A practical guide to ...

STEM COMMUNITY ENGAGEMENT IN AOTEAROA

STEM ALLIANCE AOTEAROA

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EXECUTIVE SUMMARY

"Whether it's dealing with a changing environment, confronting health challenges, improving our communities or producing high-value products and services, New Zealand needs people who can ask questions. And in an increasingly complex world, with increasingly complex problems, the answers to many of these questions will come from an understanding and application of science and technology."

– excerpt from **A Nation of Curious Minds**; Ministry of Business, Innovation and Employment, 2014

The need for greater science, technology, engineering and maths (STEM) awareness and engagement has been clearly recognised for a long time. Yet in today's education system, enrolment and achievement in STEM subjects continues to decline.

In this current age of STEM skills shortages, rapid technological advances and a growing proliferation of scientific misinformation, systemic change in our science education system is more necessary than ever.

COMET believes that all businesses and educators have a role to play in improving STEM engagement in our communities and building our future STEM skills pipeline.

Not only does this engagement help learners and educators, but it also offers a range of benefits to businesses — including employee engagement, attraction and retention of talent, increased brand recognition and corporate social responsibility.

There are many ways in which the STEM industry can participate in what we call "STEM community engagement".

Research shows us that some of these ways are more effective than others. In fact, when handled poorly, engagement can actually have negative outcomes — the last thing we want to see when time, resources and attention spans are all limited.

The intention of this book is to provide easy access to an academic body of knowledge on how best to engage with communities around STEM in an Aotearoa NZ context.

The book's purpose is to allow you to design more effective STEM-focused community outreach programmes, better directing valuable resources to where they are most likely to induce change and provide a positive "return on investment".

The book is divided into 3 parts:

Part 1 sets the scene, explaining why and where we need to intervene in the STEM education system and what community engagement actually is.

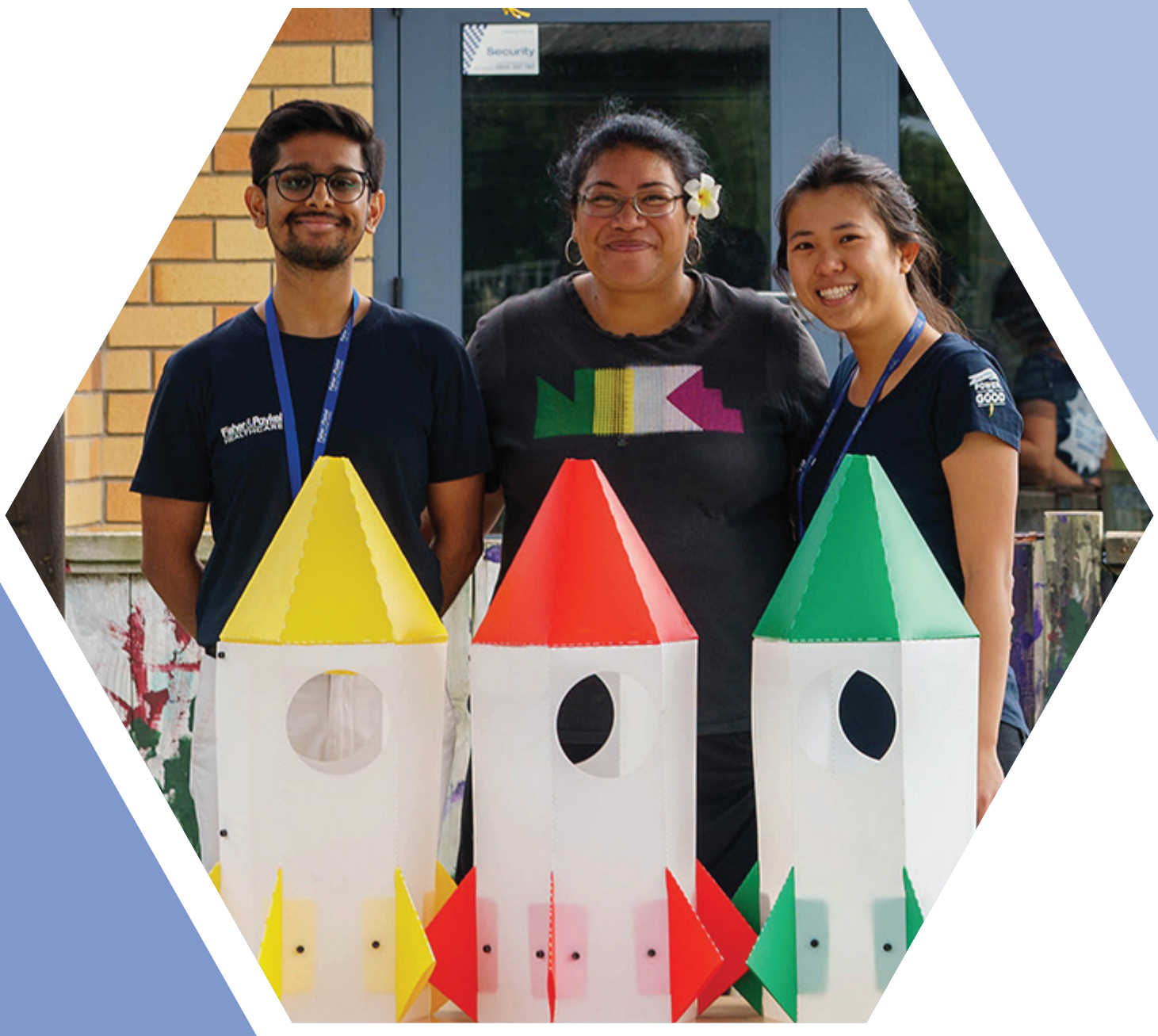
Part 2 provides an outline of the principles of effective STEM community engagement: a purposeful objective, mātauranga (knowledge and understanding), cultural inclusion and two-way communication. We offer practical guidance, templates and activities to help you use these principles to design your own community engagement initiative.

Part 3 takes you on a deeper dive into the theory and research that underpins our key principles. This will provide useful information and referenced resources for those that want to delve into the detail and learn more about community engagement.

We hope this resource provides inspiration and useful guidance as you embark on your STEM community engagement journey. For more personalised support, we highly recommend you join the STEM Alliance Aotearoa.

PART 1

Why community engagement?



Why should STEM businesses care about community engagement?

Research suggests that Aotearoa NZ is heading for a significant skills shortage. STEM businesses need a resilient and innovative workforce, so it's imperative that we support STEM educators to grow and develop science literacy and capabilities in our youth.

For various reasons, rangatahi (young people) across the country, especially those aged 11–13, are disengaging from science education opportunities (see *"Why and where to intervene?"* below). This disengagement is more notable in Māori and Pasifika communities and within low-decile schools. This disengagement means there are fewer rangatahi choosing to pursue STEM career pathways, and STEM businesses are missing out on a potentially large pool of untapped talent.

Research into STEM-related disciplines like the health sector shows that community engagement can help to reduce disparities in the access to — and quality of — various services. In an education context, organisations that engage with their communities can help to support more accessible, equitable and quality STEM learning experiences.

By engaging communities now, we can contribute to a diverse and equitable STEM-qualified workforce 10–15 years in the future — an overall benefit to organisations for their commitment to quality engagement.

Enhancing the quality of community engagement efforts isn't the only major benefit provided, however. Another is the enhancement of an organisation's societal legitimacy through their ability to demonstrate social responsibility. This also provides increased credibility with stakeholders, as well as enhancing employer attractiveness and employee retention.

Other benefits which occur less frequently include improved risk management, increased knowledge of services in communities and more innovative thinking by employees.

Improving community engagement will require awareness of historically marginalised communities within our broader population. In particular, we emphasise acting in line with Te Tiriti o Waitangi and what that might look like for a STEM engager, educator or communicator. We also encourage readers to contemplate accessibility for disabled members of communities.

Why and where to intervene?

"All citizens, not just future scientists and engineers, need to be willing and able to confront science-related dilemmas."

There are many ways that businesses and organisations utilise STEM community engagement with a goal to improve equity in Aotearoa NZ.

The driving factors for why you might invest employee time and resources in these endeavours may include the following:

- **Development and retention of current staff**
  Liaising with community groups can:
  - » build communication skills in a culturally responsive manner
  - » be enjoyable and engender feelings of connection to the community
  - » develop STEM skills
  - » provide project management and technical experience in small scale and safe environments
- **Good will, market share, brand awareness and/or corporate social responsibility**
- **Increase science literacy for a better society**
- **Ensure a steady pipeline of STEM-ready workers long-term**
- **Identify promising individuals for talent acquisition**

Whatever your goals, you will want to ensure your efforts are as effective as possible towards those goals, as well as the goals of the communities you are working with.

Identifying the spaces and target audiences where your efforts are likely to have the most impact will ensure your investment of time and resource is as effective and impactful as possible.

For instance, working with a group of students who already like science — and who come from families with an awareness of science careers and a positive perception of them — is going to have minimal return on investment for you as those students are likely to be headed in that direction already and without your help.

The following data points can help illustrate why investment in STEM engagement for our rangatahi is essential, as well as where best to direct your efforts for the highest return on investment.

If we want to make a difference to the number of young people coming through with science and maths skills, we need to start early — at or before year 11.

And we need to focus on engagement — getting them excited about STEM subjects and showing them why these subjects are relevant to their lives and future work pathways.

Susan Warren
Chief Executive, COMET

Early intervention is key

WHY

Even though 80% of future jobs are forecast to require maths and science skills, both enrolments and achievements for maths and science are on the decline.

STEM businesses need a pipeline of talent coming through to meet future demand and skills requirements. To guarantee highly skilled adults and workers, we need highly skilled rangatahi.

WHERE

Evidence for the need to engage with students in STEM subjects before they reach Year 11 comes from a worrying trend.

The National Monitoring Study of Student Achievement (NMSSA) has shown that the majority of our younger students (Year 4, or 7–8 year olds) perform at or above the expected level for Mathematics and Science for their age based on the NZ curriculum. But, as shown in Figure 1.1 below, that performance falls dramatically in only a few short years. At Year 8 (11–12 year olds), less than half of our students are at, or above, the expected level for their age. The fall in achievement is particularly pronounced in science.

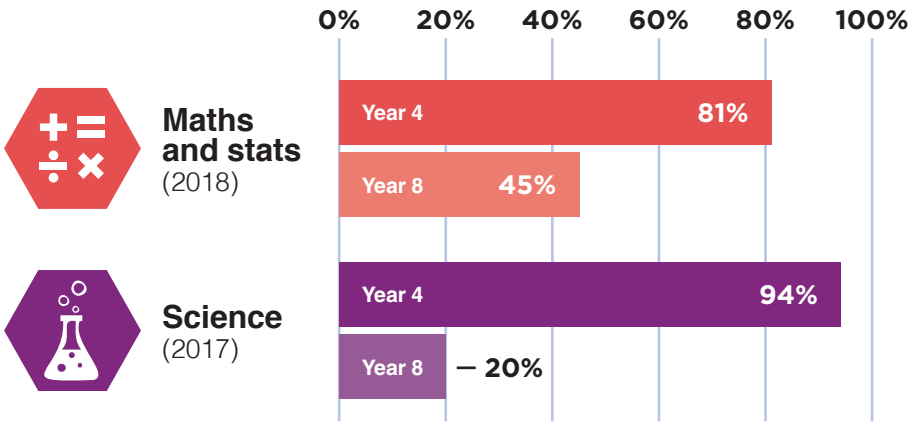


Figure 1.1 NMSSA findings show a significant drop in students achieving at or above NZ Curriculum expectations in Year 8.

At senior primary and early secondary levels, students in Aotearoa NZ are also scoring poorly on international measures of both maths and science. More than two-fifths of local students have scored below expectations in maths and about a third below expectations in science.

The OECD's Programme for International Student Assessment (PISA) measures the reading and maths skills of 15-year-olds in OECD countries. Students in Aotearoa NZ scored above average in both

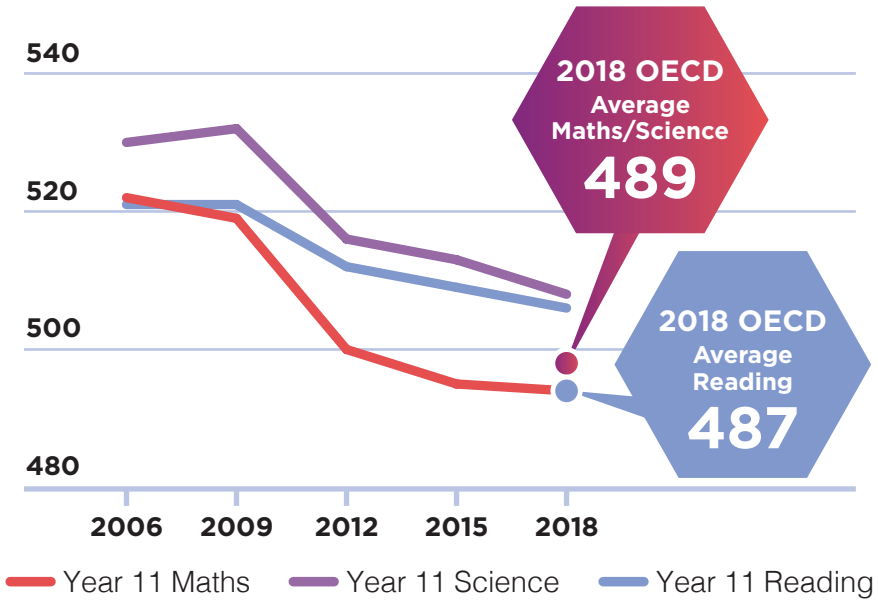


Figure 1.2 *PISA scores show students' mathematics, science and literacy scores are steadily declining in Aotearoa NZ.*

Science and Reading but not in Mathematics (see Figure 1.2 on the facing page). Our scores have also been reducing over time.

Research suggests students with more positive attitudes towards maths and science tend to score higher in achievement, so intervention at this young age group (between years 4–11 [7–14 years old]) is critical. It could lead to a positive cycle whereby students enjoy learning about STEM subjects, do better in them, feel happy about doing well and then want to continue to learn more.

In most secondary schools, science is only compulsory for students up to year 11. Interventions at this age group also target students at an influential age, before they choose elective subjects in secondary schools. By increasing engagement at this age level, more students may decide to continue with STEM learning pathways.

Technology is the future

WHY

In an increasingly complex and interconnected world, innovation and technology skills will be critical to future growth. Related to this is the fact that Aotearoa NZ's economy is increasingly moving from a primary industries base to a knowledge base, where value add, efficiency and problem solving are required to compete globally while reducing our resource use and environmental footprint.

In order to prepare our youth and communities for this increasingly complex world, we need to highlight the importance of technology, innovation and problem solving in society — and help foster these critical skills in our students.

WHERE

Children are naturally curious, tactile and less afraid to try and fail. Engaging younger students with initiatives that encourage problem solving, design thinking and technological skill as early as possible lays a powerful foundation for their future learning.

A lack of exposure to STEM, not seeing the relevance of STEM in society and poor achievement in the latter years of primary school may be some reasons why so few young people choose to continue taking STEM subjects in senior secondary school.

In particular, subject enrolments show that only roughly 8% of enrolments were in Technology subjects in Aotearoa NZ. While genders are evenly represented in maths and science subject enrolments, there are significantly fewer females enrolling in technology than males (see Figures 1.3 and 1.4 below).

This then contributes to even fewer, and less diverse, students graduating high school with Technology standards that would contribute towards a tertiary qualification in Technology or lead to technology-related careers.

