



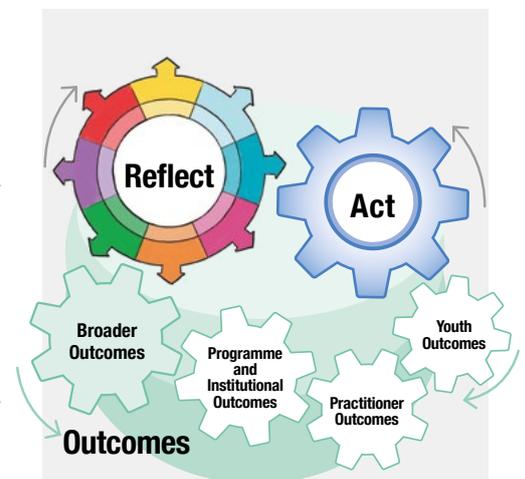
Shifting Narratives



YESTEM Insight #2.5

What is the issue?

- The stories we tell about science, technology, engineering and mathematics (STEM) and who these subjects are ‘for’ are too often **shaped by entrenched, elitist ideas**.
- For instance, our capacity to think broadly about what ‘counts’ as STEM is often limited by widely held narratives about STEM, such as **the idea that STEM is purely objective**. Our experiences of physics, chemistry, biology and mathematics at school can also profoundly affect our views about STEM.
- These narratives inevitably shape Informal STEM Learning (ISL) too. Narrow views of what ‘counts’ as STEM can leave little space for young people’s STEM-related interests and skills. Valued knowledges and practices from young people and their communities are too often rejected and/or made invisible in their encounters with ISL.
- At the same time, common narratives about **STEM being the preserve of ‘clever’, typically white, male and wealthy people** negatively impact the school STEM and ISL experiences of all young people, but particularly those from minoritised communities.
- Understandably, many young people find these narratives off-putting. **If ISL is to be equitable, these stories need to change.**



YESTEM Model for equity in ISL

Please see yestem.org for the full model and related Insight documents detailing each component.

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What is the practice?

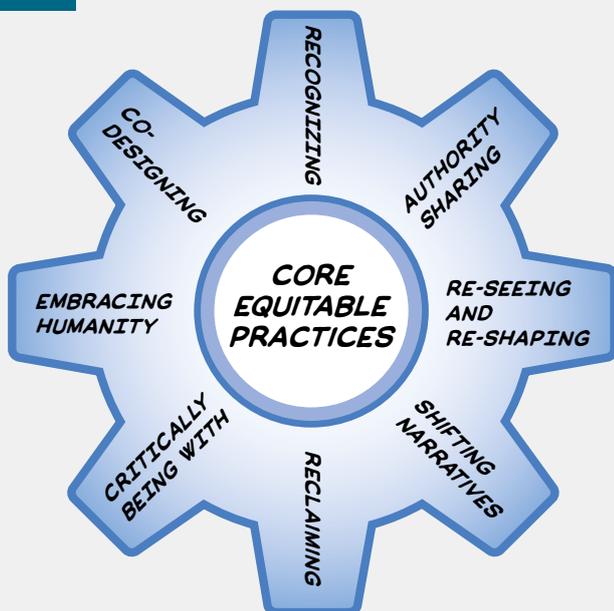
Shifting Narratives about what and who 'counts' in STEM is an urgent, crucial part of equitable, meaningfully inclusive ISL practice. **ISL practices can purposefully challenge and change stories about what 'counts' as STEM, who does STEM and how STEM ought to be done.** For instance, practitioners can work with young people and their communities to reframe STEM knowledge and practice in ways that break down stereotypes about STEM as 'stale, pale, male', and reserved for the cleverest people. Shifting these narratives can open up opportunities for more young people to be recognised and valued for pursuing STEM experiences on their own terms.

Placing youth agency at the heart of the YESTEM project helped us to think critically and intentionally about using ISL practices to challenge exclusive narratives about STEM. We took the stance that **young people are knowledgeable, not only in relation to STEM, but from their experiences of structural inequalities, such as racism, sexism,**

class discrimination, homophobia, ableism (and their intersections). Purposefully working from, valuing and representing young people's experiences and expertise allowed us to collectively discuss injustices – such as the complex colonial histories of zoos or the practice of naming science centre rooms after wealthy white men. These conversations enabled youth and practitioners to challenge unjust narratives, and importantly, change practices.

Shifting narratives in ISL goes beyond superficial representational politics. It helps young people 'see' themselves in ISL and STEM. It supports young people's agency through meaningfully inclusive practices that are purposefully designed to transform power dynamics. **Such practices value and honour minoritised young people's agency, assets and needs so that minoritised youth can both 'see' and 'be' themselves in ISL and STEM, in both the short and long term.**

Act



The practice of Shifting Narratives is about thinking differently about the stories we tell about what 'counts' as STEM, who does STEM and how STEM ought to be done.

Visit yestem.org for more information and resources from our international research effort.



