# STEM success for girls: Planning for change

## What’s the problem?

Define the problem you want to solve and identify appropriate practices to address the problem.

Be precise. It will be easier to achieve sustained results if you can focus on some specific issues, such as the following.

* Girls are not selecting maths/science/technologies subjects in post-compulsory years.
* Many girls are clearly disengaged from Science or Maths or Digital Technologies.
* Boys dominate the computing spaces in our school.
* Some of the teaching resources we use feel outdated and unappealing.
* I have faced sexism in my career and I would like things to be different for the girls I teach.
* Our students tend to disengage in one or more STEM subjects around Year 9 level.
* We would like to run some extracurricular activities in this area.
* I’d like to do something fun with the engineering part of STEM.
* Our Maths results in Years 7 and 9 NAPLAN tests are disappointing. How can we work on specific skills with students, and in which years should we do so?

So, what are the focus areas (issues/challenges) that you would like to work on? Let’s talk STEM. The web series ‘[Is STEM education for everybody?](https://www.monash.edu/stem-education/digital-classroom/lets-talk-stem-web-series/episode-2-inclusion)’ has some good questions to start a professional conversation.

You may want to start by working through some or all of [The Seven Principles for Inclusive STEM Education in action](http://www.thegist.edu.au/educators/create-inclusive-classrooms/7-principles-professional-learning-modules/) professional learning modules, where you’ll find practical ideas about changes you can make in your teaching practice to positively impact the girls you teach.

**Defining scope**

You may be wanting to initiate change as an individual teacher. This module will help you plan on an individual basis. However, there may also be capacity in your school to work as a team in a particular learning area or across a number of STEM learning areas. This module will provide you with strategies to work with others to achieve and sustain change over time.

[STEM success for girls: Templates for planning](http://www.thegist.edu.au/media/gu2lnatk/success-for-girls_templates-for-planning.docx)

**Optional tasks**

* Identify your focus areas.
* Turn these into a set of aims to be achieved at the end of 12 months. Consider what successful implementation would look like.
* Write your aims in the [planning template](https://www.thegist.edu.au/media/gu2lnatk/success-for-girls_templates-for-planning.docx) under the heading ‘Embedded practice’. This is all you need to add to the plan at this stage.

## Understand your problem with data

What data do you already use to measure how students are feeling about some or all of their STEM subjects and how much they are learning? You might use data from some of these sources.

* [Who’s into STEM? Student STEM questionnaire](http://www.thegist.edu.au/media/mkyhnidb/gist-talk-tools_whos-into-stem-questionnaire.docx)
* [Classroom interactions self-evaluation template](https://iop.org/sites/default/files/2019-07/IGB-classroom-interactions-template_0.pdf)
* Enrolment numbers for non-compulsory years of schooling in your learning areas of interest
* The [Science Capital project](https://discovery.ucl.ac.uk/id/eprint/10080166/1/the-science-capital-teaching-approach-pack-for-teachers.pdf) lists some data sources that teachers and researchers have previously collected and found to be helpful, including:
* student attainment data
* student attitudes to learning data
* student behaviour data
* teacher observations and reflections
* student science capital surveys (get in touch with Science Capital Research team!)
* examples of student work

(Source: Godec, King, & Archer, The Science Capital Teaching Approach: engaging students with science, promoting social justice, 2017)

* Careers counsellors and student choice within career pathways
* Student experiences of STEM subjects at your school, as noted by parents, teachers and students. Do experiences vary from one STEM subject to another?

**Collecting additional data**

Consider this.

* What data do you already have? Do you need more data to understand an issue? If so, how can you find out more?
* What is your data suggesting in terms of challenges or strengths? Which data will help develop your understanding?

The guide [Evaluating Stem Gender Equity Programs](https://womeninstem.org.au/wp-content/uploads/2020/11/Evaluating-STEM-Gender-Equity-Programs-Guide-Dec-2020.pdf) provides an example of different ways of evaluating the success of the [Techgirls](https://www.techgirlsmovement.org/about/) Competition program (a 12-week hands-on program for 7 to 17-year-old girls). It offers a range of questions that can be asked about this project.

