

Quick Start Guide



YESTEM

Equitable Informal STEM Learning: Tools for Practitioners

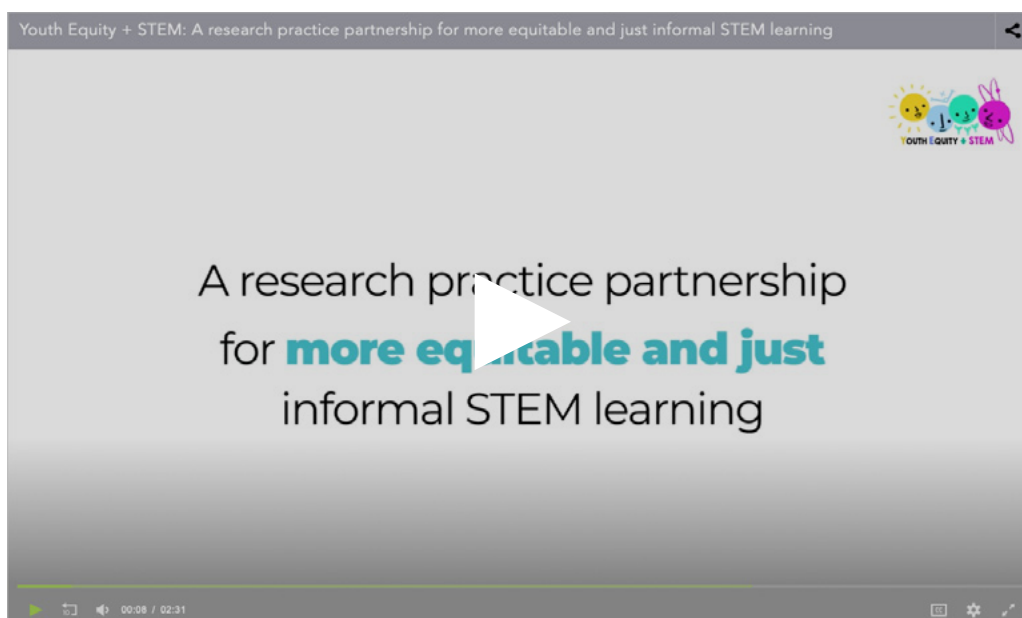


The Youth Equity and STEM project

Informal STEM learning has considerable potential for engaging young people with science, technology, engineering and mathematics (STEM). Yet, the sector would benefit from the improved capacity to understand and engage with the complexity of issues pertaining to equity and social justice, in both policy and practice.

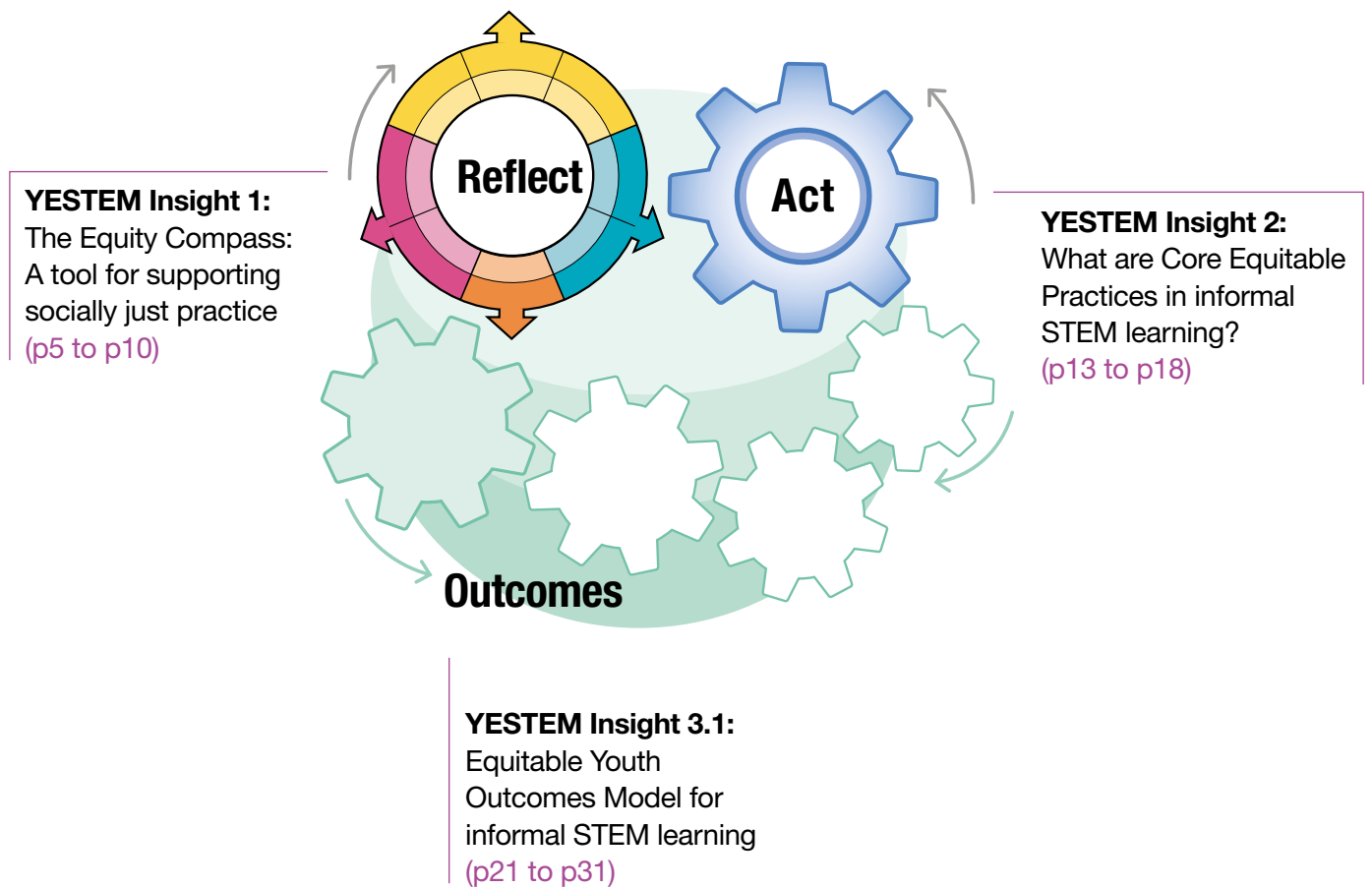
The tools and resources in this document were developed in the Youth Equity and STEM project (2017-2022), an international research-practice partnership focused on understanding and supporting equitable practice in informal STEM learning.

The materials are based on extensive mixed-method research with young people aged 11-14 and informal STEM learning practitioners, and were co-developed by a team of academic researchers and informal STEM learning organisations in the UK and the US.

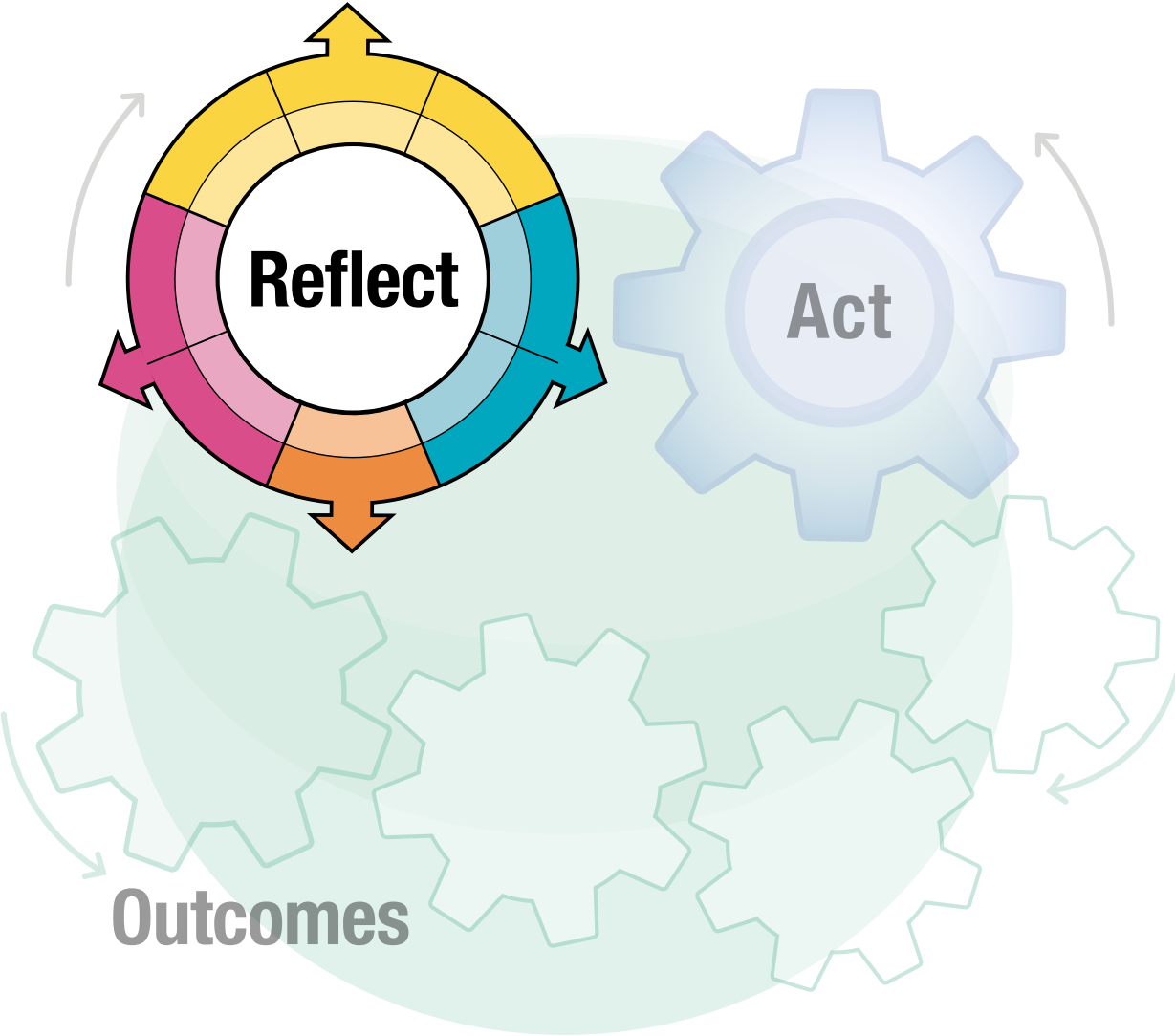


The YESTEM approach

This Quick Start Guide includes three key insights that correspond to the YESTEM model. For additional resources, see yestem.org