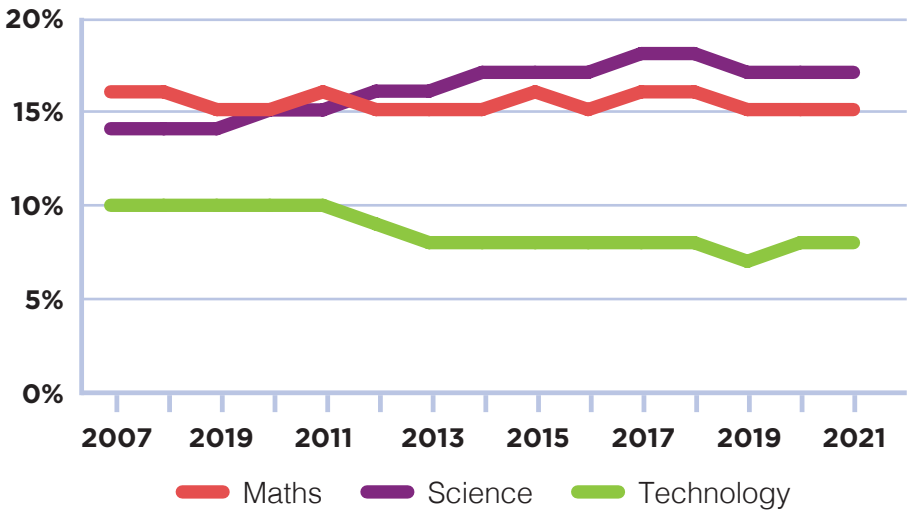


Figure 1.3 STEM subject enrolments by students in Years 12 and 13 between 2007–2019 show that technology enrolments have been persistently low and are stalling.

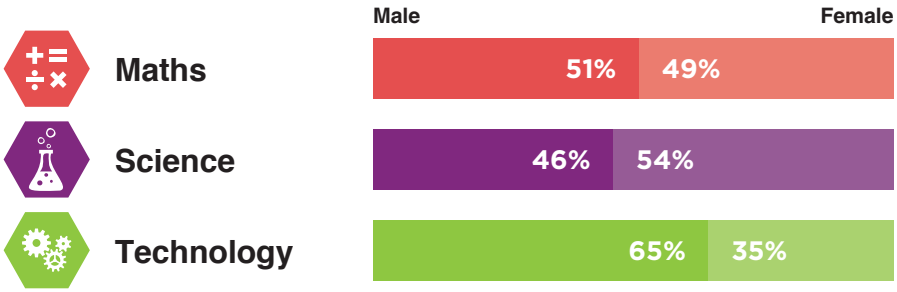


Figure 1.4 *Gender distribution of STEM subject enrolments by students in Years 12 and 13 in 2019.*

Data from the latest Programme for the International Assessment of Adult Competencies (PIAAC) — a programme of assessment and analysis of adult skills conducted in over 40 countries — are displayed in Figure 1.5 below.

The assessment grades an adults' skill set based on completing increasingly challenging tasks. The higher the level of achievement, the better equipped the person is to deal with more complex challenges in real life that require, for example, critical thinking, integration or inferential reasoning.

Literacy and Numeracy skills are graded on a scale from Below Level 1 to Level 5.

Problem solving skills (in a technology rich environment) are graded on a scale of Below Level 1 to Level 3.

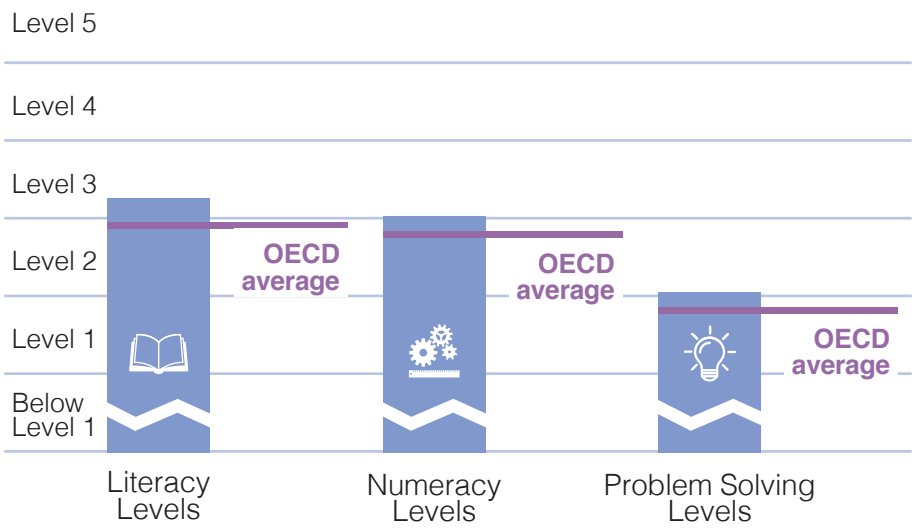


Figure 1.5 *PIAAC competency levels for adults in Aotearoa NZ compared with OECD.*

A survey commissioned by the Ministry of Education shows that while adults from Aotearoa NZ performed above the OECD average in all three areas, the levels of competency are moderate at best.

In terms of problem solving, NZ adults are operating at a level where they could use multiple applications, find relevant information and solve problems that may present some unexpected outcomes. However, they perhaps could not complete more advanced computer or digital tasks where skills like integration, inferential reasoning and innovation may be needed to a larger extent.

In an increasingly interconnected and technologically-reliant world, we need more adults with high skill levels. That training starts in their formative childhood years. If we can intervene earlier and engage children in STEM, we will not only set them up to potentially continue with STEM subjects as they grow older, but also encourage the development of problem-solving skills which will be invaluable for all learners in the future.

There are opportunities in diversity

There are significant disparities in STEM engagement and achievement across different demographics in Aotearoa NZ. With the current underrepresentation of women and minority groups in STEM, we are potentially missing out on a large pool of untapped talent who simply are not making it into the STEM skills pipeline at all. And with society becoming increasingly diverse, that talent pool is only getting bigger — so why wouldn't we invest in supporting these communities and reducing inequities in STEM?

Data from Te Matapaeroa (2019) showed that Māori-owned businesses represent 6% of businesses across Aotearoa NZ, while Māori account for around 17% of the population. Similarly, it is estimated that only 2–3% of NZ's IT workforce are of Pasifika descent, despite Pasifika peoples making up around 9% of the general population. This suggests there is substantial growth potential for Māori and Pasifika peoples and businesses within the STEM industry and overall economy.

Research also suggests that businesses which embrace and encourage diversity and inclusivity achieve better results, as they draw from a deeper pool of resources with unique perspectives, connections and strengths.

WHERE

Interventions and business participation should not be limited to English-medium or high decile schools. Data shows that the proportion of students in kura who enrol in STEM-based subjects are small compared to those who enrol in Language or Art subjects.

Lower decile schools have also seen a lower enrolment rate in STEM subjects when compared to their high decile counterparts.

There are several reasons why lower decile schools have fewer enrolments in science and technology. These include a lack of early exposure to STEM in general, fewer classroom resources, and less access to relatable STEM role models from their community. Teachers and whānau expectations may also have a role to play, with students in lower decile schools (or indeed, in low 'streamed' classes in higher decile schools) potentially missing out on the opportunities or encouragement to study STEM that other students might typically receive. In many cases, equity is the driving issue – an unequal access to resources and knowledge that supports STEM learning.

Clearly there is significant scope for STEM businesses and role models to help in reducing these systemic inequities, through STEM community engagement and other initiatives (think KickStart or KidsCan sponsorships).

As you plan your engagement efforts, it is always best to start within your local community – that is where you can build the most authentic connections and have the best chance of developing long-term relationships. But it may pay to consider how you could support *everyone* in that community, being aware of any unconscious biases that may exist or barriers that may prevent certain underrepresented demographics from participating in your engagement initiatives.

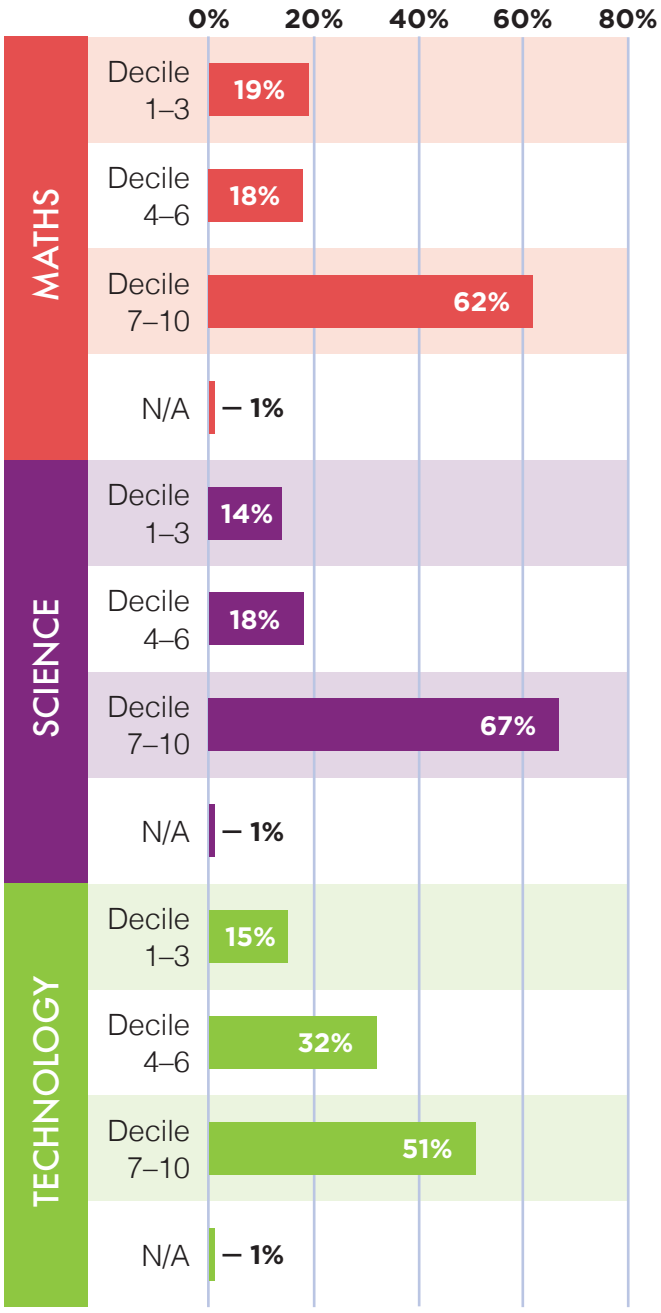


Figure 1.6 2019 STEM subject enrolment by students in Years 12 and 13 show significant disparities between lower and higher decile schools.

Spotlight on student voices

When working with students or learners of any age, it is critical to understand their needs, values and desires. As an organisation, COMET continually strives to seek feedback and inputs from our learner communities.

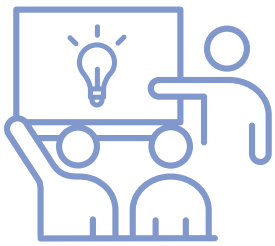
We surveyed a range of Science and Engineering students at the University of Auckland, asking them: ***What influenced your decision to study a STEM degree?***

Family or siblings

28%

Enjoyed STEM subjects or was good at it in school

29%



Inspirational teacher

23%

Science fairs, competitions or other STEM activities

11%

In addition, here's what some of the students we surveyed had to say about their decision:

I wanted to solve real problems and make a positive impact on people's lives.

School trips and info evenings showed me the industry I could end up in.

I was indecisive [and] engineering had broad options.

My parents always supported me in STEM subjects.

I enjoyed maths at high school, [and] I could see the opportunities this degree could offer.

It's clear that family, role models and exposure to real-world STEM experiences are major factors influencing students' tertiary education decisions. Effective community engagement can support all of these areas to build up the pool of students that enter STEM-related training and industries.

In another survey, we asked students what they thought was missing in the current education system: ***Can you see where STEM community engagement might help fill some gaps?***

Digital literacy is another emerging topic that we need to work on.

I'm the first in my family to go to university. Being Māori, it is actually quite hard for us. I was lucky enough to get a scholarship … But I do wish more people like me had the means to study and get education.

School prepares you for university more than for work. I feel you have to know what you want to do from a young age. It would definitely be better to get more guidance.

Stepping into the real world is a shock for everyone stepping out of school. I think schools should do more to prepare students for that.

Quotes sourced from University of Auckland students. You can watch the full video here: facebook.com/watch/?v=161268625958698

What is community engagement?

Before going deeper into community engagement, it is useful to understand what it is and to know what your organisation is doing in this space already.

If you're reading this book, you have shown that your organisation is interested in partnering with your local or larger community to support and/or expand STEM education. We hope that in the last section we have shown why community engagement should be a key part of your strategy for supporting the STEM skills pipeline.

Community engagement spans a wide range of activities and there is no single answer for what to do and how best to do it. Experience suggests that longer-term engagement built on shared values and objectives is more impactful than short-term or infrequent interventions.

In the context of STEM community engagement, this is likely to take the form of projects centred around answering a question or solving a problem. There is, however, a place for all forms of engagement — from one-day careers fairs to years-long community projects and everything in between.

This book sets out an evidence-based model of best practices and principles to follow when embarking on a community engagement initiative. We have also included examples and lessons learnt from the Curious Minds Participatory Science Platform (PSP).

The PSP is a collaborative project-based STEM initiative that COMET has been delivering in south Auckland since 2015 (known locally as 'SouthSci'). While we frequently refer to community projects, the tips and practical guidance can apply to any type of engagement activity.

As the 'engager', you span the STEM-focused organisation and its connection with your community, with the goal of mutually beneficial growth of knowledge for all participants. This growth in knowledge will result in:

- empowerment to address STEM-related issues relevant to the community
- creation of STEM engagement projects
- support for social change towards a more STEM-engaged and STEM-literate community
- a wider pool of STEM-skilled workers for your organisation

ACTIVITY 1

You might be doing community engagement already!

Go through this brief list and tick as many boxes as apply to your organisation. Tally your total to learn what stage of community engagement you are likely to be at.

Does your organisation ... ?	
◯	Have a dedicated person, division, or office for public engagement
◯	Include engagement in policy and strategic documents
◯	Hold meetings, forums, talks or similar addressed to the public
◯	Have a press or public relations person, office, or division
◯	Produce publications targeted at members of the public
◯	Get involved with projects or programmes to share knowledge with the public
◯	Have an action plan for public engagement
◯	Host community representatives on boards or committees
◯	Dedicate resources to public engagement
◯	Generate reports on the content and quality of public engagement practices
◯	Host public engagement events and/or events open to the public
◯	Maintain an accessible website with pages for community relevant information
◯	Have an accessible database of staff expertise, interests, and current projects
◯	Expect staff involvement in public engagement projects or programmes
◯	Involve other communities in knowledge sharing projects or programmes
◯	Encourage staff to participate in conferences (or similar) across industries or disciplines
◯	Understand how your public engagement efforts overlap with NZ school curriculum
◯	Systematically evaluate engagement efforts
◯	Promote responsible output (e.g. products or services) based on community input
◯	Prioritise engagement programmes that respond to community needs
◯	Draw on community advisers for support or direction in engagement efforts
◯	Generate projects that positively impact your community
◯	Have ongoing projects or relationships across industries or disciplines
◯	Expect individual professional development as part of contracted time
◯	Encourage staff to engage with community service as a learning experience

ACTIVITY 1 results

6–10 ticks	Congratulations! You are providing Transactional Engagement.

This means that currently, your community engagement efforts are most likely about providing information. You may also be giving back to your surrounding communities via financial or other kinds of resources. Your efforts are probably reaching a wide variety of individuals and community groups.

However, your engagement is likely to be mostly one-way. As a consequence, both your organisation and the surrounding communities may be missing out on the value provided by two-way forms of engagement.

Have a look at other items on the checklist and continue to the next section for ideas on how your organisation can move to the next level.

11–19 ticks	Fantastic! You may be at a stage of Transitional Engagement.

You are likely to be consulting and collaborating with your surrounding communities already. Your organisation has probably put effort into building bridges with community partners over time. As a result, both organisation and community are probably seeing beneficial outcomes.

However, there may be a certain feeling that the partnership is still a little one-sided. This may be because your organisation still has a firm hold on power in terms of learning, communication and decision-making in your community engagement efforts.

By giving a little of this to the community you are working with, your organisation can improve trust and create shared value and joint benefits. Look back at the checklist and jump to Part 2 for advice on the fundamentals for deeper community relationships.

20–25 ticks	WOW! You could be at the Transformational Engagement stage.