An example of an outcomes-focused question might be:

* To what extent did the program increase girls’ confidence in using technology?

A design-focused question for the same program could be:

* Were the program activities appropriate for the target audience (girls 7 to 17-years-old)?

An efficiency-focused question may ask:

* Did the program run as planned?

Finally, a question related to lessons learned might ask:

* What worked well, what can be improved and how?

Do you want to know more about data and how to interpret it? The Queensland-based [Data literacy framework](https://education.qld.gov.au/initiativesstrategies/Documents/data-literacy-framework.PDF) has some useful ‘Guiding questions for data-informed practice’ to help you through the process.

## What makes a difference?

What is the evidence base around the focus area that you are considering?

If you have worked through one or more of the [Seven Principles for Inclusive STEM Education in action professional learning modules](http://www.thegist.edu.au/educators/create-inclusive-classrooms/7-principles-professional-learning-modules/), you will have encountered the research underpinning each principle. Use this to help make an argument for change in your school.

## What have other schools done?

All schools are different and what works in one context may not be appropriate in another. However, there are some key elements that help to drive and sustain change more generally and there are also elements that more specifically relate to how STEM subjects and activities are approached.

Find some ideas about both in the following examples.

* Sarah Fletcher from Bonython Primary School (ACT) talks about what they have done to engage students in STEM in this podcast [transcript](https://www.teachermagazine.com/au_en/articles/podcast-excellence-in-science-teaching-gifted-students-conservation-and-school-partnerships). Read about the impact of:
* implementing an inquiry-based approach across the school
* taking the girls STEM-enrichment group to the local secondary college for the day to see what older students are exploring in Science
* developing problem-solving capacities.
* Larrakeyah Primary School in the Northern Territory has a [STEAM Pedagogical Framework](https://larrakeyahprimary.com.au/uploads/assets/uploads/files/STEAM_Pedagogical_Framework.pdf) to drive and sustain innovation. The school designs age-appropriate challenges that require STEAM and 21st-century skills to solve problems. Find our more [here](https://larrakeyahprimary.com.au/blog/steam-at-larrakeyah-primary-school/) and [here](https://larrakeyahprimary.com.au/programs/steam/).
* Review the [webinar series](https://www.thegist.edu.au/educators/stem-lesson-plans/webinars/) on The GiST to find out what other teachers have done to engage girls in STEM.
	+ Meg Bailey of Templestowe Secondary College outlines ways of engaging girls in Science.
	+ Adele Hudson of Aitken College outlines ways of engaging girls in Engineering.
	+ Hayley Dureauoutlines ways of engaging girls in Maths.
* [Using problem-based learning (PBL) in STEM: Insights from the classroom](https://www.youtube.com/watch?v=zeCAJ_f5MSM) showcases a range of schools from a research project about how problem-based learning can be used in school-based STEM education.
* Many schools have used [The Connecting Minds Project](https://onegiantleapfoundation.com.au/the-connecting-minds-project/) as a catalyst for student engagement in STEM activities.

**Optional tasks**

* Think about what you’ve read and what you’ve observed personally. What are the factors that help to drive and sustain changes in schools?
* Think about what success in STEM learning looks like in these schools?

## Firm up your plan

Being clear about the active ingredients of your suggested change is vital.

You may want to introduce change in one or more of the following areas.

* Increase hands-on activities and/or problem-solving activities and/or collaborative activities.
* Enhance the classroom environment to positively support girls.
* Explore ways to build students’ Science ‘capital’.
* Provide female role models in STEM through the curriculum and/or special events.
* Focus on how teachers talk to students in STEM classes.
* Leverage student interests in class and/or extracurricular activities.
* Ensure that all students are supported to develop and use a growth mindset.
* Access special programs for girls offered by local universities or STEM-focused organisations.
* Support ‘Girls in STEM’ days and events.
* Work with parents and careers counsellors to shift perceptions.
* Undertake teacher professional learning to support knowledge in one or more of these areas.