REFLECT: The Equity Compass





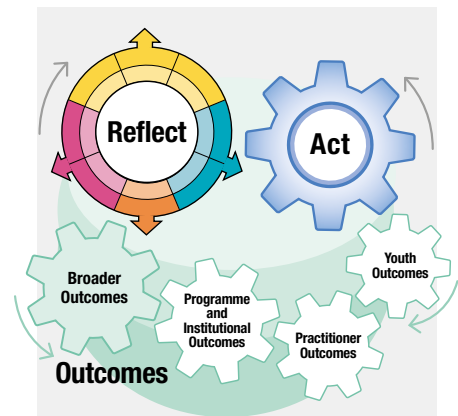
The Equity Compass: A tool for supporting socially just practice



YESTEM Insight #1

What is the Issue?

- Diversifying participation in science, technology, engineering and mathematics (STEM) remains a key challenge for policy and practice internationally.
- While informal STEM learning (ISL) settings have considerable potential to engage diverse communities, on the whole the sector does not have a diverse participation profile.
- The sector would benefit from improved capacity to understand and engage with the complexity of issues pertaining to equity and social justice, in both policy and practice.
- *Equity* refers to a model of social justice that attempts to challenge and transform social inequalities and work towards more just power relations. Whereas equality often means treating everyone the same and/or providing the same opportunities to all, an *equity* approach advocates differential treatment according to need, while also recognising and valuing differences between people.



YESTEM Model for equity in ISL

The Equity Compass is the basis of the Reflect component of this model. Please see yestem.org for the full model and related Insight documents detailing each component.

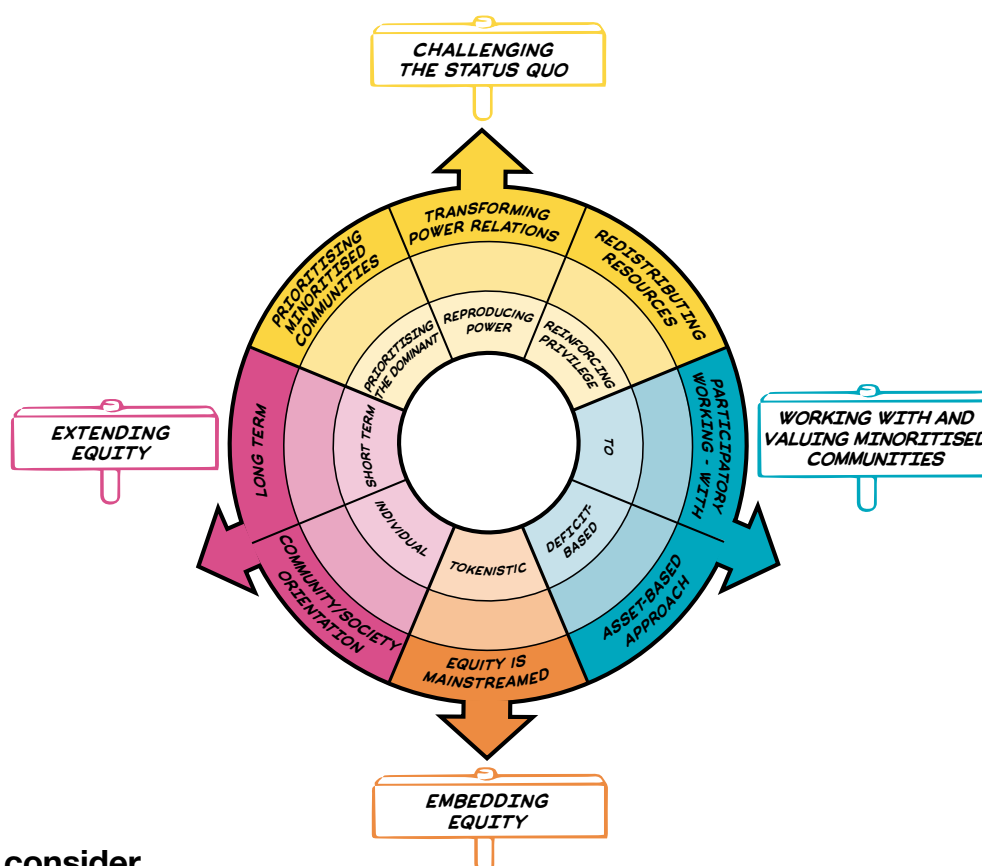
How to cite this publication: YESTEM Project Team (2021). YESTEM Insight 1: The Equity Compass: A Tool for supporting socially just practice. yestem.org



The Equity Compass: A tool for supporting socially just practice

The initial version of the Equity Compass included eight separate dimensions (axes) of equity; the version presented here was developed further through feedback from informal STEM learning practitioners and teachers, resulting in grouping the eight axes into four overarching areas.

- Equitable practice is not just about what you do, but how and why you do it. The stance taken and the principles underlying a particular programme or activity will profoundly shape its potential for either reinforcing, or transforming social inequalities.
- The Equity Compass tool helps users to adopt a social justice mindset when developing and reflecting on their policy and/or practice. It prompts them to consider multiple dimensions of equity, as represented by the eight segments of the Equity Compass.



Things to consider

- The Equity Compass helps to identify how and why particular examples of practice may be more or less equitable. By mapping your practice, the Equity Compass can help support planning for improvements in equitable practice.
- By attending to each of the segments, the Equity Compass helps practitioners to identify ways to support young people's critical STEM agency. STEM agency is the capacity for young people, particularly those from minoritised¹ communities, to use STEM to take action in their lives on issues that are meaningful to them and which help challenge societal injustices.
- While the Equity Compass has been developed and tested within ISL settings working with young people, it has also been applied by practitioners working with adults, by teachers and educators working in formal education and in contexts beyond STEM.

¹ We use the term 'minoritised' as a shorthand for individuals and communities who are minoritised by dominant culture/society. Using 'minoritised' rather than 'minority' puts the emphasis on the systemic issues and structures that are failing to sufficiently recognise, support and value some people. People can be minoritised within a particular society depending on their race/ethnicity, gender, socioeconomic background, dis/ability, sexuality and other social axes. We acknowledge that labels are always imperfect and provisional and can vary in meaning and interpretation over time and between contexts, e.g., internationally, across different professional sectors, communities and between researchers, practitioners and young people.

The Equity Compass: A tool for supporting socially just practice

AREA	EQUITY DIMENSION	GUIDING QUESTIONS
CHALLENGING THE STATUS QUO	TRANSFORMING POWER RELATIONS	To what extent are dominant relations (e.g., ideas of scientists as white men; hierarchical relations between educators and students, narrow/ elitist representations and forms of science knowledge and practice; differential experiences of ownership and belonging within STEM spaces) being reinforced vs. challenged and changed? Who has agency, power and legitimacy? Are dominant, unjust relations and conditions being reproduced, challenged or meaningfully transformed?
	PRIORITISING MINORITISED COMMUNITIES	Whose interests, needs and values drive the policy and/or practice? Those of the dominant (e.g., the institution, STEM pipeline, industry, economy) or minoritised young people and communities?
	REDISTRIBUTING RESOURCES	Are resources and efforts mostly directed at more privileged people and those who already feel 'science-y'? How are the STEM knowledge, skills, social networks, and chances of minoritised people being supported? Is the approach/experience reinforcing dominant relations and conditions, taking a compensatory approach or is it more meaningfully redistributing resources and changing ideas about what resources are valued?
WORKING WITH AND VALUING MINORITISED COMMUNITIES	PARTICIPATORY WORKING - WITH	Is the practice being done 'to', 'for' or 'with' minoritised young people and communities? Who has ownership and voice in decision making? How participatory is the practice? Are young people producers or just consumers of science? Is the practice exploitative/tokenistic? Are young people valued partners? How is youth identity and agency being supported?
	ASSET-BASED APPROACH	How are the interests, knowledge, identities and resources of minoritised young people and communities being recognised and valued (an 'assets-based' approach)? Are (some) participants treated in deficit terms (as 'lacking' information, aspiration, interest and somehow being 'out of place')? To what extent are all participants valued and recognised for who they are, rather than who they are not?
EMBEDDING EQUITY	EQUITY IS MAINSTREAMED	How central, major, intentional and foregrounded are equity issues in the programme and organisation? Are equity issues everyone's core business or are they minor, token, peripheral concerns (e.g., restricted to special programmes, and temporary funding)? How are issues and experiences of injustice recognised and challenged?
EXTENDING EQUITY	LONG TERM	Is the practice one-off, short-term or longer-term? Is attention being paid to supporting young people's trajectories and progression over time and across contexts? How are youth pathways being brokered and supported both within the experience and beyond the moment/programme/setting?
	COMMUNITY/ SOCIETY ORIENTATION	To what extent does the practice contribute to individual outcomes? To what extent are the outcomes also collective (e.g., for families, wider communities) and/or the wider field? Do the outcomes extend beyond the specific experience or programme?

