

Inclusion & Engagement

DeadlySTEM Guide
for Teachers



DEADLY
SCIENCE

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ACKNOWLEDGEMENT OF COUNTRY

DeadlyScience pays respect to the Traditional Custodians of the land, to all Elders past and present, and to First Nations people everywhere.

First Nations people have used science for over 65,000 years. Our culture is the oldest in the world. The first scientists passed on the lessons of the land, sea and sky, to the future scientists of today through stories, song and dance. We call this caring for Country.

If you care for Country, the Country will care for you.



About this guide

First Nations people around Australia have practised science for over 65,000 years. They are the first scientists of Australia. The information in this guide is designed to assist classroom teachers to improve engagement and inclusion of Aboriginal and Torres Strait Islander students with science, technology, engineering and mathematics (STEM) subjects. The approaches and strategies in this guide can, at times, be transferred to other subjects and contexts.

The aim of engagement is to inspire and connect Aboriginal and Torres Strait Islander students with STEM subjects. To create curious minds; minds which can pursue STEM if they want. We want students to become innovative in their own unique ways and pursue pathways in STEM, which may not always be through a university. There are many different STEM career pathways.

Inclusion is designed to continue supporting community and empower Aboriginal and Torres Strait Islander students with the knowledge that their culture is valued and celebrated. DeadlyScience focuses on two-way learning to achieve this aim. This means valuing and respecting the student and community body of knowledge as much as the teacher's knowledge.

We encourage teachers to build connections with their local Indigenous communities, to include the local STEM knowledge. Doing this can lead to amongst other experiences, field trips on-country where rich and deep learning can occur.

This aim of this guide is to prompt thinking about ways to engage and include Aboriginal and Torres Strait Islander students in the classroom for the purposes of sparking an interest in STEM so they have the opportunity to choose to become the future generation of deadly STEM legends.

This guide is divided into three sections. The first is about the importance of the Acknowledgement of Country. The second explains the DeadlyScience approach for teaching and learning STEM - Fusing Hearts and Minds: The DEADLY Way. This approach consists of six strategies. The third offers an approach and two strategies which support the inclusion of Indigenous perspectives in the STEM classroom.

For further explanation and demonstration about how to use these approaches and strategies in the classroom to support the engagement and inclusion of Indigenous perspectives please contact DeadlyScience.

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Acknowledging Country in the classroom



Acknowledging Country in the classroom

Begin each lesson with an Acknowledgement of Country or Welcome to Country to respectfully recognise the traditional custodians of the land, sea, waterways and sky of the local area. Discuss the meaning the Acknowledgement of Country provides as an opportunity to introduce the themes of the lessons, including custodianship, respect and connection to Country.

Make Acknowledgements meaningful. They are not just a set of words. Learn about the land on which the school resides and the Aboriginal and Torres Strait Islander culture of the land. Bring this learning to the classroom and celebrate it with respect. Invite elders of the community to come and share stories. Share what is publicly available and ask permission of elders before sharing information which is not.

Involve students in the Acknowledgement or Welcome. Let them use their own words to describe their feelings of gratitude for the country and people.

Ask the local land council whether there is an elder who can teach some language to classes and ask permission for the students to learn and speak words in language.

There are plenty of interesting ways to engage students in creating their own Acknowledgement of Country to be found.



AIATSIS Map

Use a map, such as the Australian Institute of Aboriginal and Torres Strait Islander Studies (AIATSIS) Map of Indigenous Australia, to teach students about the Traditional Owners of the land on which they live, learn and play. Explain there are over 500 distinct First Nations cultural and language groups across Australia. [Link to AIATSIS map](#)

Reconciliation NSW Aboriginal Languages Map

Use a map, such as the Reconciliation NSW Aboriginal Languages Map, to teach students about the traditional languages of NSW and your local area. They also have puzzles of the map available. [Link to NSW Aboriginal languages map and activities.](#)

Building Relationships with Local Communities

The NSW Education Standards Authority has a guide to Working with Aboriginal Communities. This guide has lots of useful and helpful information for teachers and schools. [Link to the guide.](#)

Fusing Hearts and Minds The DEADLY Way



Fusing Hearts and Minds

The DEADLY Way

When we fuse the heart with the mind a beautiful reaction occurs. A student once told us when they think of DeadlyScience they think about - and then they pointed to - their heart. To deeply engage and include Aboriginal and Torres Strait Islander students with STEM, DeadlyScience offers an approach which consists of six teaching and learning strategies: The DEADLY way.

Each of the DEADLY strategies encourages two-way learning. This is when non-Indigenous and Indigenous knowledges are drawn on in the classroom with both sets of knowledge being accepted, celebrated and integrated rather than separated. This involves intercultural understanding. Initially schools and teachers may wish to enlist the help of local land councils and language centres when beginning this type of teaching and learning in the school or classroom to ensure Indigenous knowledge and culture is treated with respect, dignity and within the local cultural customs.