Spotlight on practice:

Changing STEM narratives in a community-based digital arts centre (UK)

One of the YESTEM sites is a community-based digital arts centre in a UK City. Practitioners from this space **worked across multiple time-scales, programmes and practices to challenge and change normative stories about STEM**. Notably, their emphasis was always on how to best support the assets and needs of the young people they worked with, rather than trying to ‘get them into’ STEM. In other words, supporting young people, rather than a STEM recruitment agenda, shaped their practice.

Practitioners at the community-based digital arts centre understood the power of stories about STEM within and beyond their walls. For instance, talking about the possible STEM futures of young people in her programmes, Erin told us **“we know that tech is predominantly male, so we actively work at creating female spaces”**. Centre staff talked about challenging and changing the stories about **who could do STEM** and **what ‘counts’ as STEM** though showcasing the work of female game-designers and Manga artists and by actively supporting girls’ engagement in their programmes.

One of the centre’s after-school tech clubs provides a good example of how youth and practitioners challenged and changed narratives about STEM in multiple, complementary ways. **What ‘counts’ as STEM** was purposefully broadened to include the young people’s knowledges and skills, as well as including digital arts content. The young people’s passion for gaming, for instance, is valued in this space, with one computer always available for them to use to play Minecraft if they would rather not do that week’s activity.

Stories about **who can do STEM** as well as **how, where & why** it ought to be done were also purposefully challenged and changed in the club. For example, Ginger, an 11-year-old boy, was recognised and respected by club facilitators and other young people for his YouTube gaming channel

and his coding expertise. Ginger commented that he bet the gamers on his YouTube channel would be surprised to know he was only 11, saying “people think because of how advanced my games are that I’m much older”. Young people were encouraged to share their STEM experiences outside of the club, such as re-building computers with friends or making scrap go-carts at home with family members.

Well aware that challenging and changing narratives about STEM (not least in terms of *what, who, how, where and why*) took effort, club facilitators worked to, as Nadia put it, **“land the learning” for young people**. Practitioners welcomed and valued examples and topics from the young people’s lives that went far beyond the narrow scope of ‘school science’ – including home experiences, hobbies, and creative arts. These interests and forms of expertise were purposefully drawn on and openly valued in the space as ways of engaging with STEM. These facilitation practices foregrounded young people’s skills and expertise, supporting them to ‘be themselves’ in the club and to engage with STEM on their own terms.



Spotlight on practice: Reclaiming narratives in a science centre (US)

Reclaiming our Science Centre was an annual community project that centred the practice of Shifting Narratives involving youth, educators, and researchers at one of our US YESTEM sites, a Science Centre. By reclaim, we mean that adults made space for Shifting Narratives for youth to take back power to challenge historical representations of science and decide how their lives, histories, stories, and communities get represented at the Science Centre. As one youth, Bella, stated, **“Our goal is to reclaim [the Science Centre] so that we see ourselves here. We also want to honour the people, like us, who came before us, but whose stories don’t get told.”**

Specifically, the youth led the co-design of a new classroom based on the life and work of Dr. Katherine Johnson, who calculated the orbital mechanics for the first American in space; and a series of displays and activities about women of Colour in science. Designing these new features of the Science Centre together required the careful development of a new and shared spatial imagination of what the Science Centre could be. Foregrounding youth as legitimate critics and reclaimers of science spaces, educators and researchers enacted a set of pedagogical practices for Shifting Narratives in three important ways.

First, through **critical examination of the Science Centre spaces**, youth shared their critical noticings, questions, and comments on who/what was represented and seemed to ‘belong’ in the Centre and in STEM. As Jazmyn stated, **“Like, I knew that most places only talk about the accomplishments of White men [in science], like I, as a Black girl,**

don’t matter, but by doing this research, it made it, like, something we had the power to change.”

Second, educators and youth co-developed **justice-oriented criteria for STEM representation** and applied them to imagining a new classroom for the Science Centre. For example, the youth developed criteria for naming the classrooms after: “People who don’t get noticed,” “People who have credit taken away from them,” and “People who inspired other people.”

Third, youth also applied the criteria to how a room should be designed to best represent who belongs in science. For example, the youth design a room recognising Dr. Katherine Johnson, who calculated the orbital mechanics for the first American in space. Designed interactive experiences to engage visitors in her life and work, showcasing her life story, accomplishments, and how she confronted racism and sexism. They hoped to raise visitors’ consciousness around issues of race, while also humanising what it meant to be a person of Colour in STEM.

With these changes, educators and youth shifted the narrative of who belongs at the Science Centre, how and why. This on-going practice has turned out to be powerful accomplishment for youth (**“I feel accomplished because we actually made something happen,”** Gerard). They became legitimate owners of the space (**“We are changing the rules by changing this room,”** Lulu) and advocate of as they described, “ordinary people like us” (Ivy) who come to the science centre.



How to use this practice: Reflect & Act

The table below details a series of prompts ISL practitioners can think about Shifting Narratives around STEM in their practice. It is structured around five classic questions: what, who, how, where & why? These prompts, their context and the example questions provided are not exhaustive, but can support ISL practitioners in their work to develop more inclusive practices.