The Equity Compass: A tool for supporting socially just practice

How to use in practice: Reflect and Act

- Each axis of the Equity Compass has a set of associated Guiding Questions to help you to reflect on your policy and/or practice. You can apply the Equity Compass either generally or specifically, using it to consider anything from an organizational top level policy down to a single session within a programme.
- Use the Guiding Questions to help you reflect critically on each Equity Compass axis – where would current practice ‘sit’ on each arrow? You can draw or map it on to the Equity Compass.
- Use the Equity Compass to identify areas that you would like to work on further. For instance, you might want to prioritise areas where your mapping sits in the centre zones of the Equity Compass. Use the questions and axes to help prompt ideas about how future programmes and activities might be planned in line with the eight dimensions of equity.
- Track your progress towards more justice-oriented practice by charting outwards movement on the Equity Compass axes.



Spotlight on practice

The Equity Compass is already proving to be a useful tool within ISL settings. Project partners have told us it has helped them rethink how they work with minoritised young people, introduce more participatory approaches, improve professional development and better articulate where they want to be going.

For instance, practitioners at a city science centre in the UK (with over 200 staff and volunteers) described how, despite their embracing of the centre's public commitment to prioritising underrepresented communities and improving inclusion and equitable practice, they struggled to align these goals with the complexities of practice. Tessa, who worked with young people, was sometimes frustrated by "institutional box ticking" approaches and Barbra similarly felt that there is "never enough head space" to engage with equity issues within her busy role. For Scott, 'equity' was a new concept that he was trying to understand and put into practice.

Like many others, these busy practitioners struggled to translate complex equity and social justice issues from individual practices to a collective stance on reflective action and tracking change.

They found the Equity Compass useful in many ways. For instance, Barbra felt that it helped her to articulate changes needed to better support more equitable practice and to present these to the management team: "It's great to be able to say, we considered this programme/ activity using the Equity Compass and look, our approach falls short, so let's re-address".

Tessa and Scott both found it helpful for individual reflection and planning and for having equity-based conversations with others in the organisation.

Cole, an ISL practitioner in a community zoo, felt that the approach "has truly contextualised my teaching methods and highlighted areas in which I can improve".

He felt it gave him new motivation, inspiration and ideas and helped him "more formally, clearly and confidently assist other practitioners in my industry". Cole added: "I've used the Equity Compass on existing and new programmes, and identified areas in which we can improve on our equitable practice, ensuring the sessions we run are more socially just."



About the YESTEM 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 (1,873 in the UK and 910 in the US).



Additional resources

- Click [here](#) or visit our website to see a 2-minute animation explaining the Equity Compass.
- For the full range of Insights documents summarising the project's tools and resources, including Core Equitable Practices and Equitable Youth Outcomes Model, please see yestem.org



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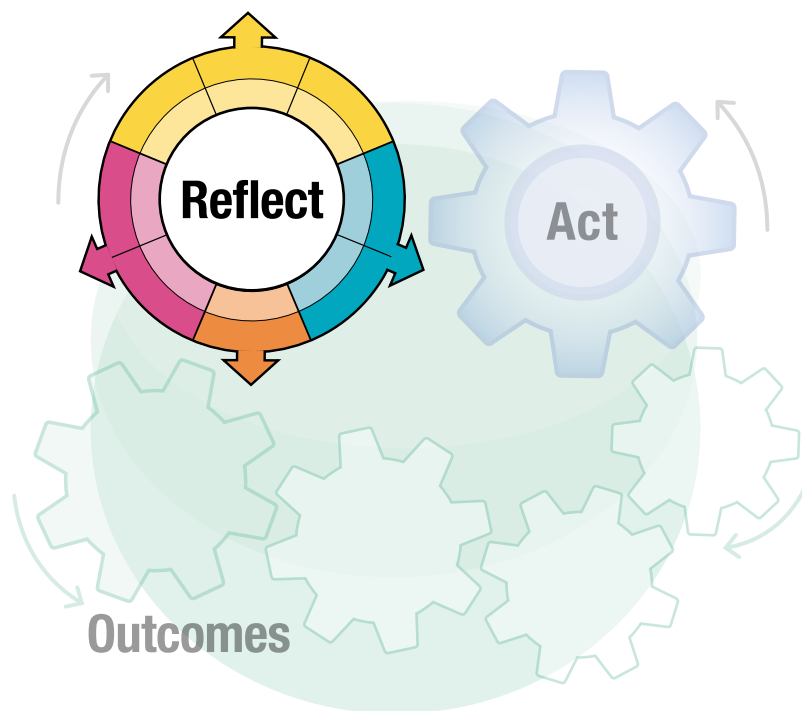
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Any opinions, findings and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the view of NSF, Wellcome, or ESRC.

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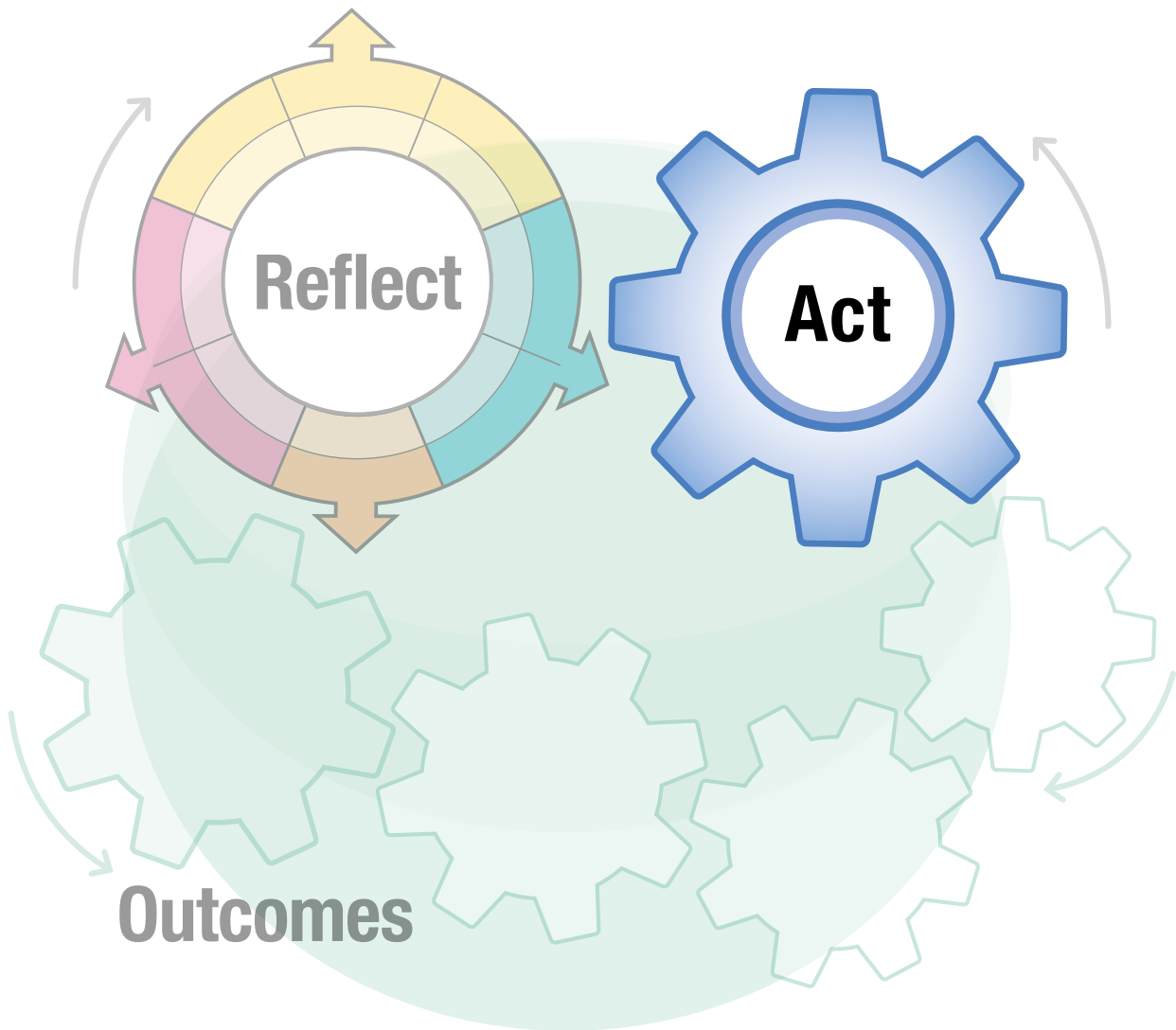




For more resources related to the Reflect part of the YESTEM model, please see yestem.org

- The Equity Compass insights for different audiences
 - [The Equity Compass - Teachers edition](#)
 - [The Equity Compass - School leaders and governors edition](#)
 - [The Equity Compass - STEM Ambassadors edition](#)
- [The Equity Compass worksheet](#)
- [The Equity Compass fortune teller](#)
- Short films and an animation
- Translations

ACT: Core Equitable Practices





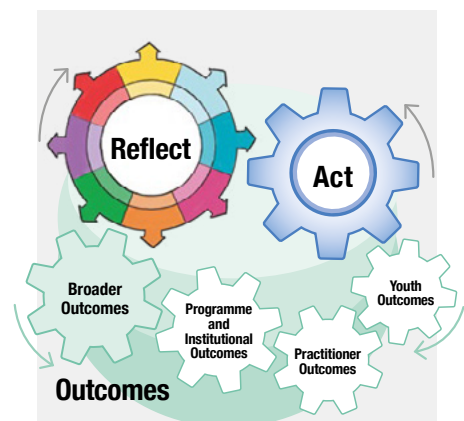
What are Core Equitable Practices in informal STEM learning?



