

Developing equitable practice with youth in makerspaces

Ideas and case studies from the
Making Spaces project

Main Report

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2022



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Introduction: Why equity in makerspaces?

Context

Makerspaces are informal multipurpose sites designed for collaborative hands-on learning and creative production, with or without tools. These innovative learning spaces offer the opportunity to share materials, skills and ideas to address technological, personal, community and societal goals. Evidence suggests that these rapidly proliferating spaces can provide ideal settings for growing science, technology, engineering and mathematics (STEM) participation, but in the UK to-date, this potential remains largely unrealised, particularly among low income and under-represented communities.

There are some inspiring exceptions, but these pockets of creative practice are not widely known, and the UK lacks the professional networks and infrastructure that could support capacity building and the sharing of equitable practice. Rather than the acquisition of more equipment, the Making Spaces project partners believe that makerspaces would benefit from accessible new understanding and resources to support practitioners to embed inclusive practice that in turn can address societal challenges, empower learners and communities, and transform barriers to equitable STEM participation.

Our research was undertaken in the UK, where the current evidence base and professional capacity relating to equitable practice in makerspaces is still at a relatively early stage, although we can take inspiration from progress elsewhere, such as in the USA¹. Initial exploratory research-practice meetings held in the years preceding the formulation of the Making Spaces project proposal suggested that there was a strong appetite for developing such understanding and practice within UK makerspaces.

¹ See, for instance, research conducted in collaboration with makerspace practitioners by academics such as Edna Tan and Angela Calabrese Barton (<https://www.informalscience.org/stem-based-making-youth-families-and-communities>), or the extensive research conducted on tinkering programmes by Shirin Vossoughi and others (<https://www.informalscience.org/tinkering-learning-and-equity-afterschool-setting>), with a particular focus on the Tinkering After-School programme (<https://www.exploratorium.edu/education/california-tinkering-afterschool-network>), which also involved an equity-oriented professional community of tinkering educators.



Our vision

The Making Spaces project aims to contribute to a longer-term vision of a future where all UK makerspaces can be vehicles for social justice, offering spaces and resources for a wide range of communities to enhance and improve their lives, wellbeing and agency through STEM-rich making in ways that feel authentic, respectful and value the wisdom, cultures, needs, values and identities of communities. This vision includes a future where the STEM workforce is diverse and representative, where STEM is used to address key societal challenges and where people can use STEM knowledge, skills and creativity as active citizens and as part of social action towards a just and sustainable world.

To achieve this vision, we believe that researchers, makerspace leaders and practitioners, and the wider STEM community need to:

1. **Better understand and recognise how the ways in which privileged communities and many of the 'dominant' ways in which STEM is structured and practised (in and beyond makerspaces) exclude minoritised, less privileged communities and contribute to ongoing inequalities.**
2. **Work in partnership with young people and communities to identify and put into practice more inclusive and socially just approaches.**

This report is just one small contribution to help address a wider challenge; it is intended to help initiate thinking, ideas and commitment towards the vision. In particular, we hope it can be a useful resource to support critical reflective practice among makerspace practitioners by:

- **Helping makerspace and STEM practitioners to recognise and understand how everyday taken-for-granted practices, assumptions and ways of thinking can hinder their efforts to support equity and inclusion.**
- **Identifying key underpinning principles and practices that can help support inclusive practice, based on respect, care and social justice.**
- **Sharing the challenges and successes of three UK makerspaces to provide ideas and inspiration that practitioners can adapt for their own settings.**



About the Making Spaces project

“As practitioners, everyone involved in this project has been pushed to develop their own practice and think more deeply about how and why we engage young people in makerspaces. Hearing directly from young people on their experience and what they have previously got out of the projects that we have run for them was really insightful and has allowed us to implement change and adapt sessions for the young people” (Makerspace practitioner).

The first phase of the Making Spaces project was undertaken between 2020-2022 and involved a collaborative partnership between researchers, practitioners and young people from three UK makerspaces. Work began just as the COVID-19 pandemic hit the UK, which compelled partners to think of innovative ways of working together and find hybrid solutions for their youth programmes. The research project is based at IOE: UCL’s Faculty for Education and Society and was funded by Lloyd’s Register Foundation.

The three partner makerspaces

As part of their involvement in the project, three makerspaces ran programmes to engage young people from under-represented communities with STEM. Each makerspace had a unique approach both in the type of programme they were running, and the content delivered. We have given the three makerspaces pseudonyms in order to provide anonymity to our partners.