The DEADLY strategies of this approach assist teachers to consider and appreciate similarities and differences between the knowledge systems. The strategies are D: Describing and Storytelling, E: Engaging, A: Appropriate sharing, D: Detecting and observing, L: Learning on country, Y: Yarning and connecting. Below is a brief description explaining the intent of each strategy and its links to STEM.

For further information about actioning these strategies in the classroom, please organise for DeadlyScience to come to your school.

D - Describing and Storytelling

Learning through describing and storytelling is empowering. There are many ways storytelling can be used in the STEM classroom including stories from you, students, other STEM professionals, song, dance and even textbooks. Stories can be direct and obvious or indirect and round-a-bout.

If we can tell stories, we can feel ownership over that knowledge and this ownership can be empowering, potentially leading to deeper concept understanding. In the same way, describing an observation for example can foster ownership of that skill of observation. Just as STEM knowledge is passed on through journals, classrooms and conferences, Indigenous STEM knowledge is passed on through behaviors, traditions, songlines, stories and descriptions.

In the classroom this may look like a student or teacher describing an event, investigation or procedure, or sharing a story that they are reminded of during the lesson. Stories are a way of personally connecting with the content and should always be listened to with the same interest as the storyteller is showing while telling the story. You can thank them for their story, and ask them if you can use that story in further lessons.

E - Engaging

Working from big to small.

It is important to engage with the literacy of STEM through inquiry and understanding before we can develop STEM literacy skills. Within Indigenous culture, often people see, think, act and make without words. The broader context is considered before the local context. Similar to changing the variables of an experiment or equation. When we change the smaller variables, we impact the end result. Through the scientific process we iterate our knowledge, developing over time and through experiences. This process over time goes from smaller basic ideas to larger more complex.

In the classroom, this may look like a scaffolded lesson plan with different student at various levels of inquiry.



A - Appropriate sharing.

Honouring what is or is not yours to share.

The advancement of STEM is shared amongst the STEM community usually through journals and conferences. STEM professionals acknowledge the work shared by their predecessors through a robust process of referencing and citations. Similarly, it is important to acknowledge the land, language, culture and STEM knowledge of Aboriginal and Torres Strait Islander people. Honour the local community and their sharing customs by finding out as much as you can.

In the classroom and in communities, this may look like an open discussion with the elders of your local community delving into questions so they have the opportunity to share and celebrate knowledge while being respectful.

D - Detecting & Observing

Learning by watching then doing. Reciprocal learning and feeling.

Learning by observation has been practiced in Indigenous culture for tens of thousands of years. The progression from watching to doing includes all the senses. This can look like watching an experiment; going on country to see, taste and feel; listening and noticing when changes take place; and drawing to clarify our understanding or hypotheses. This is sometimes described as hands-on minds-on learning.

Observation is an essential element of STEM inquiry as it is central to the culture of Aboriginal and Torres Strait Islanders. STEM observations have been recorded, on paper and in journals, and similarly Indigenous observations have been recorded, in drawings, songs and stories.

In the classroom this may look like students modeling the use of their five senses to notice changes or effects of their interventions. Either pure observations or assisted with measurement and experimental devices like microscopes, calculators and timing devices.

L - Learning on country

Learning on country builds strong relationships. Relationships built on respecting the knowledge and feelings of others manifests into a strong STEM learning environment where innovation and inquiry occur. It should be acknowledged the students bring with them to the classroom their own world of STEM knowledge, as well as that of their aunties, uncles and other kin.

Developing relationships with STEM professionals, and where possible Indigenous STEM professionals, enables the concepts to be investigated further and deeper. This allows the class to synthesize and develop their STEM literacy skills through various communication methods.

On country, this may look like a collaborative interaction between teachers, students and community members to notice and discuss relationships between similar or different observations. For example, looking at different leaves on trees, as well as under a microscope in class may lead us to make comparisons between the patterns on the leaf and veins in a human body. Actively listening to the observations of the students and their reasons for these observations builds strong relationships and feelings of trust and respect.



Y - Yarning and Connecting

Bringing people together

Aboriginal and Torres Strait Islander people maintain their connections with land and waters through storytelling and ceremony. Finding connections between concepts can be a powerful way to foster long lasting knowledge. Connections between land and sky, plant and animals, people and places can allow students to think about concepts in different ways. When doing this with community to weave learning into community goals, everyone can learn together.

Caring for land is very important and connection to land is important, just as caring for knowledge, where it comes from, who has shared it and why, is important. Linking concepts to country and traditional knowledge with community members continues that tradition and should be considered at every opportunity.

Indigenous Perspectives and STEM in the classroom



Indigenous Perspectives and STEM in the classroom

Indigenous Australians were among the first scientists, and Aboriginal and Torres Strait Islander students in particular have a unique perspective and knowledge base that can contribute to STEM, and will help to develop a more informed and culturally sensitive approach to STEM education in Australia. In this section we are offering teachers one approach and two strategies to consider incorporating into classrooms. We have found these to be very effective at engaging and including Indigenous perspectives in STEM subjects. These are the Inquiry-based approach, the Predict-Observe-Explain strategy and the Think-Pair-Share strategy. Together they provide a student focused learning environment which is both collaborative and constructive.