YESTEM Insight #2

What is the issue?

- Informal STEM learning (ISL) settings hold promise in disrupting current systemic patterns of underrepresentation in science, technology, engineering and mathematics (STEM). However, while informal STEM programs and practices may be made accessible to a wide range of audiences, the learning experiences themselves may welcome some participants while excluding and alienating others.
- Whether youth feel comfortable engaging in ISL is partly a result of their experiences and their family and communities' cultural practices. **If STEM programs and activities do not encourage and support youth in ways that leverage their cultural experience, their opportunities for meaningful learning may be foreclosed.** ISL educators' practices play an important role in whether and how youth are welcomed into STEM.



YESTEM Model for equity in ISL

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

How to cite this publication: YESTEM Project Team (2021). YESTEM Insight 2: What are Core Equitable Practices in informal STEM learning? yestem.org



Our approach: Core Equitable Practices of informal STEM learning

Core Equitable Practices are pedagogical practices that support youth's learning and engagement in STEM in empowering ways. When educators engage in Core Equitable Practices, they take the stance that educators and youth are co-learners, co-disruptors and co-creators of a more just world with and in STEM. These practices pay attention to whose ways of knowing and discourses are valued in STEM, and why that matters. We refer to these practices as **Core Equitable Practices** because these practices are meant to be a part of an educator's **everyday practice**.

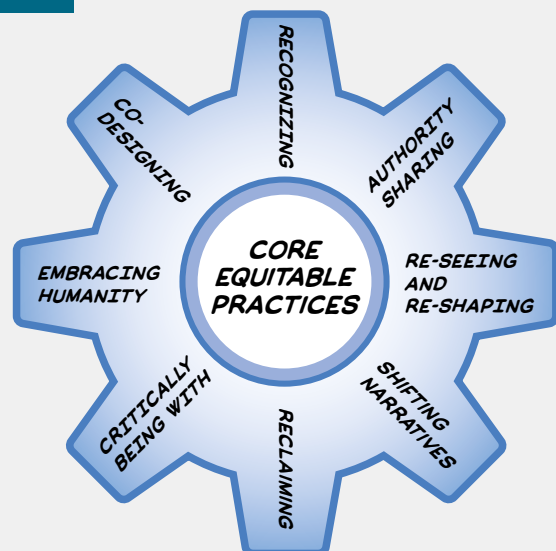
Core Equitable Practices:

- **Welcome and legitimize youth's lives, communities, histories, presents and hoped-for futures**, in the effort to re-imagine what engaging with STEM is and could be. All youth deserve opportunities to learn and become in STEM in ways that matter to them and to their communities. These practices support educators in noticing, centering and amplifying the cultural knowledge and community wisdom youth bring to learning. This is particularly important when the powerful knowledge youth bring may not have been legitimized historically in STEM spaces.

- **Disrupt dominant and unjust power relations** that have historically marginalized low-income youth, youth of Color, and girls in STEM. This involves recognizing that power and representation shape opportunities to learn through how they organize legitimate forms of knowing, doing, being, and succeeding. This also involves flattening knowledge and power hierarchies through valuing discourses, practices and forms of representation that reflect broad cultural diversity.
- **Support equitable youth outcomes** in ISL, in both individual and collective ways. These outcomes include supporting youth in developing STEM knowledge and practice alongside other powerful ways of knowing. These outcomes can help youth in participating in new ways, developing STEM agency and identities.



Act



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

Considerations

How Core Equitable Practices work

- **Core Equitable Practices are dynamic and meant to be adapted.** They may shape whole group, small group, or individual interactions/instruction, and they can, and should, be adapted to context. Learning to engage the Core Equitable Practices of ISL requires educators to learn how to notice and leverage upon youth's repertoires as well as to challenge their own personal perspectives as they learn from youth. As educators become more familiar with these practices they can employ them in more complex ways. All core equitable practices allow for variations in enactment as educators develop their craft.
- **Core Equitable Practices work across settings and time.** These practices may shape pedagogical and program activity in the moment (short-term) or over time (long-term). Educators can use the learning tools which accompany these practices to more equitably shape interactions and power dynamics in the

learning environment, as well as across learning environments, programs, and institutions. These practices are meant to shape and direct a wide range of planning, teaching and reflection activities in ISL towards more just outcomes for youth and their families and communities.

- **Core Equitable Practices work as a system of practice.** These practices are not individual or one-off or piecemeal actions. Instead, they are integrative, cross-cutting, and critically connected actions that occur across multiple scales of activity simultaneously. When enacted together, these practices are stronger than the sum of their parts and produce equitable outcomes.

A set of Core Equitable Practices. Below we offer a set of eight Core Equitable Practices. These practices are common across different kinds of ISL experiences and programs, ages and contexts.

Table 1. Core Equitable Practices defined

Practice	Definition
Recognizing	Being explicitly and publicly aware of the power of cultural knowledge and practice youth bring to STEM learning spaces, and of youth identity, agency, and expertise in STEM.
Re-seeing and Re-shaping	Building new possibilities for youth engagement in ISL through relationship building among youth, educators, space, and resources.
Co-designing	Collaboratively creating experiences, artifacts, space and desired outcomes.
Reclaiming	Fostering community dialogues and asset mapping towards creating a visible, enduring presence, disrupting and transforming what counts as STEM in the learning environment through how it's represented socially, spatially and discursively.
Shifting Narratives	Purposefully challenging and changing stories about what counts as STEM, who does STEM and how STEM ought to be done, opening up opportunities for youth to be recognized and valued for pursuing STEM experiences on their own terms.
Critically Being With	Slowing down and staying in the moment-in-action, to allow critical dialogue around inequitable classroom practices, interactions in the here-and-now and towards imagined futures.
Embracing Humanity	Valuing individual members of the teaching and learning community as fully human: as just who they are, not who they are expected to be.
Authority Sharing	Offering youth opportunities to be an expert/authority because of who they are and what they know. Giving up the centrality of adult-authority and traditional forms of STEM-authority. Supporting new forms of authority that center and amplify hybrid expertise.

Spotlight on practice: “This is Stupid!” (US)

Supporting youth in drawing upon their strengths and agency to take actions through ISL on the issues they care about is integral to how educators approach their roles at the Community Center in Lansing. Maria, one of the STEM Club educators, spoke about how it was important for her to **critically be with** the youth during their club sessions so that she could better recognize and respond to their ideas and worries from a place of their strength. This often caused her to pause in her own facilitator efforts to **share authority** with youth, **to critique or change an activity in the moment**.

Maria, an educator in an afterschool STEM club, explained how critically being with helped her to understand one youth, William’s, frustration, when he found an e-textile activity not worth the effort to struggle through the complexities of making circuits with conductive thread. She reflected:

When William threw down his bookmark during [our e-textile unit] declaring loudly, ‘this is STUPID! I want to make a fanny pack!’, at first I thought he was just frustrated with how his circuit kept shorting. You know using that conductive thread is not easy. It frays and you can short circuit without even knowing you did so. He had been so proud that his grandma taught him to sew, and I didn’t want to lose that connection. All eyes were on him as his peers stopped what they were doing and looked on. I just wanted to give him some space in that moment to express his frustration, but I also didn’t want him to just give up, and like I said everyone was watching. So, I just decided to take him at his word and ask, ‘What should we do? What do you need?’ It was then he said he wanted to make a fanny pack because it was something real, something he was gonna actually use.

In this comment Maria **recognized** how the challenges of constructing e-textiles might be too frustrating, especially if youth did not see real value in the activity itself. In that moment, she chose to **legitimize his frustration** when she said **“What should we do?”** in response to William’s expression of his frustration. She explained that when she asked the question about what to do, William said a fanny pack would be a more useful project because he could put his money and other prized items in it, and keep it on his body to prevent it from being stolen. She explained how his peers joined in, offering different ideas for why a fanny pack was a good idea:

After that a whole group was making fanny packs, using William’s pattern. While they were making, they started talking about an incident in the lunch room that day. One of the girls said a friend’s purse had gotten stolen at the lunch room that day, and another girl replied, ‘You mean her money got stolen.’ And I remember that’s when William declared, sort of matter-of-factly, “and that’s why you gotta have a fanny pack.” It was a powerful moment as I had not realized how much that meant in that moment.

Making a fanny pack did not change the technical challenges presented by e-textiles that William encountered with the bookmark. However, **William viewed the fanny pack as a worthwhile space in which to engage with both the technical and social dimension of the project**. Also, layered into his new engagement were the potentials for the “afterlife” of his project – how his fanny pack might be used, by whom, and with what impacts. Opportunities for this new form of engagement expanded the ways in which William’s cultural knowledge/practice (e.g., sewing, knowledge of his peers’ needs) became more legitimized in and hybridized as a part of a STEM project, re-shaping whose cultural knowledge had capital.

Maria’s comment further reflected the stance held by our educator partners who viewed youths’ oppositional action not as a form of misbehavior, but rather as an effort to make visible – to help educators recognize – what was unfair or inequitable in their learning spaces. Supporting William in this moment meant helping him and his peers re-imagine the task into one that made visible the ways in which e-textile making carried salience in their lives in that moment.