This means you likely have projects that are co-created with community partners from their inception. Your organisation learns as much from surrounding communities as they learn from you. By listening to your community partners, you have created authentic dialogue with your organisation, and you are responding to their needs. Sharing control over project management and decision-making means that your organisation and its surrounding community have become social changemakers together.

If you feel your engagement efforts could do with some tweaking, which ticks did you miss (if any)?

Are you looking to expand the communities you engage with, or do you simply feel like you need something else?

Jump to any section that interests you or to Part 3 – Further Reading: Mātauranga (pg 52) and Cultural Inclusion (pg 61), to deepen your knowledge around how to build a community of practice that sustains your engagement efforts in the longer-term.

To summarise, community engagement covers a range of activities that span the spectrum from transactional to transformational.

Stage 1: Transactional Engagement

This stage sees you frequently providing information to the community in one-way and/or short-term relationships.

This is a good start to build profile and awareness of STEM, but the impact may not last long.

Stage 2: Transitional Engagement

At this stage, you are beginning to build relationships and see the benefits of mutual objectives or outcomes.

As the 'engager', however, you may still be holding most of the power in terms of what is taught / communicated and how.

Stage 3: Transformational Engagement

In this stage, your engagement efforts are founded on authentic, two-way communication and trusting relationships — e.g. asking and responding to what the community wants / needs and co-developing the initiative or project with them.

It's useful to assess what stage your organisation is in so you can consider what activities or audiences might suit you best.

While we advocate for all businesses to invest in long-term, transformational engagement, we know it isn't always practical.

Biting off more than you can chew and then not achieving the desired outcomes (or worse, giving up before the end) is a common pitfall. It is better to start small and build steadily as you progress.

Targeted engagement for maximum effectiveness

How and where your organisation chooses to participate in community engagement will depend on a range of factors including community connections and needs, employee preferences, time and resource availability.

Different activities or projects will be more appropriate (and effective) for different age groups, and it's important to bear this in mind as you plan your community engagement efforts.

Younger age groups often allow more flexibility in their curriculum development, whereas working with older age groups may allow for more targeted, subject-specific engagements. Talk with your partners and think about where

Focus area	Community engagement activities
Curriculum and learning	• Project-based learning • Facilitated site visits and field trips (LEOTC) • Developing curriculum-aligned learning resources and assessments • Competitions to supplement curriculum content and engage students in STEM
Careers support	• Project-based learning • Careers fairs • Mentor / ambassador programmes
Teacher training and support	• STEM focused training to support teaching in schools • Development of resources and training tools • Sponsoring new / improved facilities – e.g. labs, maker spaces
Industry engagement	• Guided workplace or site visits and activities • Industry open days • Work placement opportunities – e.g. Gateway • Internships • Supporting schools with access to technologies and facilities • Grants and funding /scholarship programmes • Mentor / ambassador programmes

the young people are in their learning journeys, and what would most benefit them, so that you can 'pitch' your engagement activities at the right level.

We present below a range of focus areas that could guide your development of a community engagement initiative. These can act as prompts for thinking about where and how you might want engage and what your purposeful objectives could be (see Part 2, pg 30 for more info on this).

Outcomes from effective community engagement	Target audiences
• Helping children make sense of the world • Inspiring curiosity and asking questions • Connecting learning with real world contexts • Growing active learners • Developing problem solving skills • Motivating changes in communities • Understanding the nature of science as a process of discovery • Exposing learners to STEM role models	All age groups, but particularly primary and intermediate learners Community groups – e.g. STEM clubs, youth groups, libraries, etc.
• Providing career motivation • Connecting learning with real world outcomes • Exposing learners to STEM disciplines and career pathways • Connecting learners to STEM role models	Most effective for late intermediate / early secondary learners Community groups – e.g. STEM clubs, youth groups, libraries
• Upskilling teachers • Enabling engagement with new technologies • Building connections between industry and education • Developing co-learning opportunities • Increasing skills training that aligns with industry needs	Teachers and education providers
• Exposing learners to STEM disciplines and career pathways • Supporting practical work experience • Supporting learners to ask questions, solve problems and design solutions in 'real-world' context • Providing rewarding experiences and professional development opportunities to staff • Building or scouting for future talent, reducing recruitment effort and costs	All age groups, but particularly senior secondary learners and university students

STEM community engagement in Aotearoa NZ

A key theme for positive community engagement involves cultural inclusion and respect. As any community will have a diversity of cultural backgrounds among its members, the flavour of 'cultural inclusion and respect' will be different for any STEM engagement project that is undertaken, and for any focus community. Fundamental to cultural inclusion and respect in Aotearoa NZ is an awareness of Te Tiriti o Waitangi and what it means in practice.

To date, we are unaware of any guidelines that exist for Science Communicators or STEM engagers. We recommend resources provided by the Teaching Council of New Zealand: **Tātaiako Cultural Competencies for Teachers of Māori Learners** (available at teachingcouncil.nz/resource-centre/tataiako-cultural-competencies-for-teachers-of-maori-learners/).

While not all of you using this resource will be teachers, Tātaiako should support considered thought and reflection about how inclusion of Māori learners as community members can be incorporated in your own practice.

Regardless of where you are in understanding and incorporating cultural competencies into your practice, everyone can be guided by their values in creating positive community engagement.

When aiming for Transformational Community Engagement, key values are **humility** and **integrity**.

In Aotearoa NZ, we believe it is also important to be conscious of three underlying values of Te Ao Māori:

- **Manaakitanga:** extending aroha (love and compassion) to others
- **Kaitiakitanga:** guardianship or responsible stewardship, especially towards the earth, sea and sky
- **Kotahitanga:** togetherness and mutual support

These are important in terms of respecting and raising awareness of Te Tiriti o Waitangi, as well as providing excellent supporting values for community engagement.

Humility is usually defined as having a low estimation of one's importance. Specific to the context of quality community engagement is **cultural humility**. By this we mean making a commitment to:

1. self-evaluation and reflection, especially regarding societally powerful positions one might hold
2. developing and maintaining mutually respectful, adaptable and authentic partnerships

In this context, we take this value to mean that you have an accurate estimation of your importance within the engagement project, and you are aware of respecting and prioritising what the community desires.

Integrity is the quality of being honest and holding strong moral principles or values. Everyone will bring their own values to a community situation.

In community development and engagement situations, the values a community holds together should be made explicit early in the process. This allows everyone to act with integrity in working towards a common goal.

Facilitating this process generally requires an awareness of one's own central values and what it looks like when you are striving to behave in line with those values.

You will also need to be aware of your organisation's values, as these will affect the way you work with communities.

More about an initial process of dialogue and partnership building with your community can be found in Part 2.

First, we provide an activity to highlight the values that guide you as a community engager.

ACTIVITY 2

Naming and reflecting on your values and those of your organisation

Two recent publications have much to offer regarding understanding values, research about values and values-led communication as a STEM engagement professional.

Research storyteller Brené Brown's recent book *Dare to Lead* contains a chapter on being values-led. She and her research team provide a thorough (though by no means exhaustive) list of values available for download at daretolead.brenebrown.com/workbook-art-pics-glossary/

Brown's research indicates that, while we may engage various values at different times, we as individuals are mostly guided by the two core values that are most important to us.

Using the downloadable list as inspiration, spend some time considering which two values or principles are most centrally important to you:

Value 1:

Value 2:

Many organisations now specifically outline their values. If your organisation has done so, put them here, alongside any values-related behaviours that might be expected within your organisation.

Closer to home, Dr Jess Berenston-Shaw's book, *A Matter of Fact: Talking Truth in a Post-Truth World*, should be an essential on the bookshelves of professional STEM engagers.

Dr Berenston-Shaw focuses both on the importance of values and on engaging desired values when communicating science and research. Also important for us in terms of community engagement is the research on values Dr Berenston-Shaw outlines in her book.

The Schwartz Theory of Basic Values shows that values are universal across many different cultures. Certain values can also oppose or enhance each other — and, although individuals may hold two core values, any of these values can be engaged depending on the situation.

All values can be placed in 10 broad categories, associated with a defining goal. An overview of the Schwartz Theory is available for download at scholarworks.gvsu.edu/orpc/vol2/iss1/11/, with the defining goals for each category outlined on pp 5–7.

Using the defining goals as a guide, what categories do your two core values fall into?

Category of Value 1:

Category of Value 2:

Humility and Integrity — the key values for positive community engagement — fall into the Universalism / Benevolence categories in Schwartz's values wheel (see page 9).

Using the relationships identified in the wheel, how closely do your own core values relate to humility and integrity? Do your own values exist in adjacent categories or in opposite ones? What about those of your organisation?

Here, we encourage ongoing reflection about your own values and how they relate to humility and integrity. Some other questions to consider may include:

- What do humility and integrity mean to me?
- How do I behave when I am behaving with integrity (i.e. in line with my personal core values)?
- What will I do in a community engagement situation to behave with humility and integrity?
- What will I do in my professional development to engage these values in my work?
- How closely do my organisation's values align with humility and integrity?
- Are any of my organisation's values in direct opposition to community engagement values?
- Could this create difficulties or conflict when engaging with communities?
- Does our organisation need to consider any changes for improving community engagement?


KENNARDS
HIRE

PART 2

A practical guide to STEM community engagement

It takes a village to raise a child. This [participatory science] project has shown us just how capable our young people can be in terms of their creativity and problem-solving.

It would not have been possible without the support of our teachers, families, science and technology partners and community stakeholders.

Tracey Venter
Mt Richmond School

To find out more about how different partners came together to support Mt Richmond School, check out their project video: facebook.com/STEMNZ/videos/888333955411940

Introduction to the STEM engagement catalyst model

We have looked now at what community engagement is, and why and where to intervene to be most effective. The next question might be: *"How exactly can we engage with our communities?"*

Once you are grounded in your own personal and organisational values and have started thinking about the type of community engagement you are doing (or want to do more of), the next step is to build relationships with community groups. It is useful to approach your engagement efforts and relationship building with clear principles in mind.

Through our research and experience, we have identified four broad areas that are key to positive community engagement to support the STEM skills pipeline: **mātauranga**, **purposeful objectives**, **cultural inclusion** and **two-way communication**.

These four areas are explained briefly in this section to give the casual reader a summary of key considerations related to each principle. Throughout, we have tried to infuse these with concepts that are culturally relevant in Aotearoa NZ and practical tips and guidance. For more detail around common community engaged frameworks and the STEM engagement catalyst model, refer to Part 3, pg 42.

The **STEM Engagement Catalyst Model** couches the four overarching principles within a spherical model — what we've called the sphere of interactions. This recognises that in any STEM outreach or engagement activity, there are a range of people who will be interacting with, influenced by or are influencing the engagement activity. These are:

1. **The individual or target group you're trying to engage**. In the context of STEM community engagement, this will often be a cohort of school students.
2. **The whānau who surround the target individual(s)** and have the most potential impact on them.
3. **The immediate community that the target individual(s) interacts with** on an everyday basis. This may be people, organisations or groups.
4. **The wider community** that has the opportunity to touch the individual(s) life less frequently but may have resources and capabilities that others do not. This may also include people, groups or other businesses within the STEM organisation's

STEM Engagement Catalyst Model

Find where you sit in the diagram and interrogate your plan for more effective engagment to attract rangatahi into the STEM skills pipeline

OVERARCHING PRINCIPLES

PURPOSEFUL OBJECTIVES
Specific topic-driven inquiry, defined project outcomes, goal-oriented work, focused

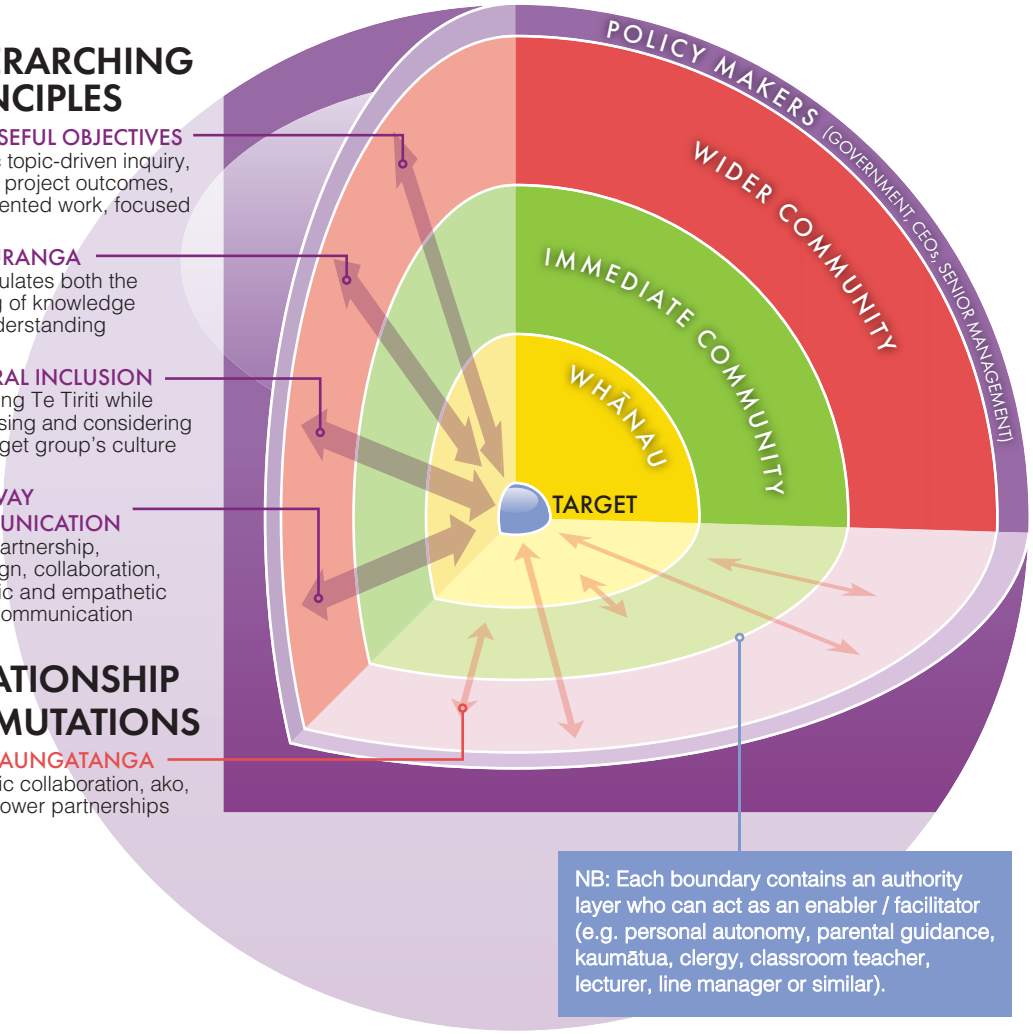
MĀTAURANGA
Encapsulates both the building of knowledge and understanding

CULTURAL INCLUSION
Upholding Te Tiriti while recognising and considering your target group's culture

TWO-WAY COMMUNICATION
Equal partnership, co-design, collaboration, authentic and empathetic active communication

RELATIONSHIP PERMUTATIONS

WHANAUNGATANGA
Authentic collaboration, ako, equal-power partnerships



SPHERES OF INTERACTION

- The **POLICY MAKERS** whose strategic plans and directions can influence the scope and/or investment in STEM education and community engagement.
- The **WIDER COMMUNITY** that has the opportunity to touch on the individual's life less frequently, but has resource and capability the others do not.
- The **IMMEDIATE COMMUNITY** the individual is part of, the people and organisations that impact them in their everyday life.
- The **WHĀNAU** that immediately surrounds the individual and has the most potential for impact on them.
- The individual or **TARGET** group you're trying to engage.

network who may have something to contribute to community engagement - for example, a business association, professional network, or other related companies.

5. **Policy makers or people and organisations who do not directly interact with the target individual(s)** but whose policies, decisions, regulations or requirements might impact on their life. In this context, policy makers might influence the scope and/or level of investment in resources for STEM community engagement.

Your community engagement activities will not happen in a silo. While your focus may be on children, it is equally important to bring their family and their community along on the journey.