University Makerspace

Who they are:

A physical workshop and a research hub, based in a city centre university in the South East of England. This makerspace brings together people, perspectives, equipment, and expertise from a wide range of disciplines. It has a diverse, international, university-based membership of staff and students (who can access the workshop daily, free of charge) and is also open to members of the public through its provision of a free public events programme. Because of the constraints of its remit, University Makerspace’s programmes had not yet engaged minoritised young people from the local community prior to the start of the Making Spaces project.

What they did:

As part of its involvement in the project, this makerspace worked with approximately 100 young people (aged 14-18), predominantly from low-income, racially minoritised local communities. New workshop sessions were designed and delivered virtually during the UK lockdowns, and when permitted, face-to-face. The makerspace partnered with a local organisation to help reach their target audience and deliver the workshops as part of autumn and summer school programmes for the local community. Topics of the workshops included: coding and AI, designing clothing from waste, face mask embroidery, CAD for beginners and a careers workshop.



Community Makerspace

Who they are:

Based on the outskirts of a city in the South West of England, within a local area categorised as in the bottom 10% of government indices of multiple deprivation. This makerspace aims to co-create projects with the community around technology, media and the arts. Their youth programmes run concurrently with the school term, free of charge and focus on building STEM skills within social action themes.

What they did:

This makerspace already had a youth programme set up, which was a long-running afterschool programme engaging the same group of young people each week during school terms. Many of the young people involved were well known to the makerspace and had been participating in programmes there for a number of years. During the length of the Making Spaces project, the makerspace worked with approximately 180 young people (aged 10-18), predominantly from low-income, white, local communities. The programme’s goal was to empower participants to make positive changes in their communities and lives by giving them the tools to experiment, explore, and be creative with digital making technologies. The sessions were run face-to-face whenever possible, and virtually when necessary due to the pandemic.



Digital Makerspace

Who they are:

An online, grassroots innovation organisation, working with technology and people to shape the world for the better. Based on the tools and methods of participatory design, they run free and accessible digital skills programmes to unemployed and under-employed young people and young adults based in and around a city in the North West of England.

What they did:

During the Making Spaces project, this makerspace ran a ‘remote bootcamp’ that focused on building young people’s coding and digital skills. The programme supported young people in underserved communities at risk of digital exclusion to develop technical skills and expertise. The virtual programme was self-paced, where participants could access guided lessons in coding as well as workshops and guidance in developing their career prospects. Over 60 young people (aged 18-30), predominantly from low-income, white local communities took part in the virtual programme delivered by the makerspace.



Project collaborators

Practitioners

Twelve practitioners from the above three makerspaces took part in the project. Of the twelve practitioners, eight identified as women and four as men. The majority who declared an ethnicity were from white British backgrounds. Between them, the practitioners had a considerable range of experience, from just starting out in this area to over 23 years.

Youth co-researchers

From the participants of the programmes offered by the three makerspaces, twenty-three youth co-researchers were recruited. In terms of demographics, nine identified as young women and fourteen as young men. Overall, there were fifteen white and six racially minoritised young people, and two participants whose ethnic background was not disclosed. Thirteen of the researchers were aged 10-16, and ten of the researchers were aged between 18 and 30. Most lived in areas classified by the government as areas of high economic deprivation. The youth co-researchers were compensated by the project for their time and were also provided with a piece of equipment to aid their research (a camera, voice recorder or tablet).

University researchers

Four university researchers took part in the project, three of whom identified as women and one as non-binary/transgender. All researchers identified as white British or American.



What the project involved

The Making Spaces project is a research-practice partnership through which university researchers collaborated with the three partner makerspaces and young people to understand, identify and document forms of equitable practice. At the start of the project, researchers, practitioners and young people developed and shared ideas and experiences about what equitable practice might involve. Practitioners then integrated these insights into their programmes, trying out and iterating specific ideas. Adult and youth co-researchers collected data to capture what this looked like in practice and what impact it had. More specifically, the project involved:

- **Meetings and visits to makerspaces:** researchers regularly connected with makerspace partners, practitioners and young people to capture their ideas and experiences and co-develop analyses.
- **Observations of youth engagement programmes:** researchers collected extensive field notes, photographs, physical artefacts and over 2300+ online data posts from makerspace sessions to understand the ways in which young people experienced these contexts, and how programmes were delivered.
- **Practitioner workshops:** researchers conducted two workshops with practitioners to co-develop understanding and ideas about social justice and equity.
- **Regular discussions and 14 interviews with practitioners:** researchers worked closely with 12 practitioners to understand their views and experiences of inclusive and equitable practice and share emergent insights. Practitioners incorporated these ideas into their programmes to make them more equitable and inclusive for young people.
- **Interviews with 17 young people:** researchers explored young people's experiences of the programmes and any outcomes from their participation.
- **Workshops with youth co-researchers:** 23 youth co-researchers were recruited from the 3 partner makerspaces and took part in a series of workshops in their respective settings (overall total of 14 workshops). Youth researchers were given training and support to conduct their own fieldwork, including interviews with makerspace practitioners, researching the makerspace setting and identifying what makes a welcoming and equitable space. The young people also developed their own ideas and designs for equitable makerspace programmes. Overall, this strand of work resulted in c.105 youth-produced artifacts and portfolios.
- **Survey and evaluation development:** Researchers worked with makerspace practitioners and 20 young people to devise and pilot a survey that can be used to help evaluate the equity and inclusivity of makerspace programmes.
- **Advisory group meetings:** project research was informed, reviewed and discussed with 10 external, international advisory group members, who represented a range of relevant research and practice expertise.



About this report

The ideas in this report were generated through the collaborative research conducted in the first phase of the Making Spaces research project with three UK makerspaces. The report aims to support the project goals and vision, by contributing to a national conversation around the value and importance of equitable practice in makerspaces and by serving as a resource to support critical reflective practice among makerspace practitioners. We summarise and share evidence, suggestions, and ideas for how makerspaces can start their own journeys towards inclusive practice. Therefore, the report identifies how makerspace practitioners can support equitable engagement among young people from communities that are under-represented in STEM.

Target audience

This report is aimed at UK makerspace practitioners who are interested in adopting and developing more inclusive practice, particularly in relation to young people from low income and under-represented communities. Those leading programmes or developing activities with young people may find the ideas in the report particularly applicable to them, but we hope that others in makerspaces may also be able to apply some of the ideas to their own situations.

How to use this report

The ideas in this report are intended to support critical professional reflective practice, that is, reflective practice that involves:

1. Understanding issues of power and injustice and how inequalities can be produced and sustained in, and through, practice.
2. Reflecting critically on one's own practice and setting.
3. Engaging in intentional planning and action for change.

In this respect, the ideas and case studies in this report do not provide a script, 'top tips' or a simple 'tick list' of actions to be undertaken. Instead, the report provides ideas and questions that practitioners can dip into in order to kick start critical professional reflection. It does not need to be read in order from cover to cover. However, you may want to start with the 'Think' section as this provides a foundation for the 'Do' section. You can then dip into aspects of 'Do' that appeal or feel most relevant to your own context. You may want to share the report with colleagues. For instance, you could collectively focus on a particular idea and then use that as a discussion point in a staff meeting. We hope that the case studies will spark thinking and provide some ideas that you can reflect on and creatively adapt for your own contexts.

Finally, we want to reiterate that equitable practice is a journey, not something that is just achieved and 'done'. It is also never easy, it is usually uncomfortable, hard work, and takes time and resource; but this effort is always rewarded. We are very much aware that, as the researchers and practitioners who produced this report, we certainly do not have all the answers and are still developing our own understandings and practice. We are also very aware that many of us are speaking from positions of social privilege. However, we hope that sharing our current learning through this report will be helpful to other UK practitioners and makerspaces who are on their own journeys towards inclusive practice. We look forward to continuing the conversation and learning with you.



Report Structure

There are five main sections in the report (**Think**, **Do**, **Evaluate**, **Impact** and **Recommendations**).

The six key ideas detailing equitable practice in makerspaces which emerged from the project are found in the sections Think and Do. For each of the six ideas, two case studies were selected to reflect:



The experience of a makerspace that was **'initiating'** and starting its equitable practice with young people.



A more experienced setting that was **'extending'** its equitable practice.

The case studies are detailed examples of practice from our makerspace partners, each explaining what the organisation did, what worked well, and how practice might be further extended. Reflective questions are included at the end of each case study to help guide development of practice. See Table 1 for further detail on organisation of the six ideas and case studies in the sections Think and Do.