Spotlight on practice:

Core Equitable Practices at a community zoo (UK)

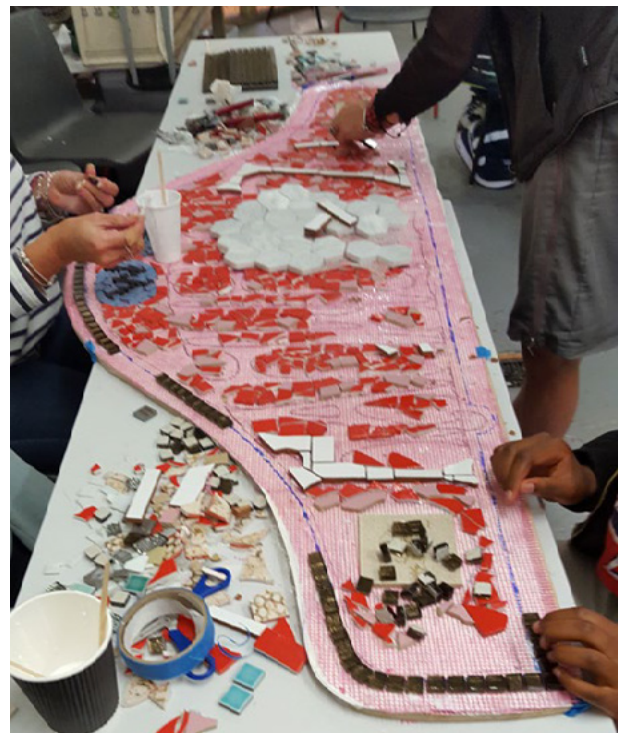
Supporting and working with a wide range of people in the local community, particularly those from marginalized groups, is an integral part of the work at the community zoo in London. Through educational programs focusing on conservation, the zoo has worked with young people attending alternative educational provision, those with special educational needs, young people on youth justice schemes and those living at a local homeless shelter.

Kevin, one of the zoo practitioners, spoke about the importance of including and welcoming these young people at the zoo and showcasing their work so they are recognized and valued as members of the zoo community. For instance, young people's artwork is displayed prominently and signage, enclosures and gardens in the zoo are all made by program participants, reflecting the practices of **Co-designing** and **Reclaiming** the space. Kevin explains "A lot of the reason we started these programs was to help show the public the value and contributions that these people make."

Showcasing the young people's work in the zoo also exemplifies the practices of **Recognizing** young people's skills and expertise, within and beyond STEM and **Authority Sharing** – as the young people played a key role in shaping the design, look and feel of the zoo.

The task of embedding Core Equitable Practices is not always easy. In the early days, the zoo's approach faced resistance from some local wealthy residents, who complained that displaying young people's work 'lowered the tone' of the zoo. However, the zoo team persisted and are pleased that their approach is now widely accepted and praised within the community.

Cole, who facilitates the education program with young people at the zoo, recognizes that respecting and valuing young people's identities, interests and existing knowledge in STEM and beyond is a key feature of his practice of **Embracing Humanity**. Cole's caring relationship with the young people is characterized by mutual trust, sharing and valuing between himself and the young people, which is evident not only in formal sessions but also during informal break times, when he chats with young people about their lives. In addition to valuing and engaging with young people, Cole also explicitly foregrounds societal injustices within his pedagogy, as exemplified by his practice of **Critically Being With**, when he openly talks with and listens to the young people, as they discuss the various challenges they experience, such as school bullying, racism and sexism.



Additional tools and resources

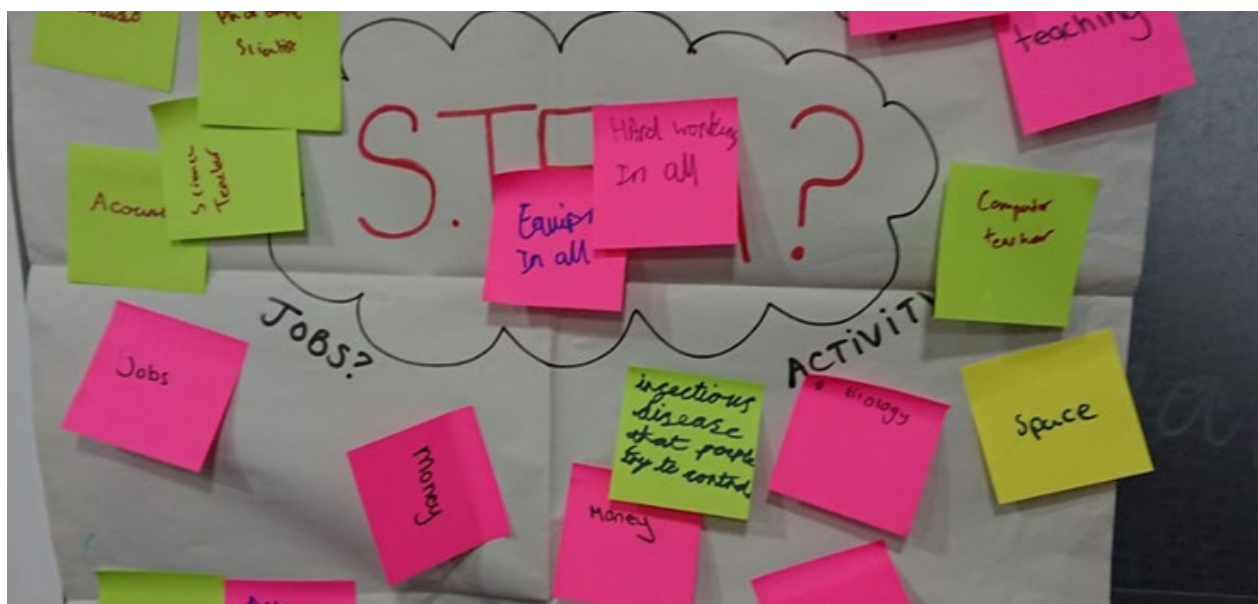
Our research-practice partnerships (RPPs) collaboratively co-authored a “suite of tools” for how each Core Equitable Practice may be implemented in context.

These tools include:

- *RPP Insights* describing the Core Equitable Practices.
- Associated “postcards” of practice, with illustrative vignettes of the Core Equitable Practices.
- Tools to support educators in planning with and enacting Core Equitable Practices.
- Practical measures for documenting impact of Core Equitable Practice implementation.

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.



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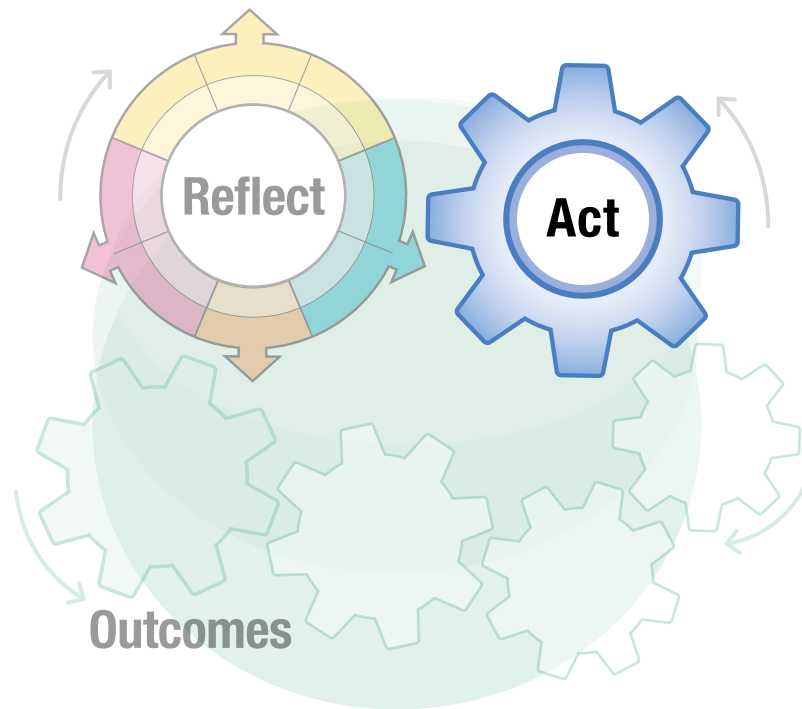
Disclaimer