Parents, older siblings, family members and friends are important role models and influencers in a student's life. If we can involve them, we are more likely to achieve long-lasting outcomes whereby the entire community can become more aware and engaged in STEM.

In addition, you will find that the immediate and wider communities haves lots to offer your project — perhaps in terms of local knowledge, cultural understanding, organisational support and enthusiasm.

Between each 'layer' of the sphere, we have authority figures who can act as enablers and facilitators. You will likely sit in one of these layers — being the key connector between your company or organisation and the communities you work with.

As a boundary spanning community engager, you will play specific roles in relationship building and project coordination. It's useful to reflect on your personal strengths and weaknesses to help you succeed in this role or seek help if required. You can read more about boundary spanning theory in Part 3, pg 45.

Purposeful objectives

You will bring your own objectives to any community engagement process, based on the goals your employer has for their CSR efforts (e.g. building their public profile, attracting potential employees or engaging existing employees).

The community with whom you partner will have their own objectives as well. These could include cleaning up their local stream, building their connections with other local community groups and businesses and/or increasing student achievement in STEM subjects.

TOP TIP

Know your audience and ask open questions

Kids never know as much as you think they do, and they will often say they understand something even when they don't to avoid disappointing or upsetting the speaker.

When talking to students, avoid yes/no questions. Ask questions like "what do you think?" instead.

This gives students a chance to figure out what they think and share that, without concern for being wrong. This can also give you useful insight into what they might or might not know already.

Acknowledge positive behaviours and responses (e.g. "Thank you for being brave and asking/answering that question."). This builds rapport and encourages students in their learning.

It's important to check in with your audience regularly and to work closely with your community partner, who is more likely to be aware of what their young people already know.

The key to a successful project is the identification of common goals or a shared vision that all participants value — something you can all return to in decisions about the project. In a STEM engagement context, this is likely to take the form of some question to answer or a problem to resolve. It may also be related to an important change a community would like that requires data to be supplied to local or national government bodies or other such organisations.

Bringing all this together to create a shared purposeful objective requires **communication**, **respect** and **patience**.

Things to consider in the project planning stage include:

- **Knowing your role as an engager**
- **Understanding why community members become involved, how to keep them engaged and how to reach new communities**
- **Recognising the importance of dialogue, deliberation and wānanga** as a framework in Aotearoa NZ
- **Ensuring that community partners remain aware and engaged at all stages of the project**, laying a strong foundation for trust, credibility and reciprocity in project relationships

Working towards a purposeful objective can induce long-term attitude and behaviour changes that reach far beyond changing opinions and engagement in STEM. Further detail about the considerations mentioned above are provided in Part 3.

Children tend to act as agents of change, where they learn about something new or have an experience in or around STEM that hasn't been possible for their wider whānau. They can induce change at home as a result.

A great examples of this is the "Make It Click" campaign, which saw Ronald McDonald convincing a generation of children that wearing seatbelts in cars themselves — as well as haranguing their whānau to do so too — was the safe choice.

A lot of changes around household recycling and energy efficiency have also been driven by young people when they learn about the global impacts of wasteful capitalism and climate change.

TOP TIP

Reinforce new learnings through whānau connection

Think about ways to involve parents and whānau in your engagement activities, perhaps through community open days or at-home activities.

By bringing whānau along, you will enrich a young person's experience and increase knowledge retention and on-going interest.

Mātauranga knowledge and understanding

This lies at the core of the purposeful objective for STEM engagement, with a key aim of growth and sharing of both knowledge and understanding. **Mātauranga is about blending a body of knowledge with culture, values and world views; and understanding that there are different ways of knowing.**

It is important to have respect for both scientific ways of knowing and social, cultural and experiential knowledge when creating shared knowledge as part of a community engaged project. There is often just as much that STEM 'experts' can learn from their communities as there is the other way around.

Often one of the most rewarding aspects of community engagement is in the social connection and social learning. In contrast with formal learning environments, social learning stresses the importance of authenticity, the involvement of emotions and vulnerability as well as play and enjoyment in creating quality engagement experiences for both 'engager' (STEM professionals, researchers etc) and 'engaged' (target students, communities).

Another important part of building mātauranga knowledge and understanding is having a clear framework for measuring and assessing outcomes from your community engagement project. As you plan your project with partners, consider questions like:

- What goals is the project trying to achieve?
- What outputs and outcomes are you hoping to create? How will these be measured?
- How will you capture unexpected outcomes or qualitative changes in behaviour, attitudes and relationships?

There are many ways we can measure success and some useful frameworks and resources are contained in Part 3, pg 56.

TOP TIP

Stay relevant

"**Scaffolding knowledge**", an important concept in education, recognises that children are not empty vessels waiting to be filled. Instead, they construct understanding by building on what they already know.

So stay relevant and build off existing knowledge or interests as much as possible. A tangible, local problem is a great place to start.

For teachers, a relevant project is one that aligns easily with curriculum requirements. While the NZ Curriculum is broad, teachers are required to teach and assess certain competencies and achievement objectives.

If a project can link in with these requirements, this makes it much more appealing to schools!

Cultural inclusion

Cultural inclusion, mutual respect and understanding underpin authentic relationships with communities. This is about creating connections whereby anyone can be comfortable bringing their culture and world view to a project.

As a professional, you may feel reluctant to share your own whakapapa and connections in the early stages of connecting


NO PANIC.
GO ORGANIC

with a community. It's easy to feel that we are only there to share our knowledge and/or because of our position in an organisation; that our personal lives, history and experiences are irrelevant.

In an Aotearoa NZ context, however, it is important to bring your full self to a working relationship, especially when working with Māori or Pasifika communities.

Communities will be much more open to engaging with you when they know you as a person and can make connections with some aspect of your background.

Similarly, it is important for you to get to know your key contacts as people, in addition to understanding their formal role in their organisation or community.

Two-way communication

Two-way communication is key to strong relationships and what is called 'relational accountability'. This means communicating from a position of curiosity, not judging and showing openness to other world views and experiences.

There are four key ideas to remember to ensure you are engaging in quality two-way communication: **respect**, **relevance**, **reciprocity** and **responsibility**. You can find out more about these concepts in Part 3, pg 64.

We've found that very often a STEM professional wants to do something or has an idea about how to conduct their research that doesn't mesh well with the reality of the classroom or community group. We cannot stress enough the importance of collaboration and recognising the expertise of your community partner. Give them a call and work together. We promise it will be worth it!

Collaboration can also extend to letting others in your community be the 'expert' or teacher — thereby empowering them to share their knowledge and skills. Useful concepts to consider for fostering collaborative teaching and learning include **ako** and the **tuakana-teina** approach (see next page for definitions).

Infusing community engagement initiatives with these approaches can have powerful impacts. You empower more people to be engaged (as both learners and teachers), so if someone learns from a "STEM expert / teacher" and can then share and pass that knowledge to others, the reach of your whole initiative will be extended. In turn,

TOP TIP

Connecting with kids

If you want to be successful when working with kids and have them feel comfortable working with you, connecting with them on an individual level and being relatable is essential.

Here are some good tips for talking with young people:

- When describing your journey, start from when you were the same age as your audience
- Include humanising factors, like what hobbies you have and how hard you had to work to get to where you are today (and how it didn't just happen by luck)
- Present 'fun facts' about yourself that young people can use to see themselves in your shoes
- When talking with a group of no more than 30 young people, sit on the ground with them if possible
- Allow opportunity for questions and connection
- For repeat sessions, ensure you touch on one or two things from previous sessions to build continuity and connection

the teacher will be getting feedback from the learner to continually improve and refine their own knowledge and teaching approaches.

Two-way communication and relationships built on shared values and cultural inclusion enables the emergence of a whānau kaupapa community of practice — relationships that continue beyond the boundaries of a specific project or activity.

This is most likely to have a lasting and positive impact, whether that means supporting a community to maintain a piece of equipment long after it's been installed or building a network of role models who continue to inspire future young people within their communities.

DEFINITIONS

Ako

A relationship in which student and educator learn from each other, ako is grounded in the principle of reciprocity and recognises that learning is a two-way street, with new knowledge growing out of shared learning experiences.

Tuakana-Teina

Literally "older sibling-younger sibling", this is a mentoring approach drawn from Te Ao Māori, where the mentor (tuakana) typically shares their experiences and knowledge with the student (teina). The tuakana also acts as a support person and advisor for the teina, while the teina gives the tuakana a chance to learn new things and develop new skills in return.

TOP TIP

The language we use is important

We should be mindful of the language and vocabulary we use, especially when engaging with students.

Even simple phrases like "this should be an easy task" can have unintended consequences.

If it's not "easy" for the student who struggles with numeracy or literacy, think how that language might negatively impact them and make them feel discouraged or that they are simply "bad at science".

ACTIVITY 3

Reflecting on purpose, people and place

This activity offers a chance to reflect on what you've learnt so far and how you'll put this to use. These reflection questions and action points should serve as prompts to help jog your thinking as you start to develop a community engagement initiative.

PURPOSE

It's important to have a clear, values-driven purpose to guide your community engagement efforts.

Reflection questions

- What are your motivations for this community engagement project?
- What values and strengths are you bringing with you?
- Who else is supporting you in creating this project?
- What are their motivations, values and strengths?

Action points

» If you have sole responsibility for developing a community engagement project, find at least one other person in your organisation that you can connect with to support your work.

» If you are not sure about your organisation's motivations and values, plan a workshop with trusted colleagues to start this discussion.

» With your team, list three key organisational values and drivers that will underpin your community engagement efforts.

PEOPLE

An experienced dialogue facilitator can help you connect with your community.

Reflection questions

- Who are your focus community?
- With whom do you already have a relationship?
- What do you need to learn about this community, its history and culture?
- What difficulties might this community encounter in participating fully in your project?
- Why should people of this community want to participate in your project?

Action points

» Identify someone you can connect with in your focus community. You could approach an existing contact, or you may need to reach out and meet some new people.

» Identify someone who can facilitate the dialogues with your community. Can you nominate someone in your organisation? Do you need to improve your own skills in this area?

» Make a list of questions to start getting to know your focus community better.

PLACE

One of the enablers of positive community engagement is “meeting people where they are”.

Reflection questions

- Where are some places relevant to your community where you can meet?
- When you are bringing a group together, what will you do to promote a space where everyone feels a sense of belonging?
- When creating this space, what will you do to encourage all participants to come in a spirit of openness, authenticity and curiosity to learn about / from each other?

Action points

» Identify a suitable meeting place for your initial dialogues with the community.

» Identify the most appropriate time to meet that will work for the most people (e.g. during work hours or at an evening event).

» Identify appropriate tikanga / protocols for meeting at external sites like marae or schools. For instance, if meeting at a construction site, you will need to consider any health and safety measures in place as well as accessibility for all participants.

OTHER THOUGHTS AND ACTIONS

Use this space to jot down any other ideas, thoughts, questions or actions that you might need to include in your kete (basket).

Putting it all together

By following the four principles of the STEM catalyst model, you should be well on your way to delivering a purposeful, inclusive and collaborative community engagement initiative.

In this section, we have summarised a few more practical tools and resources that you might find useful to help you and your community partners put it all together into a project plan. You are welcome to take from these resources whatever portions might help you in your community engagement mahi.

CHECK LIST

For community engagement planning

- ☐ Identify project partners / define key roles and responsibilities
- ☐ Agree on a purposeful objective and activities
- ☐ Schedule regular communications
- ☐ Prepare a project plan
- ☐ Agree on a timeline and milestones
- ☐ Complete a risk assessment and identify risk management processes (if needed)
- ☐ Prepare a budget
- ☐ Get photo permissions
- ☐ Plan for outcomes measurement

Project planning

It is good to get your objectives, methodology, milestones and desired outcomes down on paper so everyone is on the same page.

In our online resource pack, we have included a generalised version of our project design form used by SouthSci projects as a template you might find valuable. This may help to step you through the process as it prompts thinking about justification and milestone setting.

Depending on the size and scope of your project, it might also be useful to document in your project plan:

- Clear roles and responsibilities of key partners
- A risk register (especially if there are health and safety risks involved with the proposed activities)
- A programme of activities and milestones (of course, these will likely change as the project progresses!)
- An indicative budget, and including taking note of any reporting requirements from funders
- A framework for measuring outcomes, capturing lessons learnt, or sharing success stories

Time management

Managing a community engagement project or activity can sometimes feel overwhelming. It's important to remember that you are not alone!

Here are some tips for supporting your community engagement efforts while staying mindful of everyone's limited time and energy (including your own):

- **Set regular meetings for key project stakeholders from the start and stick to them as best you can.** This is crucial for keeping

up momentum and maintaining open communication between partners.

- **Identify the strengths in your team, delegate tasks and share responsibilities.** Many hands make light work. You might even find opportunities to engage more students or junior staff in leadership tasks that can ease the pressure from yourself and key project leads, for example, by using a tuakana-teina approach. This also empowers learners to be teachers and leaders in their own way.
- **Have a clear plan and refer back to this regularly.** This will help to ensure that all effort is directed effectively and you're not wasting precious time and resources going off track.
- **Stay flexible** – plans often change but if you have built solid foundations with your partners, there should always be a path to move forward with.
- **Don't be afraid to ask for help.** You'll be surprised how willing and generous people can be, if they know what support you need.

Managing risk

Depending on your project, there may be different levels of health and safety risks involved. It's important to assess these and develop a mitigation plan prior to starting any experimental or on-site work. Schools have policies and forms to help with this, so make sure you talk to your education partners and work together to manage any risks.

Schools will also have policies around how external volunteers can interact with students (eg. supervised or unsupervised) and whether volunteers are required to undergo safety checks like police vetting. Policies will differ from school to school.

Leadership

In the context of collaborative community-based partnerships, it may feel odd to consider your role as an engager as a leadership position. However, modern definitions of leadership do not refer to a leader only as someone in a position of power or at the top of a hierarchy. It is more about leadership as a behaviour and a practice within a non-hierarchical shared enterprise.

In at least one study, leadership development training provides powerful changes to how science educators practice. Many of the practices suggested in this resource are also used in leadership development models and programmes.

Words of wisdom from SouthSci

Don't be afraid to share your success stories — but photo permissions are a must!

In Aotearoa NZ, you cannot take and publish photos or videos of minors without their guardian's consent. Therefore, if you want to publicise your community engagement efforts, you will need to get permission.

In our online resource pack, we have included two versions of a generic photo permissions form you can use as a template, as well as a generalised media consent form.

Some schools have parents sign a media waiver as part of student enrolment that allows the school to use media portraying their child to promote the school and celebrate their students' learning without having to obtain guardian consent every time. For these schools, we used a 'blanket' consent form signed by the school principal that allowed the existing media waiver to apply to the SouthSci project.

For schools without a blanket media waiver, we used a separate form to obtain individual consent from parents/guardians for each individual minor involved in the school's SouthSci project. We endeavoured not to include children without consent in our media and always submitted content for review by the school before publishing to ensure no unconsented children appeared in our content. Any images or footage included these children was deleted.

We wrote into all of our consent forms that any media collected would only ever be used to promote or celebrate the project and could not be used for other purposes, such as for stock imagery. Organisations running programmes should only waive this policy after serious thought, especially when working with marginalised communities, so as not to take advantage of them.

We would encourage you to investigate if leadership development is available in your own field. For a list of useful resources for thinking about leadership in your role as a science engager, refer to Part 3, pg 70.

Learn from mistakes and celebrate successes

Community engagement is a continuously evolving process. As you build mātauranga knowledge and understanding, you may also identify new areas for exploration or different ways of doing things. Don't forget to continually assess what you are doing, seek feedback, and adapt as needed.

It's just as important also to celebrate successes and achievements as they happen, in ways that are appropriate and inclusive of your community partners. Celebrating shared successes helps build stronger relationships and emotional connections to your project, often leading to better longer-term outcomes. This is not just a photo-op but should be approached in a genuine and authentic manner.

Next steps

We hope that at the end of Part 2: A practical guide to STEM community engagement, you have gained an understanding of the key concepts that contribute to effective community engagement.

You are now equipped with useful tips, guidance and templates that will hopefully set you up for a fantastic community engagement project.