Inquiry-based approach

The Inquiry-based approach has its roots in constructivist learning theories, stemming from the work of Piaget, Dewey, Vygotsky and Freire. It focuses on investigating and problem-solving. We have found this approach to be effective at



engaging and including Aboriginal and Torres Strait Islander students in the STEM classroom because it encourages students to present and use their acquired knowledge to ask questions, investigate, provide evidence and communicate findings. Different to approaches where the teacher is the subject matter expert, using Inquiry-based learning enables the teacher to learn about the knowledge held by the students in parallel. This allows the teacher to fully engage with the body of knowledge held by all the students, particularly Indigenous perspectives, and meaningfully include this in the classroom.

There are different levels of inquiry and they promote engagement and inclusion in different ways. The level of inquiry can also be used as a differentiation. The inquiry skills represent the level of input, structure or guidance from the teacher and respectively the students. (Sharma et. al, 2019)

- Demonstrated inquiry. The students observe.
- Prescribed inquiry. The teacher provides a question and/or steps for the student to take.
- Structured inquiry. The teacher gives a broader question/statement that is then reflected on and sharpened by the student.
- Guided inquiry. The teacher supplies a series of questions/statements and the students select from this list to create a question of their own. [See Primary Connections](#)
- Open inquiry. The student creates their own questions and processes.

For more information about the Inquiry-based approach please [visit the Australian Curriculum page here](#). If your school would like further resource support in this space, please contact programs@deadlyscience.org.au

Predict-Observe-Explain Strategy

We often use the Predict-Observe-Explain (POE) teaching strategy, developed by [White and Gunstone \(1992\)](#), to ensure Indigenous perspectives are included in the STEM classroom. This strategy supports students through the basics of the investigation process which is independent of cultural background and knowledge. It offers teachers information about how much and what type of knowledge students hold already; generates discussion; inspires students to ask questions and think more deeply so they can further investigate the topic.

The POE strategy is a collaborative strategy whereby the teacher probes understanding by requiring students to carry out the three steps listed in the table below. The POE strategy encourages students to use their prior knowledge and understanding and supports developing an agreed meaning of specific words as used and understood by the classroom teacher and students. It is especially important for Indigenous students because the student may have access to culturally specific knowledge which they may be able to share with the class. This demonstrates acknowledgement and inclusion of Indigenous perspectives through engagement with the student and, possibly further, the community.

For more information about the POE strategy please see the [working scientifically diagram on the NSW Depth Study website](#). If your school would like further resource support in this space, please contact programs@deadlyscience.org.au

Predict	This is the process of using what we already know in order to ask questions that will help us learn something. A strong foundation to build upon. This predication is often referred to as an hypothesis, or a testable question. We create hypotheses based on our accumulated knowledge, available tests and investigations.
Observe	This is the process where students use experimentation to test their hypothesis. They can do this by watching someone else solve the problem or they can work to solve the problem themselves. During this process the students review their hypothesis through iterations as they progress through the problem solving phase to discover new information.
Explain	This is the process of analysing, synthesising and communicating what the problem solving phase has uncovered according to what we see. We try to answer our question in this step. Sometimes we see the results differently and sometimes the results move us to ask more questions.



Think - Pair - Share Strategy

Think-Pair-Share (TPS) is a cooperative learning activity that can work in varied size classrooms and is suited well for the STEM classroom. Teachers pose a question or ask students to engage in an activity, students first THINK or reflect to themselves prior to being prompted to discuss their response with a person sitting near them (PAIR). Finally, the groups SHARE what they discussed with their partner and/or to the class and discussion continues.

The TPS strategy encourages students to think critically, creating a learning environment that encourages high quality responses. By doing so, learning is enhanced by the formation and articulation of an idea. It is especially important for Indigenous students because the cultural tradition of yarning is an important communication and knowledge sharing method in Indigenous cultures across Australia.

This demonstrates acknowledgement and inclusion of Indigenous perspectives through engagement with the student and, possibly further, the community. Parallels may be drawn with the TPS strategy and robust science skills such as peer review, communication, synthesising.

Think	This is the process of synthesising what we already know in order to help us learn something. Considering what we already know is a good place to start. Each question or task that we complete should have some strong context and background to start from. Thinking can involve abstract thought inquiry, experiments, observations or activities.
Pair	Students come together, bringing what they have discovered through activities or thinking to share their experiences and observations with their peers. During this process the students reflect on what they and their peers have done taking further information into account, learning with and from each other. This is a collaborative process as they progress through the problem solving phase.
Share	This is the process of analysing and communicating what the students have discussed in the problem solving sharing phase. This phase encourages the development of syllabus related skills such as working scientifically and communication. Sometimes we see different results and ideas and that may lead us to ask more questions.