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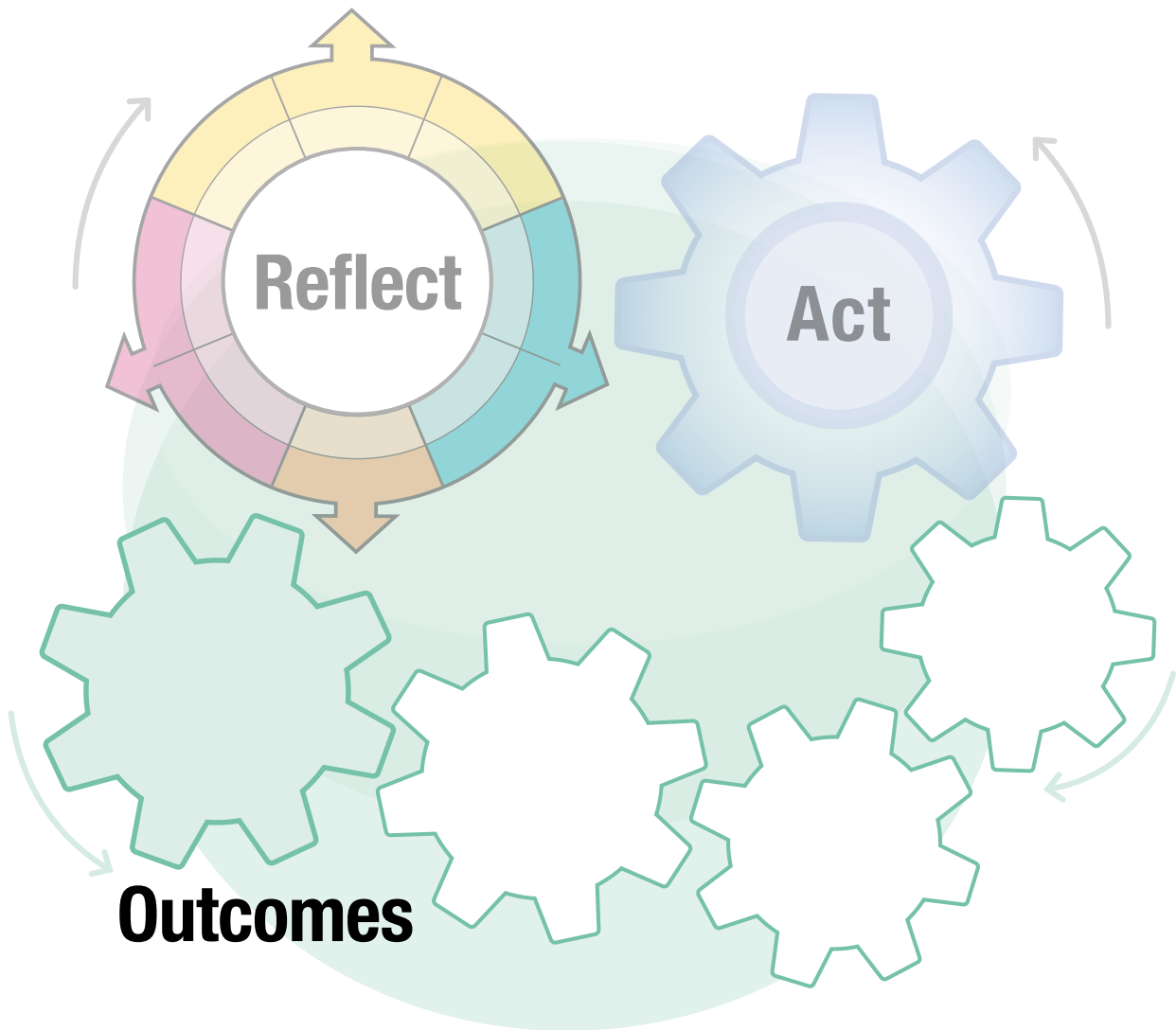




For more resources related to the Act part of the YESTEM model, please see yestem.org

- Constellations of Core Equitable Practices
- Toolkits for individual Core Equitable Practices, consisting of an Insight, the bids tool, the talk moves tool and the practical measure tool.
 - Recognizing
 - Re-seeing and re-shaping
 - Co-designing
 - Reclaiming
 - Shifting narratives
 - Critically being with
 - Embracing humanity
 - Authority sharing
- Translations
- Equitable practice in action: How to set up and run an equitable youth board

OUTCOMES





Equitable Youth Outcomes Model for informal STEM learning

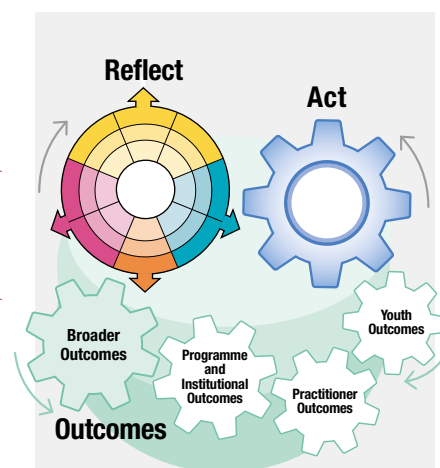


YESTEM Insight #3.1

What is the Issue?

- Young people can derive a range of positive outcomes from taking part in informal science, technology, engineering and mathematics (STEM) learning.
- Evidence shows that informal STEM learning (ISL) participation often reproduces dominant relations of power and privilege. In other words, **outcomes from ISL are not always equitable.**
- Thinking about young people's experiences in ISL from an equity perspective is important if we want to challenge social inequalities and better support all young people, but particularly those whose experiences are adversely shaped by intersecting social inequalities, such as racism, sexism and social class.

This YESTEM Insight explains our Equitable Youth Outcomes Model for ISL, intended for ISL researchers, practitioners, organisations and funders. **The model can serve as a tool for recognising equitable youth outcomes from ISL participation, for reflecting on current practice and for planning further opportunities that best support such outcomes.**



YESTEM Model for equity in ISL

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

How to cite this publication: YESTEM Project Team (2021). YESTEM Insight 3.1: Equitable Youth Outcomes Model for informal STEM learning. yestem.org



What are Equitable Youth Outcomes?

Many practitioners and organisations think about the kinds of outcomes young people generate through ISL participation in terms of enjoyment, fun, learning, socialising, and skill development.

While there are many frameworks available to evaluate ISL outcomes, there is little to help practitioners assess the extent to which outcomes are equitable.

Positive outcomes tend to be easier to come by for young people from dominant groups, while young people from minoritised¹ backgrounds experience injustices that impact the extent to which they feel respected, valued and represented in ISL, how far they are supported to feel that they belong in ISL in ways that are true to themselves and affects the outcomes of their participation.

The focus on equitable youth outcomes helps to 'cut through' generic outcomes data to identify outcomes with a greater equitable potential.

While a programme might support a range of positive outcomes for young people, this focus can help you identify and critically question those that are reinforcing positive STEM outcomes and experiences for privileged young people versus those that are supporting equitable outcomes for young people from minoritised communities.

The model focuses on what makes particular outcomes equitable. We frame equitable youth outcomes as those that **challenge, disrupt and transform unjust dominant power relations and practices** through ISL participation, and those that **meaningfully support young people from minoritised groups in gaining positive outcomes**, feel welcome and have a sense of ownership and 'rightful presence'² within an ISL setting.

Equitable youth outcomes can be individual and/or collective; they both support the individual young people and transform unjust power relations in support of new patterns of participation and engagement.

¹ We use the term 'minoritised' as a shorthand for individuals and communities who are minoritised by dominant culture/society. Using 'minoritised' rather than 'minority' puts the emphasis on the systemic issues and structures that are failing to sufficiently recognise, support and value some people. People can be minoritised within a particular society depending on their race/ethnicity, gender, socioeconomic background, dis/ability, sexuality and other social axes. We acknowledge that labels are always imperfect and provisional and can vary in meaning and interpretation over time and between contexts, e.g., internationally, across different professional sectors, communities and between researchers, practitioners and young people.

² By 'rightful presence', we refer to young people being welcomed into the ISL community, where their discourses, practices, knowledge and lived experiences are powerful resources for meaningful engagement. The framing of rightful presence underscores how young people have long been engaged with science, whether this is recognised by those in power or not. See Calabrese Barton & Tan (2020). Beyond equity as inclusion: A framework of "rightful presence" for guiding justice-oriented studies in teaching and learning.

The Equitable Youth Outcomes Model for informal STEM learning

- The Equitable Youth Outcomes Model for ISL uses the Equity Compass, which we developed with YESTEM ISL practitioners to reflect on and develop equitable practice. The Equity Compass helps us consider which outcomes are more and which are less equitable, through applying four main ways to think about equity.
- The model is organised by Question starters (corresponding to the Equity Compass areas) that practitioners could use to identify equitable youth outcomes.
- **The model does not provide a prescriptive, definitive method for capturing equitable youth outcomes.** Rather, it provides a framework and guidance for how different dimensions of equity could be applied to consider outcomes (whatever outcomes you might be recording for your programme or activity). To illustrate how this could be done, we apply the Equity Compass to consider four types of outcomes that we focused on in the YESTEM project: STEM capital, STEM identity work, Agency+ and STEM trajectories.
- **Equitable youth outcomes can be identified through qualitative and quantitative data.** See the two Spotlights below with examples of what data practitioners might collect to identify equitable youth outcomes.



The Equitable Youth Outcomes Model for informal STEM learning

- Start by thinking about the Equity Compass dimensions and the practices they highlight. Then consider 'so what' by working with the question starters and endings from the Equitable Youth Outcomes Model for ISL to reflect on practices in your context.
- In the next step, think about 'how do we know' – what data you might already have (or could collect going forward) to identify equitable outcomes.
- Finally, consider 'now what', setting priorities for collecting and using data and further developing your practice to support equitable outcomes.