**Tasks**

* Identify the active ingredients of the change that you wish to support.
* Consider using the [Boulder, Pebble, Sand](https://teachingsprints.com/boulder-pebble-sand-tool) tool to break down elements into manageable chunks.
* Draft what you want to do each term for a specific period of time. You will find some examples of generic implementation strategies on page 23 of [Putting evidence to work: a school’s guide to implementation](https://evidenceforlearning.org.au/assets/Guidance-Reports/Implementation/Guidance-Report-Putting-evidence-to-work-a-schools-guide-to-implementation2.pdf).
* Discuss what elements are essential in your plan, and what are ‘nice to have’.

Education and change consultant Michael Fullan advises, ‘Beware of fat plans’. Is the scope of your plan feasible given the time and resources you have?

## Planning considerations

These questions will help you think about your context.

* Which teachers and school leaders need to be involved?
* What professional development is required?
* How motivated are staff to engage in this change process? What will need to happen to bring people on board?
* What changes are needed in terms of existing processes and structures? What sort of team will work and how will the proposed change fit within the schools existing structures and meeting times?
* What resources are needed (budget, teaching resources, administrative support)?
* How will you collect, analyse and share data on implementation?

## School readiness

Education consultant Michael Fullan has written a lot about how to implement change in schools. Effective communication is one key element. He says that ‘purposeful peer interaction’ works effectively under three conditions:

* when overall values of the school and those of individual teachers and groups mesh
* when information and knowledge about effective practices are widely and openly shared
* when monitoring mechanisms are in place to detect and address ineffective actions, while also reinforcing and consolidating effective practices.

Source: [The skinny on becoming change savvy](https://michaelfullan.ca/wp-content/uploads/2016/06/11_TheSkinny_US.compressed.pdf)

When you have developed your draft plan, consider the following within your school context:

* How does it mesh with the current values and goals of the school?
* How are you going to communicate your plan?
* How do you build knowledge about effective practices?
* What would help to get buy-in from other staff members?

## Give people new experiences in relatively non-threatening circumstances

Michael Fullan says:

‘Behaviours before beliefs: Research on attitudinal change has long found that most of us change our behaviours somewhat before we get insights into new beliefs. The implication for approaching new change is clear. Do not load up on vision, evidence and sense of urgency. Rather, give people new experiences in relatively non-threatening circumstances, and build on it, especially through interaction with trusted peers.’

Source: [Motion leadership: The skinny on becoming change savvy](https://michaelfullan.ca/wp-content/uploads/2016/06/11_TheSkinny_A4.compressed.pdf)

**Consider the following.**

Anticipate where you might find champions and where you might find resistance. Plan around this. You might opt for small gains over larger gains in terms of the scope of your plan by working with fewer people.

* What might be the ‘new experiences in relatively non-threatening circumstances’ that you can offer other staff in your school?
* Can you provide people with concrete examples of how the suggested changes might roll out in practice?
* How does the change fit within your internal curriculum documents?
* How does the suggested change build on what is already working?
* Be clear about how you would respond to this question: ‘Can the change help teachers to teach and kids to learn?’

Consider talking with your leadership team and seek endorsement from that team for commencing this work. Ask for input into your draft plan.

## Preparing staff and resources

**Professional learning**

Identify the professional learning options that you will use. Identify when these will happen, and which staff will be involved. Professional learning opportunities may include:

* [The Seven Principles for Inclusive STEM Education in action](https://www.thegist.edu.au/educators/create-inclusive-classrooms/7-principles-professional-learning-modules/) professional learning modules
* [ESA webinars](https://www.thegist.edu.au/educators/stem-lesson-plans/webinars/)
* readings, videos, online artefacts (see Additional resources for more ideas).

**Resources**

What resources will you need to source to implement the changes that you want to see? Consider budget, time, meeting structures and availability of other staff. Have a discussion with the school leadership team about the availability of resources.

**Optional tasks**

* Plan when and how professional development will be delivered, and to whom.
* Which forms of data will you collect, and how?
* Finalise your plan. Remember that an idea is only ‘good’ if it can be manifested in day-to-day practice in classrooms.