Theme	Context	Guiding questions for reflection and action
What?	STEM has much to offer young people, but balancing the positives of STEM engagement with STEM's complex history is crucial for developing meaningfully inclusive ISL practices. Narrow, dominant narratives about STEM knowledge, skills and applications as objective, truth and/ or as beneficial solutions to problems persist in our societies. These stories have a complex history, rooted in colonialism, racism, sexism, homophobia, ableism and their intersections (among others). Shifting narratives about <i>what</i> 'counts' as STEM helps young people see their own interests, experiences and knowledge as valued and relevant within STEM and ISL.	<ul style="list-style-type: none"> • How do we represent STEM in our programmes and exhibits? Who/what 'counts'? Who/what is absent? • What assumptions are built into the boundaries we draw around what does and does not 'count' as STEM in our practices? • Whose histories are we foregrounding and whose are we disparaging or ignoring when we represent STEM? • What activities could support young people to challenge narrowly framed stories about what STEM is? • How can ISL practice build on the interests, issues faced by and experiences of young people to broaden what 'counts' as science?
Who?	Narrowly framed stories about <i>who can engage with STEM</i> abound in popular culture and education (e.g. the TV show <i>The Big Bang Theory</i>). Challenging and changing who 'counts' in STEM and ISL requires that we pay attention to patterns of representation, language, programme design, staff and youth recruitment strategies as well as the design of physical and digital spaces.	<ul style="list-style-type: none"> • Who is visibly represented amongst our staff and visitors? • Who is visibly and positively represented in our displays, marketing and online presence? • Who do we celebrate through named exhibitions, prizes, statues or buildings? • Whose knowledges, practices and skills do we proclaim as important for science? How do we signal this? • How can we challenge and change these established practices? • What activities would support discussion and generate alternative narratives, practices and/or material resources?
How?	Minoritised young people are too often failed by STEM learning practices that favour the behaviours of white, middle-class boys. Where they do engage with STEM, their efforts, skills, knowledges and practices risk being invisible, misrecognised and/or seen as inappropriate. A meaningfully inclusive ISL practice means meeting young people where they are, recognising their interests, valuing their skills, building their confidence and agency.	<ul style="list-style-type: none"> • How can we disrupt behavioural expectations in ISL about how to engage with STEM? • Which of our 'standard' ISL practices (from facilitation, to exhibition design, to marketing) close down opportunities for young people from minoritised backgrounds and which open these opportunities up? • How can we understand and disrupt assumed behavioural norms embedded in ISL about the 'right way' to do things?

Theme	Context	Guiding questions for reflection and action
Where?	STEM engagement can happen anywhere and everywhere; from home to school, from a community youth club to a science centre, through hobbies and games, alone or in groups. Thinking broadly about <i>where</i> STEM engagement happens means recognising, respecting and valuing activities outside the traditional STEM and ISL scope. What about the coding involved in young people's collaborative fan-fiction websites, micro-blogging or environmental activism? It is crucial to open up the digital and physical spaces where minoritised youth can engage with STEM, to meet youth wherever and whenever they want and need, and—importantly—in ways to ensure they feel safe and comfortable doing so.	<ul style="list-style-type: none"> • How can we recognise, value and draw on the STEM activities across the full breadth of young people's lives in ISL practices? • What messages might we (intentionally and unintentionally) send about legitimate and illegitimate spaces of STEM engagement? • Which spaces do we openly discuss, respect and advocate for and which spaces are largely overlooked or actively dismissed? • How do space and place function to reinforce or undermine stories about who matters in STEM and what forms of STEM matter?
Why?	In placing youth agency at the heart of the project we wanted to think critically and intentionally about <i>why</i> STEM matters for young people from minoritised backgrounds. In doing so we purposefully decentred STEM from these stories, focusing instead on youth agency, assets and needs. For instance, while the STEM pipeline can be an important pathway for young people, we did not prioritise it over practices that support young people in their daily lives and that help them achieve their own goals, <i>whether within, through or beyond STEM.</i>	<ul style="list-style-type: none"> • How can we disrupt widely held expectations that the STEM pipeline is the only successful destination for young people involved in ISL? • Are we purposefully or inadvertently 'selling science' through our ISL practices? • What do we need to change in our practices to support STEM engagement as a route to youth agency?

About our project

- Over four years, our project involved researchers, ISL educators and young people working in partnership to develop new understandings and insights about how ISL might better support equitable outcomes for young people aged 11-14 from minoritized communities.
- Our project partnership involved data collection in the UK and the USA with partners in two science centres, two community STEM clubs, a zoo and a digital arts centre.
- Overall, 260 young people and 30 practitioners took part.
- In the wider project we also conducted surveys with 2,783 young people.

For the full range of Insights documents summarizing the project's tools and resources, including Core Equitable Practices and Equitable Youth Outcomes Model, please see yestem.org

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