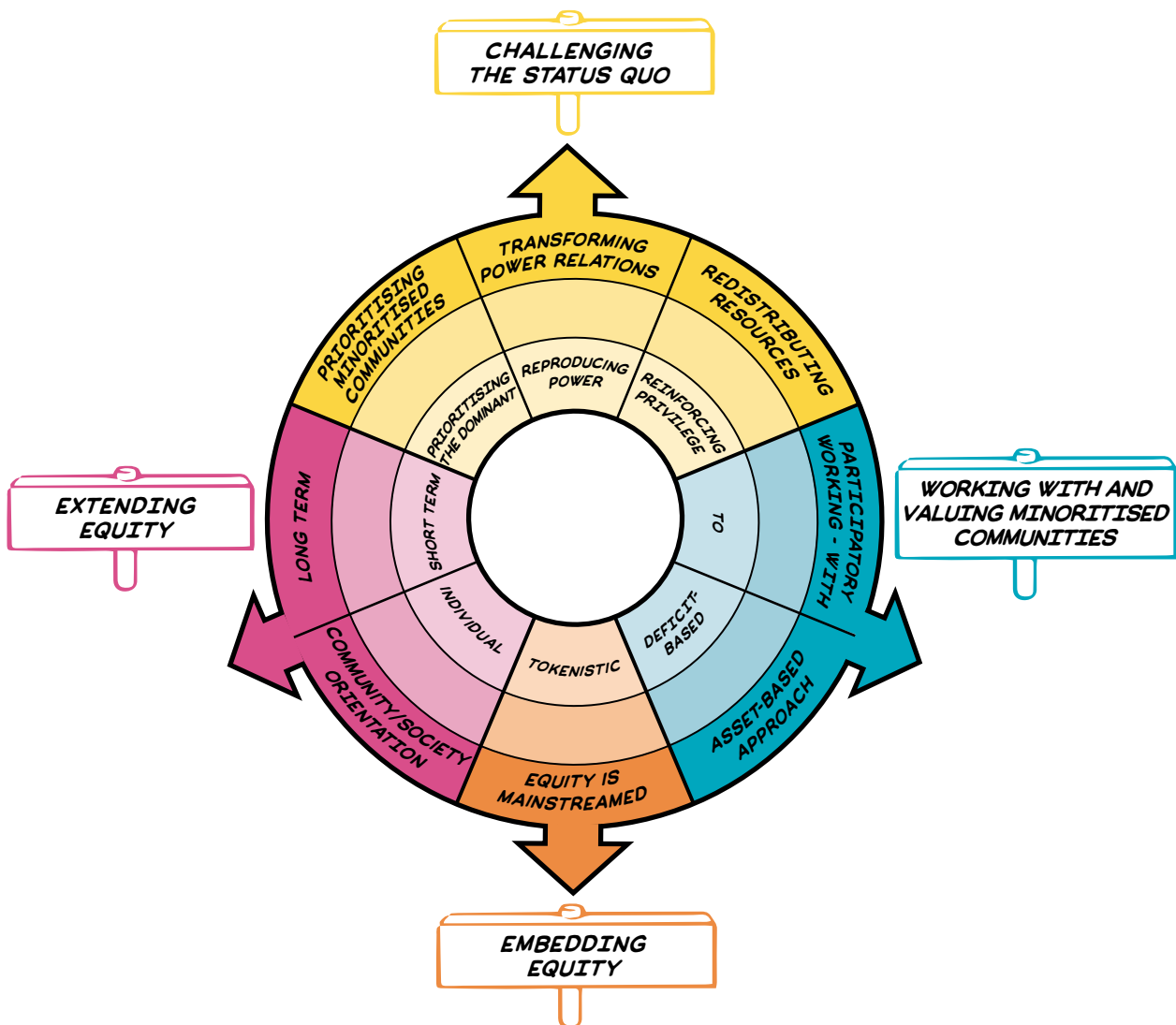


Figure 1: The Equity Compass

The Equitable Youth Outcomes Model for informal STEM learning

QUESTION STARTER (corresponding to the Equity Compass area)	YOUTH OUTCOMES			
	STEM CAPITAL	STEM IDENTITY WORK	AGENCY +	STEM TRAJECTORIES
<p>To what extent was the status quo challenged, so that youth ...</p> <p>CHALLENGING THE STATUS QUO</p>	... experience ISL as disrupting and transforming what counts as STEM (beyond traditional content, skills and practices)?	... experience ISL as disrupting and transforming who counts in STEM (beyond traditional representations)?	... have opportunities and support to use STEM to challenge injustices and 'make a difference' through their contributions?	... feel supported towards socially just life trajectories?
<p>To what extent have ISL practitioners worked with and valued minoritised communities, so that youth from these communities ...</p> <p>WORKING WITH AND VALUING MINORITISED COMMUNITIES</p>	... feel that their knowledge, skills and experiences are recognised, valued and expanded?	<p>... feel that their identities/ histories/ communities are valued and represented?</p> <p>... have a sense of ownership and belonging within ISL and STEM?</p>	... feel that they have authority and are being heard?	... feel supported in their desired life trajectories, in STEM and beyond?
<p>To what extent has equitable ISL practice been extended, so that ...</p> <p>EXTENDING EQUITY</p>	<p>... equitable youth outcomes are sustained over time (long-term)?</p> <p>... ISL supports not only individual but also wider equitable outcomes (e.g., for others, community, society)?</p>			
<p>To what extent has equitable ISL practice been embedded, so that...</p> <p>EMBEDDING EQUITY</p>	... equitable youth outcomes are prioritised across the whole ISL organisation?			

Spotlight on practice: Identifying equitable youth outcomes at a community zoo (UK)

Cole runs educational programmes with young people at a community zoo and wanted to use the model to inform how he collects data, reflects and then refines his **holiday programme**.

Prior to his involvement with the YESTEM project, Cole would typically record outcomes from his sessions using a short exit survey that anonymously asked about things like the enjoyment of the activities ('How much did you enjoy the activity?'). Cole admitted that the evaluations often resulted in "hearing what we wanted to hear" because the "topic that we're talking about is quite exciting and it is fun." On reflection, Cole told us that the equity focus was implied but there was little data to understand if the programmes supported equitable youth outcomes, or not, or even moving in the right direction.

Considering the Equity Compass, Cole decided to rethink his approach to collecting data and making claims about outcomes for the new holiday programme for young people from low-income families. For instance, Cole planned to keep **observational records** during the sessions and follow up with individual participants about their outcomes and whether the programme activities lead to 'making a difference' and support wider outcomes. Committed to challenging the status quo, Cole also intended to lead **a group discussion about what and who counts as science** (which he anticipated would contribute to data about how the programme is helping to challenge dominant views about what it means to do science and be a science person).

Cole found it difficult to know the extent to which programmes were supporting minoritised young people. He planned to improve this by i) **collecting key demographic data alongside other evaluation data**, and ii) analysing the data by paying attention to **how outcomes might differ between young people**, and the extent to which the programme was supporting minoritised young people (and thus redistributing resources rather than reinforcing privilege). Cole decided to keep an exit survey, but revised the items by adding questions that would help identify equitable outcomes, such as relating to participatory practice and the asset-based approach (e.g., 'I was able to make a contribution during the programme. '; 'I felt heard.').



Cole reflected on how a stronger focus on equity has helped the zoo embed an equitable stance in everything they do, ensuring that supporting equitable practice is at the heart of the zoo's practice.

"As conservation educators we always label our stuff as for everyone: everyone's welcome, ... but, in practice, it's not always this way. So, by achieving these equitable outcomes, meaning that we have to proactively do something from when we're designing the programme to when we're marketing the programme and allocating spaces, delivering the programme and then evaluating the programme, at each step of the way, it's our actions that are going to affect how equitable the programme is and, therefore, the outcomes."

Spotlight on practice: Identifying equitable youth outcomes from a Youth Action Council (US)

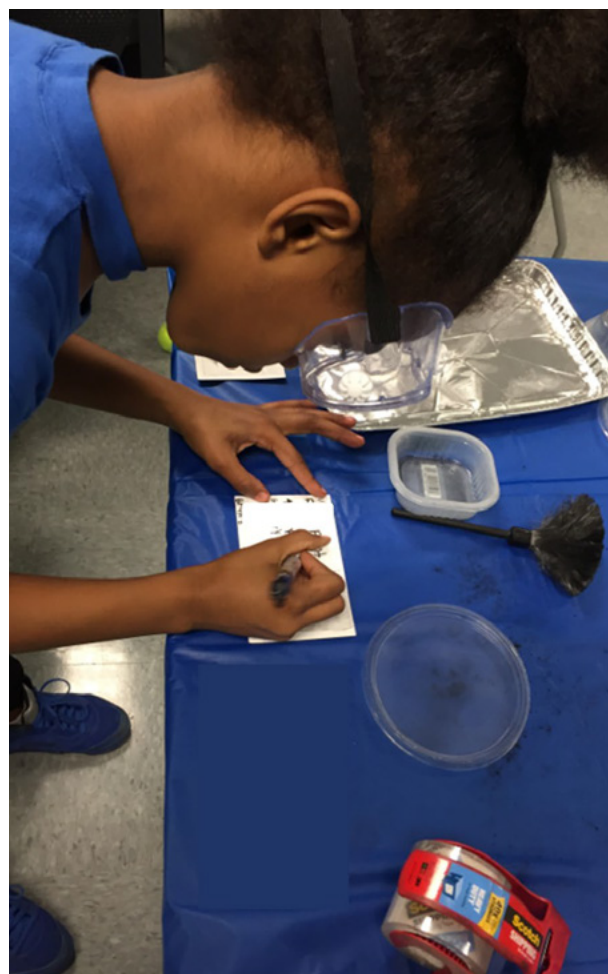
Chris has worked with a group of young people via the Youth Action Council (YAC) programme at a Science Centre. Together with his colleagues, he was keen to use YESTEM tools to examine youth outcomes from an equity perspective.

He recorded outcomes from the YAC sessions through i) **collecting the artifacts** that young people generated during the sessions, ii) **engaging in conversations with young people**, asking about their experiences and suggestions for the session activities, and iii) using exit surveys that asked about the enjoyment and challenge of the activities ('What did you enjoy and why? What was challenging and why?') and relevance of the activities to their lives ('How do your projects connect to your life?').

YAC involved several young people from minoritised backgrounds (Black, lower socioeconomic backgrounds) and Chris was keen to record how outcomes they gained compared to more privileged (White, wealthier) young people. For instance, Chris paid attention to not only what outcomes young people were gaining, but also who was gaining the outcomes, to ensure that minoritised young people are supported.