The STEM engagement catalyst model has been developed based on extensive research from Aotearoa NZ and abroad.

If you want to delve deeper, we highly recommend you read on to *Part 3: Further reading – research and evidence* for more theory, guidance and activities.

This guide is structured so you can dip in and out as needed, so please feel free to bookmark, take notes and refer back to the book as much as you need as you embark on your STEM community engagement journey.


STRIVE TO SUCCEED

PART 3

Further reading – research and evidence

Introduction to Part 3

This part of the book provides more research and theory behind the principles of effective community engagement presented in Part 2.

We have included links between the sections so you can easily dive in and out depending on what you'd like to read more about.

For more information, we recommend reading the referenced resources and/or contacting the STEM Alliance for specialised advice and support for your organisation.

TOP TIP

Defining community

Community is a fluid concept. Defining it for an individual project may relate to:

- **people** (e.g. high school students, LGBT people, blind / low-vision people)
- **place** (e.g. local iwi, people neighbouring a local river, visitors to an eco-sanctuary)
- **purpose** (e.g. promoting composting to reduce landfill waste, gardening ideas to promote bee populations, changing ideas of who science is for)

Further reading: Community engagement frameworks

There are a number of frameworks for community engagement, which can be useful as signposts or checkpoints for you as project facilitator, depending on the project focus determined in early stages of the engagement process.

The frameworks can help you understand the different ways of engaging with communities and guide your planning for:

- what steps need to be taken
- where you may need to undertake professional development
- where you may be able to involve others in the project
- maintaining a focus on serving community interests

We provide a description of some of the most common frameworks below, along with key considerations for each.

Participatory action research

Participatory Action Research is an approach where the community collaboration focus is both education and taking action to effect social change. This process is often seen in work related to ecology, where dialogue has been required for many years between scientists, government agencies, business interests and local communities. Participatory Action Research is also sometimes referred to as "democratic science" or "citizen science".

Participatory Action Research recognises that community engagement work is cyclical and involves four phases:

1. **Planning** – a collaborative process between science educators/ engagers, community leaders, and other participants needed for the project
2. **Doing** – implementing the project alongside relevant communities
3. **Observing** – gathering feedback on impacts and outcomes of the project, preferably through multiple sources (surveys, focus groups, participant observations)
4. **Evaluating** – analysing feedback; recording, reporting and discussing findings with project participants; reflecting on lessons learnt; return to planning for following stages

With an underlying motivation of effecting social change, participatory action research also asks

- Are participants more informed, engaged and empowered by the engagement project?
- Does the project enhance social learning, mutual understanding and trust; integration of scientist and community knowledge; credible science; constructive public dialogue?

Community-based participatory research

This framework is used mainly in public health research, in which purposeful objectives may be decided by a research body before communities are identified or become involved. In other fields of research, co-creation is important to successful outcomes.

The following principles underpin effective engagement in Community-based participatory research:

1. **Active collaboration** – the project should foster equal participation throughout and an equal sense of ownership for all participants
2. **Co-learning** – researchers and community members contribute their respective expertise and learn from each other
3. **Community driven** – questions or goals are guided by issues or concerns of community members and the research methods are culturally appropriate
4. **Useful results** – outcomes or results are communicated in useful, culturally appropriate and accessible ways

University–community partnerships

A common structure for university-based partnerships, this framework can prove challenging when there is a gap between the professional researchers and the community participants. Overcoming the gap involves clear, consistent communication. Including the community in joint planning and decision making will also help. It's also important to include community members in the data analysis and knowledge building to ensure that the results are accurate and beneficial.

Principles of community engagement in research involving a university partner include:

1. **Institutional Preparedness** – Creating policies, goals, plans and education around the engagement process. Highlight the value of trust, mutual respect and respect for diversity and community culture in ensuring a partnership will work.
2. **Understanding Contexts** – For university participants, this involves gaining an understanding of community history and relationships. Also important is that community participants understand the university context. This may include external education efforts targeting communities and welcoming them to the university.

Further reading: Purposeful objectives

At the heart of positive community engagement is a shared vision, purposeful objective or challenging task. In a STEM engagement context, this is likely to take the form of some question to answer or a problem to resolve. It may also be related to an important change desired by a community that requires data be taken to organisations such as local or national government bodies.

The process of community engagement falls under theories of "systemic engagement". This theory recognises that practice can be messy, cyclical and dynamic.

Although methods for community engagement participation exist, both theorists and practitioners agree that quality participation — rather than holding fast to methodology — is key. Quality participation means remaining aware at all stages of who is making the decisions and whose interests are being served. This lays a strong foundation for trust, credibility and reciprocity in project relationships.

What is my "why" as engagement project leader and facilitator?

To ensure quality participation, your focus will be on two things:

1. Bringing your authentic self, vision and values to the project.
   This will help you form authentic partnerships and relationships.
2. Having a willingness to serve the project before your own vision.
   This involves both acting to achieve what the community desires as well as reflecting on whether their interests are being served.

While the development of a whānau kaupapa community of practice is not something one can control, it is still an important aim for quality community engagement. See Part 3, pg 60 for more details.

You are unlikely to be operating alone when creating an engagement project. Having an awareness of your team and/or community — and the strengths, skills and resources they can bring to an engagement project — is crucial. Additionally, connecting to broader networks of community-engaged professionals will be part of your own purpose.

Boundary spanning theory

When describing your team's roles as engagers, it can be useful to consider a concept called **boundary spanning theory**. This theory identifies four main types of engager based on role responsibilities and whether the role favours relationships with an organisation or a community.

Anyone may take on any role at different times of their career or for different projects. Knowing which role one inhabits as an engager can inform which aspects of engaging in community relationships may pose a barrier to effective engagement or need a special focus.

Role 1: Community-based problem solver

- Those filling this role will have social relationships with the community and may come from community organisation or practitioner roles.
- Their work usually focuses on problem support, resource acquisition and partnership development.
- They bring expertise and can draw on social and leadership skills (e.g. rapport building and dialogue facilitation).
- A common challenge for those in this role is maintaining neutrality between community partners and organisations.

Role 2: Technical expert

- Technical experts have a practical or content-focused role and a closer relationship with organisational or professional partners.
- Their work is likely to be in content expertise and research.
- They are more likely to experience challenges in building relationships with community partners and may bear the effects of a lack of trust from them due to any negative historical actions from their organisation.

Role 3: Internal engagement advocate

- Closely related to professional partners, internal engagement advocates hold positions intended to develop engagement infrastructure (e.g. budgets, reward systems and engagement support guidelines).
- Advocates may also be responsible for selecting staff to ensure strong engagement and making them aware of engagement expectations.
- Although less visible outside of an organisation, those in this role are important in creating the culture to support external engagement.

Role 4: Engagement champion

- This role has stronger ties to community and tends to focus on creating alliances and networks that support engagement work.
- Engagement champions tend to be managers or senior leaders. As such, they may find it challenging to stay connected to current engagement efforts at "ground level."
- As the public face of an organisation's engagement efforts, this role is important to the sustainability of engagement initiatives and the support of other boundary spanning roles.

TOP TIP

Balance of power

Many organisations have access to resources (such as knowledge, people, social networks, or finances) that community partners may not. Open discussion of power differences requires time, patience, and commitment.

Respect means thinking of things which are important to community members such as location, parking or public transport access, refreshments at meetings, childcare availability or provision, physical access to meeting spaces, and celebrating project successes together.

How do I create an engagement project?

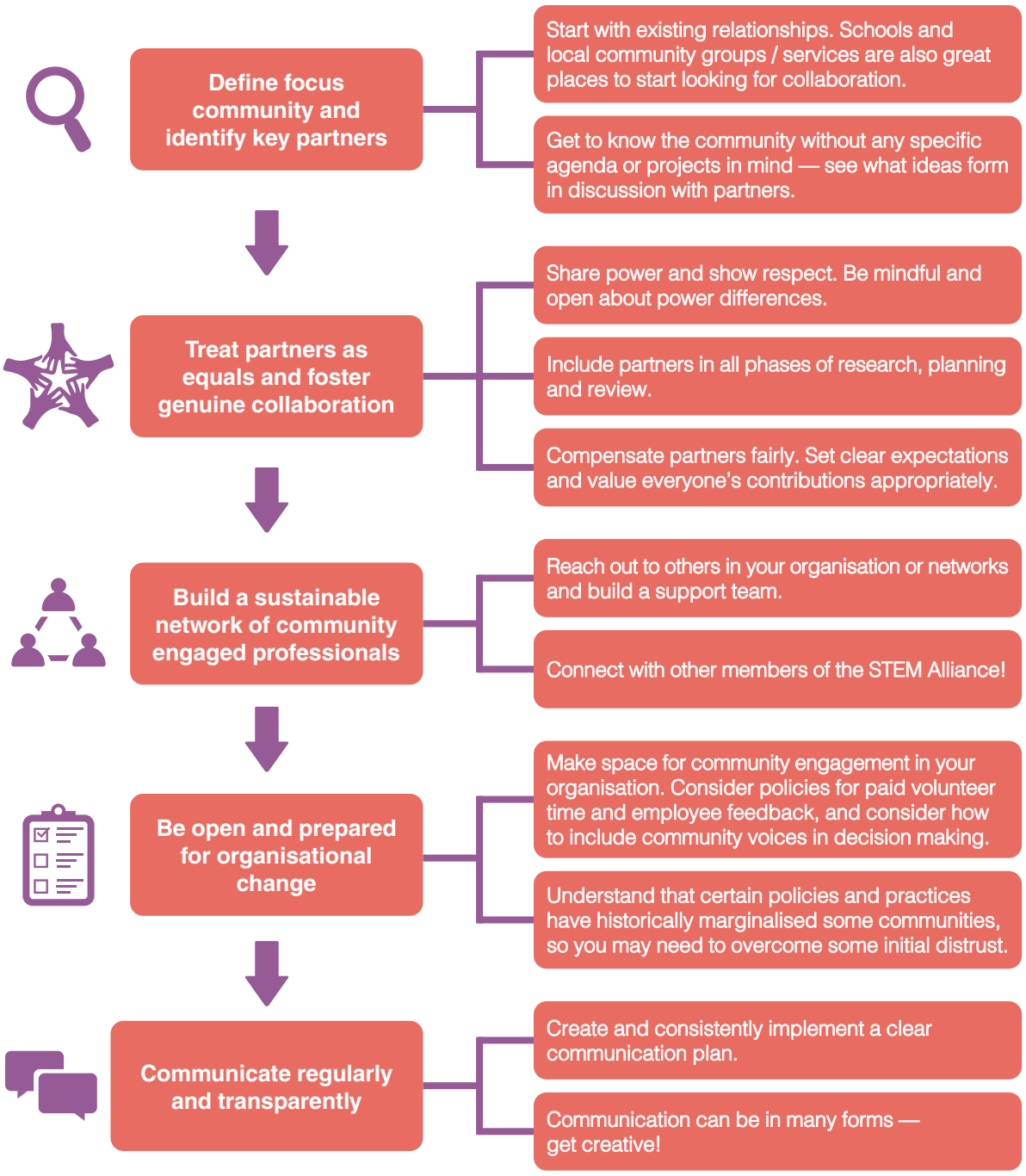
Across our review of literature, it became clear that a process cannot be prescribed for community engagement. This is cited by multiple researchers and practitioners.

Every community and every engagement project generates different contexts and requires different responses.

Nevertheless, we present two frameworks that may provide you with guidance for creating your project.

Framework 1

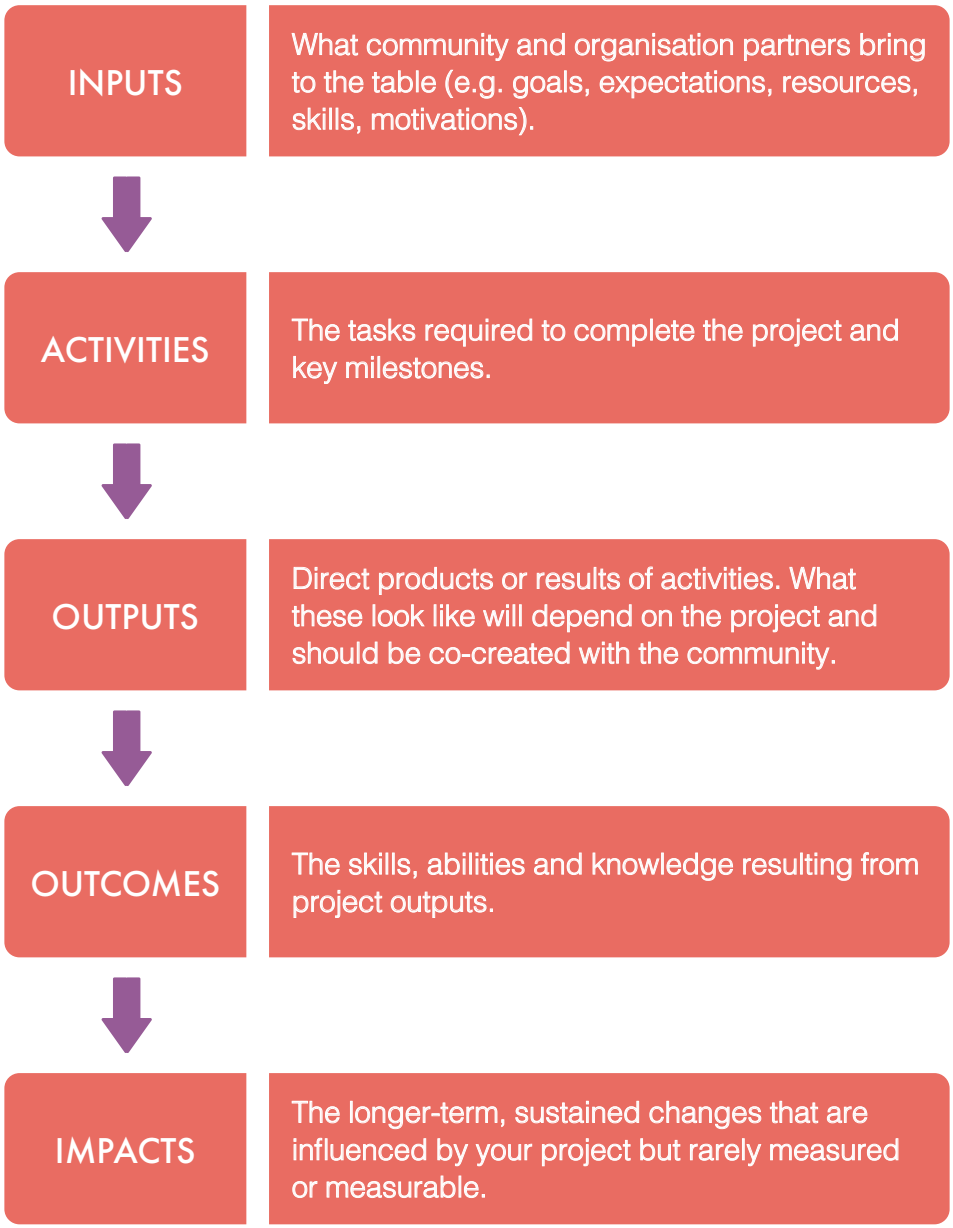
Derived from Michener and colleagues' *Aligning the Goals of Community Engaged Research*, this first framework identifies five steps to improve community engagement:



Framework 2

The second framework comes from Shirk and colleagues' *Public Participation in Scientific Research* and is based on the W. K. Kellogg Foundation's format for outcome-oriented logic models. This offers an alternative way of looking at project creation and helps to identify what you'll need for your project, what you'll do and what you can expect to achieve.

The five considerations of this framework are:



Why do community members become involved? What maintains their engagement?

Any individual will have their own reasons for getting involved in an informal STEM education project but there are four common reasons that people engage in social participation towards a common goal (such as a community project). These are:

1. Egoism – people are motivated by some kind of personal benefit
2. Altruism – people aim to help another individual or group
3. Collectivism – people intend to improve a situation for a group they belong to
4. Principlism – people act to uphold principles they value deeply

Attracting engagement

In STEM community engagement projects, volunteers indicate that their initial decisions are because of the potential for personal benefit (Egoism).