The third section, Evaluate, discusses the challenges involved in evaluating equitable practice, particularly focusing on the development of a new survey that was designed to help makerspaces map and reflect on their progress towards an equitable culture and experience for all young people.




The Impact section details evidence of the positive outcomes that developing equitable and inclusive practices can have on young people, practitioners and communities.

Some recommendations are provided at the end of the report, which include a summary table containing reflective questions that practitioners can use to support their thinking and planning, together with links to a variety of useful resources produced by other projects/ organisations.





Table 1: Organisation of the six key ideas within sections Think and Do

Section	 Ideas	Case studies	
		 Initiating equitable practice	 Extending equitable practice
Think	1: Developing a social justice mindset and institutional culture	1a: Staff development and external partnerships	1b: Embedding a social justice organisational culture
Do	2: Creating safe, welcoming, sustainable and inclusive spaces	2a: Recognising how physical and social spaces can be complex and challenging	2b: Creating safe, welcoming and inclusive physical and online spaces
	3: Working in participatory ways with young people	3a: Starting to consult with young people	3b: Youth-led programming
	4: Fostering caring pedagogies & relationships	4a: Considering young people's needs in a virtual workshop	4b: Mentoring and caring for young people
	5: Supporting young people's agency and social action through making	5a: Supporting young people's critical citizenship through making	5b: Supporting young people's social action through making
	6: Building young people's capital, skills and routes for progression	6a: Showcasing diverse STEM professionals	6b: Supporting young people's STEM skills and employability

A note about terminology

The terms used that relate to equity and social justice can be complex and change across time and context. There are many different definitions of the terms we use, and some terms may not be familiar. Therefore, definitions for terms that are of particular importance are provided in coloured boxes throughout the text. A glossary of all the terms as understood by this project is also included at the end of the report.

Think

Think

This section explores how equitable and inclusive practice is founded upon social justice values and principles, and provides examples of how makerspaces initiated, extended and embedded a social justice mindset across staff and the organisation as a whole.



“Our individual practice and the language that we have used has developed and we are able to articulate some of our practice in a better way”

(Makerspace practitioner).





Idea 1: Developing a social justice mindset and organisational culture

Contemporary societies are characterised by entrenched forms of inequality and injustice. Makerspaces, like any other organisation, are part of society and will be shaped by these power relations. If makerspaces are to help challenge – rather than reproduce – wider inequalities, then they need to ensure they understand and foreground issues of equity and social justice and be able to reflect on and identify aspects of their own culture and practice that can be exclusionary.

Although there are many debates around terminology, in this report we use the following definitions:

- **Equality** approaches treat different communities in the same way, for instance, providing the same resources or opportunities to all.
- **Equity** approaches treat communities differently according to need, for example, providing more resources to those who need more due to being minoritised or excluded by society.
- **Social justice** approaches focus on identifying and challenging the structures, practices and relations that produce and sustain injustices.

Further definitions of key social justice concepts can be found at www.m4kingspaces.org/glossary

The potential for a makerspace to make a difference to the experiences, outcomes and well-being of participants, but particularly those from excluded and minoritised communities, will depend to a large extent upon the values, mind-set and organisational culture that it espouses. In this respect, Idea 1 seeks to support makerspaces to understand and develop a social justice mindset that can provide a firm foundation for strategy and practice.



Case study 1a: Staff development and external partnerships

Despite its successful history of supporting innovative making among adults and its strong reputation for public engagement with a diverse international audience of all ages, University Makerspace's specific on-campus remit meant they had limited engagement with some local communities, particularly young people from minoritised groups who were not already students at the university. The staff also recognised that as a team working inside a university they were largely from socially privileged backgrounds. One of their motivations for engaging in the Making Spaces project was to use the opportunity to increase their understanding of social justice issues and build connections with local communities.

What the makerspace did

- Ran a series of meetings to discuss, understand more about and recognise issues of diversity and inclusion in the wake of the Black Lives Matter movement.

“It’s been a lot easier for us to talk about as a team and how it impacts on the makerspace and research. [Equity] is part of our weekly meeting where we talk about... things that someone’s read, and we are thinking about more proactively making changes. It hadn’t been a regular topic of conversation at team meetings until recently, so that changed”
(University Makerspace practitioner).

- Gave themselves space to learn as a team.