Chris used these outcomes data he collected from every YAC session to inform his planning of the next YAC sessions. For example, he designed an activity in which youth were encouraged to design and create posters that would showcase their interests and talents in science and making. This activity was designed drawing **on his reflection on the outcomes data** where he identified that some of the participating young people did not feel that they were able to share their interests during the session and did not always feel that their contributions were being heard.

Chris' practice also illustrates that outcomes do not need to only be collected at set points, or at the end of the programme, but that practitioners can engage in dialogue with young people throughout their participation (through what we called moment-to-moment engagement with youth outcomes). For instance, during the aforementioned poster activity,



several young people criticised Chris' instructions (e.g., 'It feels like schoolwork.', 'We don't wanna do this!', 'You write all this stuff, and in the end it doesn't really matter.'). which Chris interpreted as young people feeling that the session is done 'to' them rather than meaningfully created 'with' them (reflecting participatory approach) and that they felt that their work was not recognised (their assets not being valued). Chris acknowledged the critique as valuable evaluation insight, and acted upon it immediately to improve the session toward becoming more participatory, inviting youth to be the organisers and co-producers of the ISL activity.

The Equitable Youth Outcomes Model: Worksheet for recording equitable outcomes

Use this worksheet to map out what you know about equitable youth outcomes in your setting, what evidence you already have and what further evidence you need to answer the questions. You can use the worksheet to map equitable outcomes in a programme over time. You can use the model to plan equitable outcomes into your practices (formative evaluation), as you go through a particular programme (on-going evaluation) as well as at the end of a piece of work (summative evaluation).

QUESTION STARTER	YOUTH OUTCOMES	WHAT EVIDENCE DO I ALREADY HAVE?	WHAT FURTHER EVIDENCE MIGHT I NEED?
<p>To what extent was the status quo challenged, so that youth ...</p> <div data-bbox="555 1796 657 2042" style="border: 1px solid black; padding: 5px; display: inline-block;"> CHALLENGING THE STATUS QUO </div>	<p>... experience ISL as disrupting and transforming what counts as STEM (beyond traditional content, skills and practices)? [STEM capital]</p> <p>... experience ISL as disrupting and transforming who counts in STEM (beyond traditional representations)? [STEM identity work]</p> <p>... have opportunities and support to use STEM to challenge injustices and 'make a difference' through their contributions? [Agency +]</p> <p>... feel supported towards socially just life trajectories? [STEM trajectories]</p>		
<p>To what extent have ISL practitioners worked with and valued minoritised communities so that youth from these communities ...</p> <div data-bbox="1289 1818 1391 2042" style="border: 1px solid black; padding: 5px; display: inline-block;"> WORKING WITH AND VALUING MINORITISED COMMUNITIES </div>	<p>... feel that their knowledge, skills and experiences are recognised, valued and expanded? [STEM capital]</p> <p>... feel that their identities/histories/ communities are valued and represented? ... have a sense of ownership and belonging within ISL and STEM? [STEM identity work]</p>		

The Equitable Youth Outcomes Model: Worksheet for recording equitable outcomes

QUESTION STARTER	YOUTH OUTCOMES	WHAT EVIDENCE DO I ALREADY HAVE?	WHAT FURTHER EVIDENCE MIGHT I NEED?
To what extent have ISL practitioners worked with and valued minoritised communities so that youth from these communities ...	<p>... feel that they have authority and are being heard? [Agency +]</p> <p>... feel supported in their desired life trajectories, in STEM and beyond? [STEM trajectories]</p>		
To what extent has equitable ISL practice been extended so that ... 	<p>... equitable youth outcomes are sustained over time (long-term)?</p> <p>... ISL supports not only individual but also wider equitable outcomes (e.g., for others, community, society)?</p>		
To what extent has ISL practice been extended so that ... 	<p>... equitable youth outcomes are prioritised across the whole ISL organisation?</p>		

Ideas of evidence to collect



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Who might use the Equitable Youth Outcomes Model and how?

Informal STEM learning practitioners and organisations

- The model is designed to be used alongside existing formative, on-going and summative evaluation tools to support a focus on equity.
- The model can also be used as a reflective tool to help support equitable practice (together with the Equity Compass) when planning programmes, exhibitions, staff development and so on, to support opportunities for enhancing equitable youth outcomes across different institutional practices.
- Use the model to help foreground the issues of equity when thinking about and planning for young people's outcomes from ISL, particularly in working with minoritised communities.

Funders

- Funders could help by supporting meaningful and complex approaches to evaluation and project reporting that take equity seriously and recognise the complexity of evidencing equitable outcomes.
- Support long-term investment in young people, ISL practitioners and ISL institutions to help support the achievement of equitable, consequential outcomes for all parties.

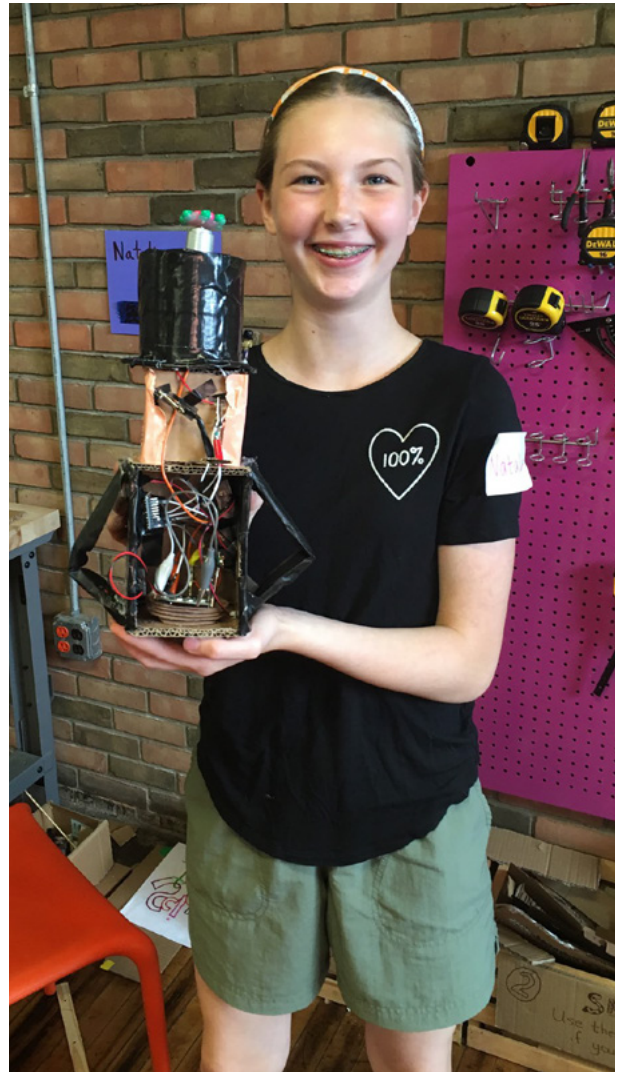


About the YESTEM project

- 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 (1,873 in the UK and 910 in the US).

Additional resources

- See [YESTEM Insight 1: The Equity Compass: A Tool for supporting socially just practice](#).
- Click [here](#) to see a 2-minute animation explaining the Equity Compass.



This material is based upon work supported under a collaboration between the National Science Foundation (NSF), Wellcome, and the Economic and Social Research Council (ESRC) via a grant from the NSF (NSF grant no. 1647033) and a grant from Wellcome with ESRC (Wellcome Trust grant no. 206258/Z/17/A)

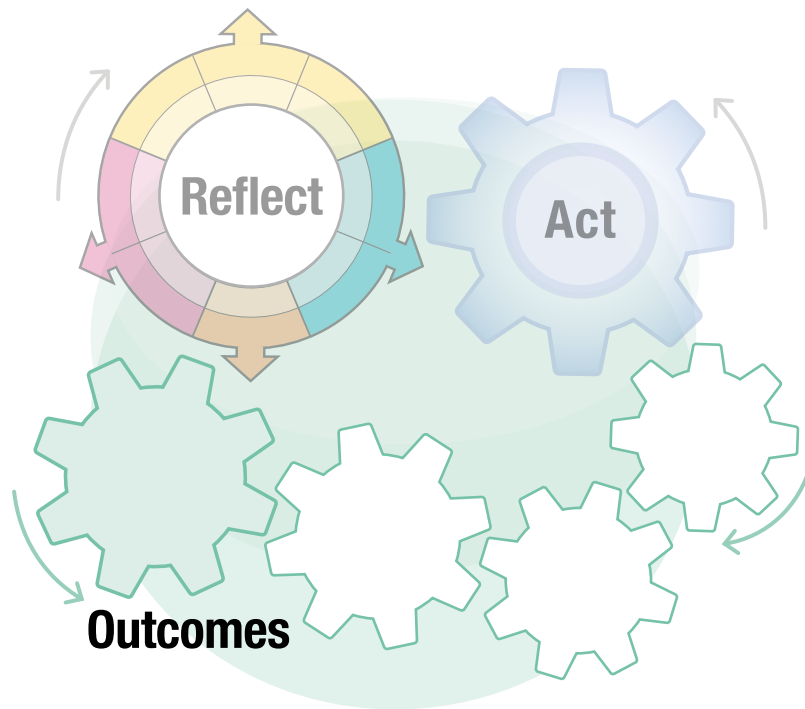
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For more resources related to the Outcomes part of the YESTEM model, please see yestem.org

- Translations

The resources in this pack were co-developed by academic researchers and informal STEM learning practitioners.

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