## ‘Fidelity’: using an intervention as it was intended

[Putting evidence to work: a school’s guide to implementation](https://evidenceforlearning.org.au/education-evidence/guidance-reports/putting-evidence-to-work-a-schools-guide-to-implementation) advises the importance of knowing ‘where to be tight and where to be loose’. It talks about ‘fidelity’ as ‘the degree to which staff uses an intervention as intended by its developers’.

‘Fidelity is the implementation outcome most acknowledged and measured in implementation studies in education. It describes to what degree an intervention has been implemented as intended by its developers (both in-school and external developers).’

You have probably observed that some teachers often adapt an idea or concept almost as soon as it is implemented in the school. Or they think they are applying the concept but it’s not quite as it was intended to occur. Or they might misrepresent what they are actually doing in terms of implementation because the new idea challenges the way that they have been approaching teaching literacy in the past.

You need to be clear about specifying the ‘active ingredients’ of your plan – those elements and features that are tightly related to an intervention’s theory and mechanism of change.

Consider the following.

* What will help teachers to:
* use program materials in the appropriate sequence
* understand the intention of new practices
* dedicate the recommended amount of time to the new practices
* follow recommendations for relevant teaching practices?
* Consider how will you assess or monitor how closely teachers are implementing changes that you planned? What data will help you to do this?

## Changing practices plan checklist

[ ]  Identified a focus area to address.

[ ]  Created some draft aims (in relation to the issue) to be achieved in a specific time period.

[ ]  Identified existing sources of data and additional data to support understandings of focus area.

[ ]  Identified a potential approach to achieving the aims.

[ ]  Considered the resources needed to support the change/s.

[ ]  Drafted a plan based on the identified aims with clear and actionable tasks associated with each aim.

[ ]  Considered seeking endorsement and support from the school leadership team and plan a communications strategy with the leadership team.

[ ]  Planned professional development for relevant staff and any follow-on support to embed new skills and knowledge developed (for example, coaching, mentoring and peer-to-peer collaboration).

[ ]  Considered the program elements that are non-negotiable, that deliver fidelity according to research. How will you ensure that teachers understand and commit to implementing these elements?

## Additional resources

[The Seven Principles for Inclusive STEM Education in action](https://www.thegist.edu.au/educators/create-inclusive-classrooms/7-principles-professional-learning-modules/)

[The GiST STEM lesson plans](https://www.thegist.edu.au/educators/stem-lesson-plans/webinars/)

[The Science Capital Teaching Approach](https://www.ucl.ac.uk/ioe/departments-and-centres/departments/education-practice-and-society/stem-participation-social-justice-research/science-capital-teaching-approach)

[STEM women: Resources](https://www.stemwomen.org.au/resources/education)

Let’s talk STEM: [Is STEM education for everybody?](https://www.monash.edu/stem-education/digital-classroom/lets-talk-stem-web-series/episode-2-inclusion) with associated questions for a professional conversation

[Talking Teaching–3: How can we best support girls to stay in STEM subjects?](https://www.youtube.com/watch?v=fmq9NLhXCfo)

[STEM Equity Monitor](https://www.industry.gov.au/publications/stem-equity-monitor)

[Using problem-based learning (PBL) in STEM: Insights from the classroom](https://www.youtube.com/watch?v=zeCAJ_f5MSM)

[How to strengthen your school’s STEM education program for a post-COVID world](https://www.monash.edu/education/teachspace/articles/how-to-strengthen-your-schools-stem-education-program-for-a-post-covid-world)

[The 7 Most Important STEM Skills We Should Be Teaching Our Kids](https://www.weareteachers.com/important-stem-skills-teaching-kids/)

[School and Early Learning STEM initiatives](https://www.education.gov.au/australian-curriculum/support-science-technology-engineering-and-mathematics-stem/school-and-early-learning-stem-initiatives)

[STEM Professionals in Schools](https://www.csiro.au/en/education/programs/stem-professionals-in-schools)