They may already have an interest in the topic, have a related hobby, or be curious to expand their knowledge. This implies that those participating in STEM engagement projects are already engaged by STEM. In a sense, we are "preaching to the choir."

To expand or improve community engagement, it may be useful to consider who we are not reaching. Perhaps targeting other types of motivation or highlighting other benefits to community members from such projects would bring new people to the communities we create with these projects.

While there are direct benefits (such as increased skills or knowledge) from involvement in a STEM engagement project, other benefits occur for both individual participants and broader community groups.

Depending on the project, community participants may see physical and/or psychological health benefits such as improved self-confidence and social relationships.

As an exercise in community building through developing mutual trust and understanding, participation can also create broader social benefits of increasing these qualities between population groups. Promoting an awareness of these broader benefits may increase initial interest, or engagement of new communities.

Maintaining engagement

Maintaining engagement across a project depends on how participant motivation changes across that project. An initial motivation for personal benefit is satisfied by acknowledgement, recognition and public attribution of what individuals contribute.

Some community participants may also view training in project-related skills as valued recognition of work, especially if it is accompanied by an official certification. After recognition of individual contributions, feedback about contributions of whole groups or entire project outcomes becomes an important motivator. If this is lacking, participants may lose their motivation to contribute.

Likewise, seeing positive effects of a project for the focus community influences community participants to continue their involvement with STEM engagement projects. As projects progress, community participants become motivated more by altruistic and collectivistic aims. Providing feedback in line with these changing values is important to continuing involvement.

As projects come to an end, and community participants begin to consider ongoing involvement or what to do next, advocacy becomes important. Community participants want to understand and share with others the project's scientific outcomes and link these with wider issues that affect their community.

This eventual shift to a collectivist-principlist motivator is important to be conscious of throughout the engagement process.

What does community participation look like? Where do we start?

As with initial considerations for planning an engagement project, once it is ready to go there is no checklist to make sure you are "Doing it Right." Again, different disciplines identify various points of awareness, many of which are similar or serve a similar purpose. The major frameworks outlined in the section "What is community engagement" can provide valuable direction to planning and creating an engagement project. Regardless of the model used, or disciplinary background to a project, all start with collaboration in a process of dialogue and deliberation.

As an engagement facilitator, you are not necessarily the dialogue and deliberation facilitator as well. This role may fall to another member of your team who has previous experience or relevant skills.

TOP TIP

Empowerment through engagement

Just as important as thinking about how to attract and maintain community interest in a project, is considering how a project might end and what participants will be left with.

Community members want to be empowered by engagement efforts. The project should leave a legacy whereby participants have gained knowledge and skills that they can use to benefit themselves and others in the long run.

Always have clear outcomes in mind and continually reinforce these throughout the project to maintain and enhance engagement.

However, understanding the purpose of this process is important, regardless of which role you may take during it.

An excellent resource already exists for delving into the theory of dialogue and deliberation facilitation. This resource Public Dialogue and Deliberation was created by Oliver Escobar for the Edinburgh Beltane Beacons of Public Engagement and can be downloaded for free at beltanenetwork.org/resources/beltane-publications/

DEFINITIONS

Dialogue

The purpose is to hear many different views, explore them non-judgementally and create mutual understanding. Active listening, honesty and transparency are important skills for constructive dialogue.

Deliberations

The purpose is to weigh alternative choices for group decision making. Dialogue should lay the foundation for inclusive deliberation.

Traditions of dialogue, or what may also be called "collaborative inquiry," are present in many cultures across history. In Aotearoa NZ, we have wānanga as a process from Te Ao Māori and Talanoa from Samoan culture.

To start exploring how wānanga as a culturally relevant framework complements the 21st century idea of dialogue and deliberations, we recommend The Complementarity of Wānanga and Deliberation in the Work of the Bioethics Council by Moana Durie Sinclair.

This is published as part of the International Indigenous Research Conference Proceedings, available to download at maramatanga.ac.nz/publication/te-tatau-pounamu-greenstone-door-traditional-knowledge-and-gateways-balanced-relations

Whichever role you find yourself in, or what path a project may take in its creation, ensuring quality in partnership activities is foundational. This starts with good communication, meaning communication that is clear, honest and respectful.


Unitec
Unitec

Next, is the mutually agreed upon goals and objectives — hopefully, this section has enabled you to begin co-creating this with a community. Remember, in creating this mutual objective both parties must perceive a benefit and come to an agreement about clearly defined roles, where each partner has the authority and resources to fulfil this role.

Within a STEM focused community engagement project, this may provide a fundamental point of relational reciprocity. Community partners may not have particular resources or skills for certain aspects of the project.

One important aspect of community engaged work is assessment and monitoring. For community members to participate in all aspects of a project, this is a key area for training and growth of skills.

This is a wonderful starting point to examine our next key research theme: mātauranga, mutual sharing and growth of knowledge and understanding.

Further reading: Mātauranga

When translated to English, mātauranga is often interpreted as a body of knowledge. A more thorough translation acknowledges mātauranga Māori as "the pursuit and application of knowledge and understanding of Te Taiao (the natural world), following a systematic methodology based on evidence, incorporating culture, values and world view" (Hikuroa, 2016).

For this theme, we have chosen the term mātauranga to highlight the importance in STEM community engagement of both the scientific method and its body of created knowledge and the incorporation of culture, values and world view.

Within an Anglo-European (English-based) world view, science highlights the importance of objective measurement and the collection of data. This is important in community engagement.

Equally important is a recognition of different ways of knowing, experiential knowledge, and social aspects of learning. Within a community setting, learning occurs with others and about others in partnership, which requires flexibility.

Ways of knowing

Traditionally, scientific knowledge construction is thought of as an objective reality, existing separately from an observer (or knower), which is value-neutral, and can be measured within a degree of accuracy if context is controlled. This concept is incredibly important to the scientific method. From this concept arises the assumption that we should be able to tell people objective facts and have those adopted into what they know.

However, quality community engagement requires recognition of, and appreciation for, other ways of knowing. Alternative models of knowledge construction recognise that a reality or multiple realities can exist, dependent on social, cultural, historical and individual factors. Especially in situations such as community engagement, where shared knowledge is created socially, these models provide important recognition of the influence of values, language, relationship, experience, and dialogue in weaving knowledge into an individual's personal narrative.

In previous sections, we have highlighted the importance of values, respect, and relationship building, and involving all participants at all stages of a project. Here, the important aspect is creating space or capability for community knowledge and expertise to contribute to outcomes or findings of the project alongside relevant scientific knowledge. It is important in its own right and contributes to the process of respect and relationship building required for quality community engagement.

This aspect of inclusion is often overlooked but provides an excellent opportunity for reciprocity in the community/organisation relationship. Organisations benefit by having community informed viewpoints on data. Communities gain educational benefit in understanding the data gathering, analysis, interpretation cycle and insights into what data says about their community.

Through working together in a social learning process, both communities and organisations benefit by growing trust, respect, and understanding of each other's ways of knowing.

Social learning

For effective community engagement, learning shifts from a formal environment, such as school or university, to learning as a social and informal process.

TOP TIP

Benefits of multiple ways of knowing

Documented benefits of including and respecting multiple ways of knowing include:

- scientific processes are more responsive to community needs and local contexts
- data interpretation can be more accurate and applicable
- project outputs — like new tools or ways of doing things — may be more readily adopted by the community
- participants gain a deeper understanding of a topic at a systemic level

Professional participants may be challenged to take themselves out of the role of professional or expert and see themselves as co-learners. Community participants may not recognise their skills or knowledge as relevant to the process or topic because it may not come from a formal background.

Awareness of how learning occurs in informal and social settings will help you as an engager to facilitate and promote this social learning process in project design.

Contrasted with formal learning environments, such as schools and universities, informal learning environments are those where social, emotional and relationship factors have a core role to play.

Because motivations to participate in this type of learning are internal and allow participants to bring new ideas in line with formerly held knowledge and personal narratives, learning in these environments may be stronger and longer lasting. This provides potential for long-term outcomes generated from the knowledge gained.

The process of a scientific inquiry project provides many opportunities for informal learning experiences, including:

- Constructive dialogue interactions between novices and experts
- Internal dynamics of communities supporting self-direction
- Individuals building relationships within a community and providing support to each other's development
- Involvement in real projects with real outcomes presenting the reality of science as "human", "messy" and "relevant"
- Holistic or multidisciplinary approach to science (and practicing other skills like numeracy, literacy, communication and teamwork)
- Recognition of experience and focus on science as story, narrative and individual meaning-making

Make learning fun!

Learning through play is relevant in an informal learning environment. Community engagement projects are not just about respect, relationships and learning together. They are also about enjoyment and the encouragement of wonder, delight and awe.

The environment should provide for curiosity, surprise and a sense of ownership over how one participates. You can attend to these emotional facets of learning by including aspects of artistic or creative enterprises in your project.

The products of this creation are broadly termed “boundary objects”. They can be simple, like an image, figure, map or tool; or complex, like a new product design, art exhibition, comic book, video game, science fiction story, piece of music/waiata or a theatre script.

These objects facilitate co-creation of knowledge by opening discussion around scientific ideas, which are often complex and abstract for children or community participants.

Narrative and storytelling can help you with co-creation. Boundary objects engage the whole person — mentally and emotionally — allowing participants to explore feelings and imagination alongside the scientific facts.

Several cases report that this gives participants better insight into people’s feelings, knowledge and personalities — and in some cases can trigger a change in participants’ own perceptions, thinking and experiences related to the topic.

Boundary objects can also facilitate meaningful conversations around difficult or sensitive scientific topics by allowing the incorporation of knowledge and skills from other disciplines.

In this way, boundary objects can be an effective way to a) encourage greater diversity among your project participants and b) encourage more respect and openness to diverse viewpoints. Lastly, boundary objects can also create entry points into STEM education for those who may not have previously identified it as being “for them”.

Words of wisdom from SouthSci

Boundary objects in action

Our goal of developing a healthy snack [was] a means of talking indirectly about issues like obesity or plastic waste. It served as a more positive way of talking about these problems than merely getting the students to remember facts about the issue.

Callum Baird
Manurewa Central School

Check out their school’s healthy lunchboxes project here:
facebook.com/STEMNZ/videos/604812193771102

Measuring and assessing

How one measures or assesses a project and/or its outcomes can and will vary based on the goals of the project, which are likely to be agreed upon during early dialogue with the community.

This section focuses on how to assess the quality of your engagement and the outcomes of the engagement process. Assessment of engagement activities is important to gain feedback in real time and to ensure quality participation.

In STEM community engagement projects, common goals for measurement include:

- understanding how science works
- changing attitudes about science and scientists
- increasing awareness of STEM jobs
- increasing numbers of those choosing to study STEM subjects for longer times
- increasing confidence in scientific thinking

As seen so far, though, quality engagement is built on concepts that are not always easy to identify or measure. These include values, respect, cultural awareness, trust, reciprocity, honesty, dialogue-based communication, humility, enjoyment and many more.

This makes quality engagement complex and multi-dimensional. Research on evaluating engagement has suggested some best practice measurements and practices. There is no universal consensus, and certain criteria or measures may be more relevant to your engagement project than others.

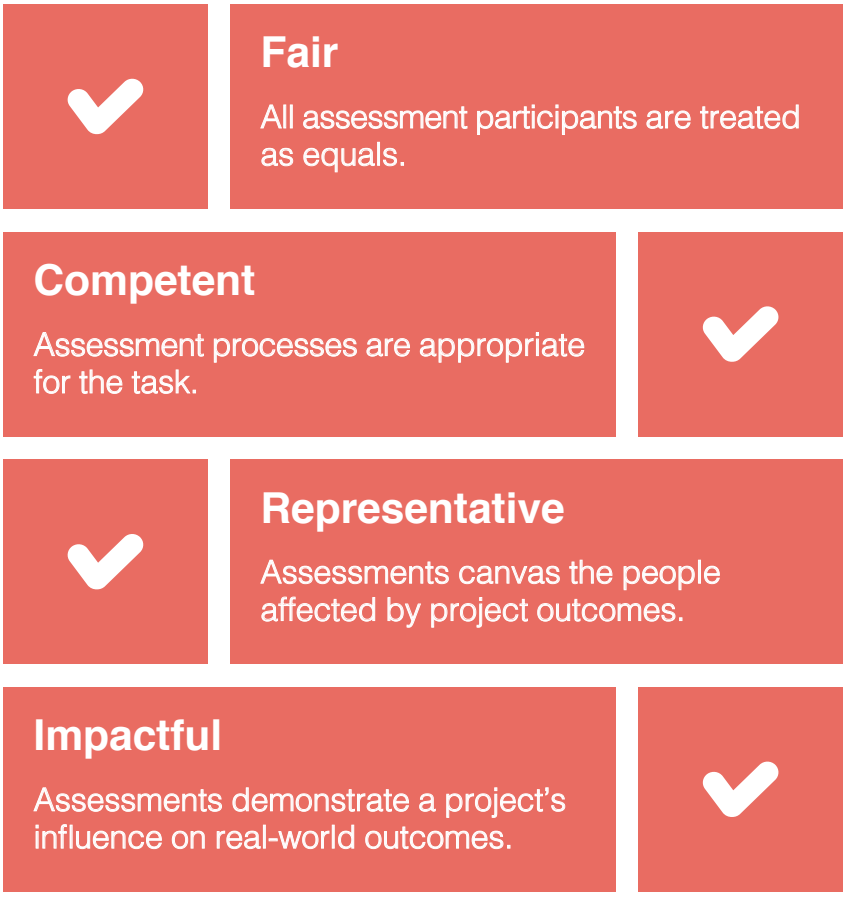
What to assess to determine quality engagement

Research supports approaches to assessing engagement that are:

- **Multi-method** – use both qualitative and quantitative approaches to gather information
- **Multi-criteria** – consider various criteria and evaluation perspectives
- **Theoretical** – use pre-existing evaluation criteria, and validate the process internally for relevance
- **Pedagogic** – should identify lessons to improve ongoing engagement, not simply judge success and failure.

Four broad criteria for assessing quality engagement

Four broad criteria have emerged from literature to guide possible assessment of some of the concepts that underlie quality engagement:



These four broad criteria have led one framework to suggest nine possible criteria to assess as part of both process and outcomes:

1. **Representativeness:** Participants should be a broadly representative sample of affected community
2. **Influence:** Output of engagement project should have genuine impact relative to its goals
3. **Transparency:** Transparent process so participants know what is happening and how decisions are made
4. **Resource accessibility:** Participants have appropriate access to resources enabling them to successfully fulfil expectations

5. **Task definition:** Nature and extent of the participation task should be clearly defined
6. **Early Involvement:** Community should be involved as early as possible and at least as soon as value judgements become important
7. **Independence:** Participation process should be conducted in an unbiased way
8. **Cost Effectiveness:** Effective engagement projects should also be cost effective
9. **Structured Decision Making:** Engagement exercises should use or provide appropriate mechanisms for structuring and displaying decision making processes.

In combination with these criteria, your assessment could consider the Generic Learning Outcomes for informal science education, outlined by the Museums, Libraries, and Archives Council in the United Kingdom. This includes looking for certain outcomes for participants as a result of having been a part of the project:

Enjoyment

Participants experienced enjoyment, inspiration and creativity.

✔

✔

Inclusion

Participants felt welcomed, respected and supported.

Learning

Participants developed knowledge, skills and understanding

✔

✔

Change

Participants' attitudes or behaviours towards STEM have improved.

TOP TIP

Consider your positionality

Positionality is the position of the researcher in relation to the study or community, organisation or participant group. This recognises the position held or adopted by a researcher affects the research process.

Consider your role as an engager. When evaluating the engagement process, be sure to recognise your own biases and make efforts to mitigate these impacts on the evaluation process.

Methods for assessment

Although evaluation in community engagement depends on the project and the community you are working with, most will choose to use some sort of survey. Survey questions should be guided by project objectives, what stage of engagement you are at (i.e. what information is needed now) and what you want people to do after participation.

