- Pose and respond to questions, and make predictions about familiar objects and events (ACSIS037).
- Participate in guided investigations to explore and answer questions (ACSIS038).
- Compare observations with those of others (ACSIS041).
- Represent and communicate observations and ideas in a variety of ways (ACSIS042).



# Summary

- There is **strong** alignment between the *Little Scientists* program and the NQS, EYLF, and Australian Curriculum.
- *Little Scientists*' content **explicitly** links to the EYLF, NQS, APST, and the Australian Curriculum.
- The *Little Scientists* program can **support you** in relation to the programming, planning, and documentation obligations you have in your workplaces.

# Contact

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