Inclusion of several open-ended questions on surveys is most effective in both gathering the information you need and meeting best practice guidelines for assessment. Multiple survey templates and guidelines for project evaluation are available at sciencengage.com.au/evaluation/evaluation-resources

These were developed through assessment and evaluation of Australian science engagement projects, and should provide an adaptable starting point for Aotearoa NZ.

Self-reflection and critical evaluation are highlighted again as part of best practice for assessment of engagement activities. This method can also be used as part of the evaluation of the engagement process itself, by having community participants provide reflections on their experiences.

Critical reflection or reflective practice is any instance where individuals think critically about actions, thoughts, or experiences. An excellent guide to starting this practice is included in our online resource pack.

As the name suggests, this is a practice. It is a skill to be developed and may not come easily the first time. It may be a practice that is completely new to you as an engager, or your background may mean you are already well practised in critical reflection. Before applying it as an assessment method of the engagement process, we encourage you to work on your own reflective practice. We have tried in this resource to begin exposing you to reflective practice in exercises for each section. In the next section, we will think more about positionality alongside cultural inclusion in community engagement.

ACTIVITY 4

How have your knowledge, skills and understanding grown?

Although we can convey knowledge in a written resource for community engagement, developing skills and practising them is also important. Using the guide to reflective practice provided above, consider these questions about this resource so far.

- What are some new ideas you have learnt about so far in this resource?
- What (if anything) have you found surprising, amazing, or delightful?
- What has sparked your curiosity? From here, what will you go and learn more about?
- Has any of this new knowledge challenged you to revise your engagement practice? In what way?
- What can you do with this new knowledge to make a change in your practice immediately?

Force field analysis

This activity gets you thinking about where you are now compared to where you ultimately want to be (i.e. doing transformational engagement).

1. On the scale opposite, draw a vertical line where you think you are right now with regard to progress towards your community engagement goals.
2. On the left-hand side of the line, identify the driving forces that can support your progress. What connections, people, values, etc are driving your engagement work? What untapped resources can you make use of?
3. On the right-hand side, list any barriers or challenges you can foresee that may hinder your progress. What is stopping you from engaging deeper?
4. Finally, think about how you can overcome these challenges with the resources you have, or what other new solutions you might need to come up with to reach your goal. Jot down any ideas or action points in the space provided.

FORCE FIELD ANALYSIS SCALE

Driving forces
(strengths, resources)

Restraining forces
(challenges, constraints)

IDEAS AND ACTION POINTS TO START OVERCOMING RESTRAINING FORCES

Further reading: Cultural inclusion

By now, it may be apparent that community engagement work is vastly different to most scientific research, business or education methods. In addition to conducting and organising the work itself, one must also be conscious of one's own position in society, how that affects assumptions informing the work and how that affects relationships.

At the heart of community engagement is relationship — namely, recognising differing worldviews and forming relationships across these boundaries. Though we may believe otherwise, most of us are not well practised at this. Classically, we build relationships by identifying the things we have in common with someone. Community engagement efforts can — or perhaps should — involve building relationships with others with whom you may have little in common.

This work is not only about engaging communities but also about building communities toward a common goal. A large aspect of this is cultural inclusion — creating ways of acting together where any participant can comfortably bring their culture and worldview to bear on the work.

This poses the question: *is there a "culturally neutral" way to create such an environment?*

The short answer to this is no. Nothing is culturally or value neutral. The longer answer is that ways can be found for cultural inclusion, through learning from and understanding other cultures, and taking this opportunity to question our own social and cultural assumptions.

As a colonised society, Aotearoa NZ generally prioritises an Anglo-European worldview and mindset. In previous sections, we have introduced ideas of critical reflection and dialogue as methods forming part of the community engagement process.

These also support cultural inclusion, partly because a good proportion of research and practice surrounding these ideas comes from Indigenous scholarship and methodologies, along with other work with marginalised communities.

An important recognition identified across multiple Indigenous cultures lies in the interconnection of all things. Within Te Ao Māori specifically, this is encapsulated in the concept of whakapapa (which is also used to refer to genealogy). Indigenous methodologies hold this concept at front and centre.

The formation and identification of relationships is key. Creating inclusive relationships for a community requires accountability for

one's actions in relation to both self and others, including all one's relationships. For Indigenous cultures, relational accountability also includes having an awareness of one's place in the broader web of the universe.

As a professional, you may feel reluctant to share your own whakapapa and connections in the early stages of connecting with a community. It is easy to feel that we are there for our knowledge and/or our position in an organisation, and that our personal life, origins and experiences are not relevant.

However, in the context of Aotearoa NZ — and especially when working with Māori or Pasifika communities — it is important to bring your full self to a relationship. Communities will be much more open to engaging with you when they know you as a person and can make connections with some aspect of your background. Similarly, it is important for you to get to know your key contacts as people, not just in terms of their formal role in their organisation or community.

ACTIVITY 5

Pepehā and Whakapapa

In one context, whakapapa refers to one's genealogy, a listing of ancestors and family affiliations. In another, it refers to a layering or foundation — those experiences and history which inform your current place. In Aotearoa NZ, it is now common to introduce yourself (especially in formal settings) with a pepehā or recitation of your ties to family and place. We encourage you to learn how to introduce yourself with pepehā if you cannot already. An excellent website (pepeha.nz) exists to guide you in creating this.

In addition, we provide a guided exercise for you to reflect on the foundation, or previous experiences, that contribute to your purpose and practice as an engager. Being able to share some of your journey at the outset of an engagement project will contribute to bringing about relationships founded in the 4 Rs - respect, relevance, reciprocity and responsibility (discussed further in the next section).

- **Where** are you from? You might include where you were born and grew up; where your ancestors came from; any places that are important to your story e.g. University town, where you live now, or if you might have lived somewhere overseas
- **Who** are the important relationships in your life? Family will likely be central for most people. Go further than this. Are there organisations or community groups that are important to you? Where do you work? Do you have pets? Are your friends a big part of your life?
- **What** are you passionate about? How do you spend your free time? What gets you excited or motivated? What would you always say yes to? Are there any big life events on your horizon?
- **When** are you at your best? What do people need to know about working with you? Is there anything that is a barrier to you bringing your best self to the project? Is it something others need to know about, that is, should it be part of the expectations for how participants act together in creating the project?
- **Why** are you doing this work? What previous work, skills, experiences brought you to this position? What are the values you bring, and how do they inform your work? What do you hope to achieve?
- **How** do these experiences influence your engagement practice? Do any of your experiences highlight social assumptions you may need to question? Which kind of boundary spanner are you in your present role? What is posing a special challenge to you in your current engagement work? Which of the 4 Rs might this relate to, and what small change can you make to address this?

The importance of relational accountability

As outlined on pg 51, projects that are formed with a basis in dialogue and deliberation with a community lead to quality relationships. The process of dialogue and deliberation emphasises communicating from values of curiosity, non-judgement and openness to other world views and experiences. This style of communication is foundational for relational accountability which lies at the heart of quality two-way communication and engagement.

Four key ideas emerge from research as the basis for relational accountability: Respect, Relevance, Reciprocity and Responsibility (first explained by Kirkness & Barnhardt, 1991). These are essential to two-way communication within and across any cultures and underlie the authentic relationship formation which is so essential to quality community engagement.

RESPECT

Respect is fundamental for nurturing relationships. It is not simply about being polite, but also about listening intently to other ideas and not insisting that yours are right.

Respect means displaying characteristics of humility, generosity and patience with process. Within community engagement, an important aspect is also accepting decisions of the focus community.

RELEVANCE

Relevance requires discussions around understanding whether the engagement project meets community needs.

Is the work important to them?

Does the community have the capability to participate?

Participation capability is not always a given. If left unaddressed, it can jeopardise aims at co-creation.


AQUACULTURE
easy-grow

RECIPROCITY

Reciprocity means not seeing one form of knowledge (professional vs community) as dominant or having greater value than the other.

All participants should work to ensure mutual benefit either directly or indirectly as a result of the project. There should be a recognition that any knowledge brought to the project is gifted, and that gifts should be made in return.

RESPONSIBILITY

Responsibility is the link between consciousness and conscience. In other words, not simply knowing how one should behave, but also being aware of how one's behaviours affects others and modifying these so that value and behaviour are aligned with each other.

These four Rs summarise concepts which come up repeatedly in research investigating the relational foundation of community engagement:

- Trust, confidence and fairness
- Reciprocity and mutuality
- Individual and community empowerment
- Willingness to take risks together and be vulnerable
- Listening and valuing interactions that occur in informal settings connected with or beyond the project
- A willingness to share power and trust in the process of being co-learners

These are all values and behaviours that individual participants should aim to hold themselves accountable to within a community engagement project.

Building relationships on these foundations has two outcomes. The first is that when people work in partnerships in this way it creates a space together where dialogue and knowledge evolve alongside an evolution of knowledge systems. Local research (Hudson et al, 2012) has termed this "negotiated space."

This model was created through a series of wānanga/dialogues between mātauranga Māori experts and scientists and describes the creation of a space where both convergent and divergent possibilities can be discussed while respecting multiple worldviews. In other words, an environment is created where quality community engagement, described in previous research themes, can flourish.

The second outcome when relationships with these foundations occur within multi-layered engagement partnerships is emergence of a (largely) self-organising complex adaptive system, where decision making is interdependent, no individual has dominance, and all participants can influence changes or outcomes.

In a STEM engagement context, we can then call the new community formed in this way, and from the concepts explored in earlier sections, a "community of practice."

What is a community of practice?

Several definitions exist, but the most used relates to a community which is developed over time by a shared pursuit. Practice of that pursuit takes on a community dimension when different people with different backgrounds and knowledges work together and learn from each other while doing so.

If this sounds familiar, it is because the characteristics which encourage the emergence of communities of practice are the very same as those which encourage high-quality STEM community engagement.

As mentioned earlier in the book, formation of a community of practice is an important part of the long-term vision for engagement facilitators. It forms part of the vision because it is not a process that can be planned for and controlled.

There is, however, a process to be aware of and trust in. This is the process of systemic engagement, and the various frameworks for community engagement form one part of it.

Six key principles guide systemic engagement efforts:

1. Systems thinking – widening the scope of inquiry to include more contextual factors in understanding complex problems
2. Collaborative inquiry – methods of inquiry which foster deep participation, such as those outlined in this resource
3. Support for ongoing learning – this requires flexible, adaptive approaches to evaluation for real time feedback to support both learning and action within the project
4. Emergent design – designing for a degree of uncertainty and unpredictability through recognising the limited usefulness of predetermined structures. For example, in this resource we have focused on frameworks, awareness of a vision, and allowing a process, instead of suggesting specific elements to use in a community engagement project
5. Multiple strands of inquiry and action – different teams, each with an individual focus within the larger project, where each focus addresses a part of the larger investigation
6. Transdisciplinarity – inviting multiple disciplines and 'ways of knowing' to contribute to the project, working jointly and creating a shared conceptual framework to understand the project focus.

Fundamentally, community engagement is systemic engagement because communities are complex adaptive systems of relationships.

Throughout our review of community engagement research, one of the greatest benefits and greatest challenges is creating community relationships which extend beyond a single project.

Designing community engagement with an awareness of these six key principles should promote ongoing relationships by encouraging the emergence of a community of practice. Encouragement alone is insufficient and needs to be combined with ongoing practice of reflection and action in community relations.

How does a community emerge?

The nature of complex systems means not all efforts will be successful. Aiming for it will still result in higher quality individual community engagement efforts through shifting project focus to co-creation.

Co-creation also emphasises success via a systems perspective, designing the experience and focusing on process (framing of issues, leadership, relationships and conflict management).

Some researchers emphasise the importance of effective dialogue (discussed on pg 50) and well-designed boundary objects (pg 54) as a facilitator of these processes.

In successful cases, communities bring more energy, commitment, expertise, and enthusiasm to individual projects.

Once again, research can only provide guidelines to support success — i.e. ways to try and do the best you can with what you have available.

- Establish a common language to talk about processes and structures – academic scientific and/or industry jargon can be off-putting. This can be a difficult task, but effort and process have a big effect on community relations.
- Work with those who want to work with you – endless possibilities exist. No-one need be forced into engagement work. Co-designed projects evolve from the passions, needs and interests of participants through the creative enterprise at the heart of scientific investigation.
- Secure funds to cover participant time – many other aspects of projects may not require financial input or may have other avenues of support. Every participant's time and ability to participate should be supported and facilitated.
- Play to organisational strengths – partnerships that turn out for the best are those that link most closely to core organisational business or mission.
- Emphasise 'practice' rather than organisational forms, hierarchies, or structures – committees and working groups will always exist. Processes will always have to go through these groups eventually. In working with community organisations, focus on forming useful, authentic relationships, and what benefit is produced.
- Take spatial issues seriously – space (in both physical and metaphorical senses) holds deep meaning in partnerships. Are some parts of the project better in a community space? Will welcoming community members to organisational space help them feel more included in certain project aspects?

- Let definitional problems stimulate dialogue and communication – engagement work is often framed as organisation vs community. This is because creating an engagement project brings together people from various communities with multiple interests, which sometimes overlap and contend with each other. This work challenges them to create something together. Creating and improving shared language as part of this process cannot be underestimated.
- Emphasise the positive – community engagement work is often stimulating and rewarding for both professional and community participants.
- Work with community-organisation brokers who can work across different cultures and in different 'languages'.
- Enjoy the relationships.
- Find creative ways around standard organisational process as what you need to do will often not fit the standard mould.

Throughout this resource, much of what we have described relates back to working on relationships. Relationships within one's organisation and one's community of focus. Leading researchers in the field of communities of practice have the following to say:

"The heart of a community is the web of relationships among community members, and much of the day-to-day occurs in one-on-one exchanges. Thus, a common mistake in community design is to focus too much on public events. A community coordinator needs to 'work' the private space between meetings, dropping in on community members to discuss their current technical problems and linking them with helpful resources, inside or outside the community. These informal … discussions actually help orchestrate the public space and are key to successful meetings … Every phone call, e-mail exchange, or problem-solving conversation strengthens the relationships within the community." (Wenger, McDermott & Snyder, 2002)

At the beginning of this resource we asked, *"Why community engagement?"* It seemed like so much more work, more to do, more time and resources required. We leave you with the question: *"Why not?"*

Clearly, there is more to it than a single relationship. And what if improving a single one of your connections was all it took to start a wave that led to ripples through a community system and turned into big changes?

Further reading: Resources for leadership training

Several times within this resource, we have referred to engagers considering themselves as community leaders. With the definition many people hold of leadership, this may seem at odds with the simultaneous call to serve the communities' needs and act with respect for their desires.

Modern definitions of leadership, and those used in community engagement literature particularly, do not refer only to a leader as someone in a position of power, or at the top of a hierarchy. This idea of leadership-as-management still holds a powerful sway in most people's minds. Recent conceptualisations view leadership as a practice of non-hierarchical engagement in a shared enterprise — a call to collective action. If you have made it to this part of the resource, bells might be ringing, linking back to earlier sections and themes for effective community engagement.

In fact, there is a generous overlap in literature regarding leadership development models and community engagement. In at least one study, leadership development training provides powerful changes to how science educators practice. Many of the practices suggested in this resource are also used in leadership development models and programmes.

We would encourage you to investigate if leadership development is available in your own field. Below is a list of resources that can be a starting point for thinking about leadership in your role as a science engager.

Teaching Council of New Zealand: Tātaiako Cultural Competencies for Teachers of Māori Learners
teachingcouncil.nz/resource-centre/tataiako-cultural-competencies-for-teachers-of-maori-learners/

List of values outlined by Brené Brown
daretolead.brenebrown.com/workbook-art-pics-glossary/

Schwartz Theory of Values
scholarworks.gvsu.edu/orpc/vol2/iss1/11/

"Public Dialogue and Deliberation" Facilitation Resource
beltanenetwork.org/resources/beltane-publications/

2008 International Indigenous Research Conference Proceedings
maramatanga.ac.nz/publication/te-tatau-pounamu-greenstone-door-traditional-knowledge-and-gateways-balanced-relations

Survey templates and guidelines for project evaluation
sciencengage.com.au/evaluation/evaluation-resources/

Detailed Framework including Generic Learning Outcomes for informal science education
artscouncil.org.uk/measuring-outcomes/generic-learning-outcomes#section-1

Guide to engaging in Reflective Practice
studylib.net/doc/8121981/reflective-practice-and-writing--a-guide-to-getting-started

Beginning to create a pepeha
pepeha.nz

Templates for STEM community engagement planning are provided in an online resource pack, which you can access via the link below. These generic templates are based on what we use for the Curious Minds participatory science platform but may be adapted for any community engagement purpose.

STEM community engagement online resource pack: drive.google.com/drive/u/2/folders/150yXrQ5xQWDP4S73YT1xUVfFMZkK8fsd

FINAL WORDS

The intention of this resource has been to provide readers with research-based evidence, knowledge and guidance to confidently go forth and engage with their communities on STEM initiatives.

We hope this has been achieved and thank everyone involved for their support and wisdom in contributing to this book.

The authors hope that finishing the book is only the beginning of the journey for you (the reader).

Community engagement will look different for every business, organisation or community and there is no right way to do it. There are, however, principles that can guide you towards engaging with communities as effectively and equitably as possible, so all partners learn and gain meaningfully from the experience — not least of all our young people, who are naturally curious, enthusiastic learners and have huge untapped potential.

We hope that building closer relationships between industry, educators and communities will ultimately benefit those learners so we can grow a more scientifically engaged and technologically skilled society for the future.

Ehara taku toa i te toa takitahi, engari he toa takitini

My strength is not that of a single warrior but that of many.

– recorded as said by Here Huata, who attributed it to Paterangi of Ngāti Kahungunu

ABOUT THE STEM ALLIANCE

Our mission is **to connect schools/kura, businesses and STEM outreach providers to enhance Aotearoa's STEM education, giving every learner the opportunity to engage with real-world mātauranga Māori, science and technology.**

Our vision is for **a diverse and equitable STEM-literate Aotearoa NZ.**

We support our members to save time, make connections and be recognised for their STEM engagement efforts. Together, we are building a community of practice dedicated to strengthening partnerships across the STEM sector and promoting the value of science, technology, engineering, maths and mātauranga Māori for all learners.

ABOUT THE AUTHORS

This book has been a collaborative effort and builds on many people's work over the past near decade of community work through the SouthSci Participatory Science Platform and Auckland STEM Alliance. However, the practical construction of the book has been contributed to as follows.

Dr Sarah Morgan was a member of the original STEM Providers' Network and the Auckland STEM Alliance in 2014 while a research fellow at the University of Auckland. She moved to COMET in 2015 to set up and run the PSP in south Auckland.

Dr Morgan took over project management of the STEM Alliance, incorporated the STEM Providers' Network members into the fold and then led its re-emergence in 2019.

Dr Morgan conceived the idea of the book and is behind a large portion of its thinking and writing.

She has a background in Molecular Genetics, Science Communication and is a Primary-trained Teacher.

Dr Rajshree Gopala Krishnan is is a Senior Data Analyst at COMET and prepared the data behind the "Why and Where to Intervene" sections in Part 1.

Every year, COMET puts out a data snapshot that looks at the different tests and measures available to the public. These snapshots show trends, gaps and points of celebration for one of the top five most diverse cities worldwide. They are intended to make education-related statistics data easily accessible and are used by COMET's stakeholders in their work with communities and systems change in Tāmaki Makaurau and wider Aotearoa NZ.

In 2019/2020 the COMET Education Data Snapshot had a STEM focus, and it is these data points (updated for 2021) that we have used to illustrate both why we should intervene in the STEM community engagement space and where along the education pipeline we should intervene to have the greatest impact.

Dr Gopala Krishnan has a background in Education Psychology and Data Analytics.

Dr Susan Rapley prepared the literature review portion of the book. As this field is still fairly new, from the perspective of business and industry community engagement, they had to delve into publications focusing on community engagement by universities, traditional citizen science initiatives, science communication, public health, communication with indigenous populations and a hundred fascinating segues.

Dr Rapley's background is in Neuroscience and Science Communication, and we are truly indebted to them for their contribution.

Drs Gopala Krishnan and Morgan co-constructed the STEM Engagement Catalyst Model (pg 29) based on Dr Rapley's literature review and their combined experience in the community engagement space.

The book was compiled into a cohesive resource and managed through to publication by **Ying Yang**, STEM campaign manager at COMET.

Ying has infused the book with practical tips and guidance, drawing on her years of experience co-designing and delivering collaborative projects in both STEM outreach programmes and engineering consulting.

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REFERENCES

Adams, K.R. (2014). The Exploration of Community Boundary Spanners in University-Community Partnerships. *Journal of Higher Education Outreach and Engagement, 18*(3), 113–118.

Allen, W., Fenemor, A., Kilvington, M., Harmsworth, G., Young, RG., Deans, N., Horn, C., Philips, C., Motes de Oca, O., Ataria, J., & Smith, R. (2011). Building Collaboration and Learning in Integrated Catchment Management: The Importance of Social Process and Multiple Engagement Approaches. *New Zealand Journal of Marine and Freshwater Research, 45*(3), 525–539.

Annetta, L.A., Minogue, J., Holmes, S.Y., & Cheng, M.-T. (2009). Investigating the Impact of Video Games on High School Students' Engagement and Learning About Genetics. *Computers and Education, 53*, 74–85.

Attree, P., French, B., Milton, B., Povall, S., Whitehead, M., & Popay, J. (2011). The Experience of Community Engagement for Individuals: A Rapid Review of Evidence. *Health and Social Care in the Community, 19*(3), 250–260.

Berenston-Shaw, J. (2018). *A Matter of Fact: Talking Truth in a Post-Truth World*. Bridget Williams Books, Wellington: New Zealand.

Bhagwan, R. (2018). University-Community Partnerships: Demystifying the Process of Engagement. *South African Review of Sociology, 49*(3), 32–54.

Bovaird, T. (2007). Beyond Engagement and Participation: User and Community Coproduction of Public Services. *Public Administration Review, 67*(5), 846–860.

Bowen, F., Newenham-Kahindi, A., & Herremans, I. (2010). When Suits Meet Roots: The Antecedents and Consequences of Community Engagement Strategy. *Journal of Business Ethics, 95*(2), 297–318.

Brown, B. (2018). *Dare to Lead: Brave Work. Tough Conversations. Whole Hearts – Daring Greatly and Rising Strong at Work.* Penguin Random House, London: UK.

Carriere, A. (2006). Community Engagement Through Partnerships. *Paper presented at the CHE-HEQC/JET-CHESP Conference on Community Engagement in Higher Education.* 3–5 September, Cape Town, South Africa.

Cashman, S.B., Adeky, S., Allen, A.J. III, Corburn, J., Israel, B.A., Montaño, J., Rafelito, A., Rhodes, S.D., Swanston, S., Wallerstein, N., & Eng, E. (2015). The Power and the Promise: Working with Communities to Analyse Data, Interpret Findings, and Get to Outcomes. *American Journal of Public Health, 98*, 1407–1417.

Escobar, O., Faulkner, W., & Rea, H.J. (nd). Building Capacity for Dialogue Facilitation in Public Engagement Around Research. *Journal of Dialogue Studies, 2*(1), 87–111.

Feldman, D.L., & Ingram H.M. (2009). Making Science Useful to Decision Makers: Climate Forecasts, Water Management, and Knowledge Networks. *Weather, Climate, And Society, 1*, 9–21.

Goemans, M., Levkoe, C.Z., Andrée, P., Changfoot, N., & Christopherson-Cote, C. (2018). Learning to "Walk the Talk": Reflexive Evaluation in Community-First Engaged Research. *Engaged Scholar Journal: Community-Engaged Research, Teaching and Learning, 4*(2), 61–84.

Greehalgh, T., Jackson, C., Shaw, S., & Janamian, T. (2016). Achieving Research Impact Through Co-creation in Community-Based Health Services: Literature Review and Case Study. *The Milbank Quarterly, 94*(2), 392–429.

Hart, A., & Wolff, D. (2006). Developing Local 'Communities of Practice' through Local Community-University Partnerships. *Planning, Practice & Research, 21*(1), 121–138.

Hartley, T.W., & Robertson, R.A. (2006). Stakeholder Engagement, Cooperative Fisheries Research and Democratic Science: The Case of the Northeast Consortium. *Human Ecology Review, 13*(2), 161–171.

Henry, R., Tait, C., & STR8 UP. (2016). Creating Ethical Research Partnerships – Relational Accountability in Action. *Engaged Scholar Journal: Community-Engaged Research, Teaching and Learning, 2*(1), 183–204.

Heywood, B.K., & Besley, J.C. (2014). Education, Outreach, and Inclusive Engagement: Towards Integrated Indicators of Successful Program Outcomes in Participatory Science. *Public Understanding of Science, 23*(1), 92–106.

Hikuroa, D. (2016). Mātauranga Māori – the Ūkaipō of Knowledge in New Zealand. *Journal of the Royal Society of New Zealand*. doi.org/10.1080/03036758.2016.1252407

Howe, A.C., & Stubbs, H.S. (2003). From Science Teacher to Teacher Leader: Leadership Development as Meaning Making in a Community of Practice. *Science Teacher Education, 87*, 281–297.

Hudson, M., Roberts, M., Smith, L., Tiakiwai, S.-J., & Hemi, M. (2012). The Art of Dialogue with Indigenous Communities in the New Biotechnology World. *New Genetics and Society, 31*(1), 11–24.

Israel, B.A., Schulz, A.J., Parker, E.A., & Becker, A.B. (1998). Review of Community-Based Research: Assessing Partnership Approaches to Improve Public Health. *Annual Review of Public Health, 19*, 173–292.

Kajner, T., Fletcher, F., & Makokis, P. (2012). Balancing Head and Heart: The Importance of Relational Accountability in Community-University Partnerships. *Innovative Higher Education, 37*, 257–270.

Longnecker, N., Elliott, J., Gondwe, M. (2014). *Inspiring Australia: An Evaluation Tool for Science Engagement Activities.* Report Prepared for the Department of Innovation, Industry, Science, Research and Tertiary Education. Canberra, Australia.

Matuk, C., Hurwich, T., Spiegel, A., & Diamond, J. (2019). How do Teachers Use Comics to Promote Engagement, Equity, and Diversity in Science Classrooms? *Research in Science Education*. doi.org/10.1007/S11165-018-9814-8

McNall, M,A., Barnes-Najor, J,B., Brown, R,E., Doberneck, D., & Fitzgeral, H,E. (2015). Systemic Engagement: Universities as Partners in Systemic Approaches to Community Change. *Journal of Higher Education Outreach and Engagement, 19*(1), 1–25.

Michener, L., Cook, J., Ahmed, S.M., Yonas, M.A., Coyne-Beasley, T., & Aguilar-Gaxiola, S. (2012). Aligning the Goals of Community-Engaged Research: Why and How Academic Health Centres Can Successfully Engage with Communities to Improve Health. *Academic Medicine, 87*(3), 285–291.

New Zealand Digital Skills Forum. (2018). Digital skills for a digital nation: An analysis of the digital skills landscape of New Zealand. Downloaded from nztech.org.nz/reports/digital-skills-for-our-digital-future/

O'Fallon, L.R., & Dearry, A. (2002). Community-Based Participatory Research as a Tool to Advance Environmental Health Sciences. *Environmental Health Perspectives, 110*(supp. 2), 155–159.

Ridge, M. (2013). From Tagging to Theorising: Deepening Engagement with Cultural Heritage through Crowdsourcing. Curator: *The Museum Journal, 56*(4), 435–450.

Rotman, D., Preece, J., Hammock, J., Procita, K., Hansen, D., Parr, C., Lewis, D., & Jacobs, D. (2012). Dynamic Changes in Motivation in Collaborative Citizen-Science Projects. *CSCW '12: Proceedings of the ACM 2012 Conference on Computer Supported Cooperative Work*, 217–226.

Schwartz, SH. (2012). An Overview of the Schwartz Theory of Basic Values. *Online Reading in Psychology and Culture, 2*(1). doi.org/10.9707/2307-0919.1116

Selman, P., Carter, C., Lawrence, A., & Morgan, C. (2010). Re-connecting with a Recovering River through Imaginative Engagement. *Ecology and Society, 15*(3), article 18.

Shirk, J.L., Ballard, H.L., Wilderman, C.C., Phillips, T., Wiggins, A., Jordan, R., McCallie, E., Minarchek, M., Lewenstein, B.V., Krasny, M.E., & Bonney, R. (2012). Public Participation in Scientific Research: A Framework for Deliberate Design. *Ecology and Society, 17*(2), article 29.

Sinclair, MD. (2008). The Complementarity of Wānanga and Deliberations in the Work of the Bioethics Council. *Proceedings of The Traditional Knowledge Conference Te Tatau Pounamu: The Greenstone Door – Traditional Knowledge and Gateways to Balanced Relationships.* 8–11 June, Auckland, New Zealand, 255–260.

Strickert, G.E.H., & Bradford, L.E.A. (2015). Of Research Pings and Ping-Pong Balls: The Use of Forum Theatre for Engaged Water Security Research. *International Journal of Qualitative Methods, 14*(5), 1–14.

Tāmaki Māori Village. (2020). *3 Māori Concepts That Will Change the Way You See the World.* Retrieved from tamakimaorivillage.co.nz/blog/3-maori-concepts-that-will-change-the-way-you-see-the-world/

Thornton, T.F., & Scheer, A.M. (2012). Collaborative Engagement of Local and Traditional Knowledge and Science in Marine Environments: A Review. *Ecology and Society, 17*(3), article 8.

Tinirau, R. & Marshall-Lobb, D. (2008). Pupuruhia Tō Manawaroa: Holding Steadfast to Our Enduring Covenants of Peace: Designing Rangitāne Waiata as Educative Tools in the Transmission of Knowledge and Understanding Across Generations. *Proceedings of The Traditional Knowledge Conference Te Tatau Pounamu: The Greenstone Door – Traditional Knowledge and Gateways to Balanced Relationships.* 8–11 June, Auckland, New Zealand, 305–313.

Vargiu, A. (2014). Indicators for the Evaluation of Public Engagement of Higher Education Institutions. *Journal of the Knowledge Economy, 5*, 562–584.

Wallerstein, N.B., & Duran B. (2006). Using Community-Based Participatory Research to Address Health Disparities. *Health Promotion Practice, 7*(3), 312–323.

Walls, J., Rowe, G., & Frewer, L. (2011). Stakeholder Engagement in Food Risk Management: Evaluation of an Iterated Workshop Approach. *Public Understanding of Science, 20*(2), 241–260.

Weerts, D.J., & Sandmann, L.R. (2008). Building a Two-Way Street: Challenges and Opportunities for Community Engagement at Research Universities. *The Review of Higher Education, 32*(1), 73–106.

Weerts, D.J., & Sandmann, L.R. (2010). Community Engagement and Boundary-Spanning Roles at Research Universities. *The Journal of Higher Education, 81*(6), 632–657.

Wenger, E., McDermott, R., & Snyder, W. M. (2002). Seven principles for cultivating communities of practice. *Cultivating Communities of Practice: a guide to managing knowledge, 4.* Downloaded from clearwatervic.com.au/user-data/resource-files/7Principles_Community-of-Practice.pdf

A practical guide to ...

STEM COMMUNITY ENGAGEMENT IN AOTEAROA

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GROWING A COMMUNITY UNITED BY SCIENCE

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STEM Alliance Aotearoa is proud to release the ultimate guide to STEM community engagement.

For too long, science learning has been confined to classrooms. Many of our young people are leaving school without a clear vision of a STEM career pathway or the skills they will need to fill Aotearoa New Zealand's STEM-related jobs. There is significant potential for the STEM business sector to connect and collaborate with educators to show young people the value of science and technology in their communities.

In this book, we present an easy-to-use, research-based guide for effective STEM community engagement. This is an invaluable resource for all community engagement facilitators, educators and STEM professionals wanting to know how they can work better, together. It is packed full of insights, activities and tools to help you on your STEM engagement journey.