“I think what we found quite useful as well was that we didn’t immediately get into the specifics of what we were going to change. So, we gave ourselves a bit of space to have the discussions first, as a kind of learning experience, and then we have only later come onto thinking about what we’re going to change”
(University Makerspace practitioner).

“I think having these diversity sessions, and having a chance, space to kind of read and discuss together, has given us a space to do that so that everyone on the team is kind of on the same page. I think that’s been really helpful”
(University Makerspace practitioner).



- Undertook new Equity, Diversity and Inclusion training and invited external professionals to run workshops on issues relating to social justice, for example, a staff workshop to develop understanding of white privilege.

“The workshop... encouraged discussion about the problem of white privilege and what we could change to make our team and our makerspace more inclusive and anti-racist. We then set up a monthly internal diversity and inclusion session to discuss issues like racism, ableism, transphobia, gender inequality and the intersections between these forms of discrimination” (University Makerspace practitioner).

- Worked closely with an external community organisation to understand what young people from minoritised communities might want and need from this new programme, to bring more of a user focus into planning. Changes made as a result included: the timing of sessions, employing makers and facilitators whose backgrounds more closely reflected the communities and cultural backgrounds of participants; designing workshop content and focus based on feedback from young people about what they wanted.

“So, I’m aware that we’re going to have to change things about the way that we [usually] run things. We don’t waste young people’s time and put them off, like if you come to something and it’s not right” (University Makerspace practitioner).



- Actively sought out and learned from other organisations with expertise in relation to equitable youth engagement.

“I spent quite a lot of time talking to various different people who are running different youth programmes trying to work out what works” (University Makerspace practitioner).

- Developed new youth programmes based on learning from their new partnerships and approaches.





What worked well

- Starting with sustained critical professional reflection, involving collaborative learning, thinking and discussing, the staff were able to make more informed plans for action.
- Developing and extending external partnerships for training and working with local communities was also effective and helped produce an engaging new programme of youth workshops that were positively received. Working with experienced community partners also gave them a nuanced understanding of what was required to deliver a high-quality programme for young people from minoritised communities.

What could be developed and improved next

- University Makerspace had just begun to develop their equitable youth programme, and because of time, funding and space constraints, began with several workshops (i.e., summer school, autumn school). These could be extended to longer-running sessions to build stronger links and pathways for progression for young people.
- Relationships with local young people and local community partners could be strengthened by continued engagement and co-production with the same groups.
- Embedding understanding of social justice issues within an organisation is always a challenge over time, given staff turnover and programme growth. An evolving organisational plan for how to induct, sustain and grow a social justice approach over time could be useful.
- Learning from other organisations on how to develop and embed participatory approaches with youth.
- Extending monitoring so that it considers not just the diversity of participants but also includes reflection of programmes through an equity lens (for example, using reflective tools like the [Equity Compass](#)), mapping the extent to which they support and align with social justice values and using these insights to inform planning and action.



Learning Points 1a (Initiating)

What and why?

When starting out, it is important to develop (i) a shared, deep understanding of equity and social justice issues (e.g., how privilege and every day, taken-for-granted practices can create and sustain inequalities) and (ii) an organisational culture that values and practices critical professional reflection. This is because the equitable potential of your practice will be shaped by the mind-set and values that practitioners and leaders adopt.

How?

To help get started, draw on expertise and training from organisations that provide equality and diversity training, along with resources and frameworks that have been developed to help practitioners adopt an equity/social justice mind-set and approach – see the 'Key Reflective Questions for Practitioners' table in the recommendations section for resource links.

Key reflective questions:

- How can we ensure that all staff develop a shared, deep understanding of equity and social justice issues?
- How are we creating and sustaining an organisational culture that values and practices critical professional reflection?



Case study 1b: Embedding a social justice organisational culture

Community Makerspace had a long history and strong reputation for equitable practice. However, the setting was also keenly aware that they did not want to become complacent and recognised that they wanted to be proactive in maintaining and continually extending their inclusive practice and culture of critical professional reflection.

What the makerspace did

- Developed a clear staff recruitment, induction, training and development programme that focused on social justice issues and continued over time via staff mentoring and professional development. As a result, all staff had a strong knowledge, commitment to, and understanding of social justice issues and were able to confidently articulate these principles to others and embed them into their practices.
- Embedded a culture of continuous professional reflection and openness to change and development.

“I think from my point of view it's like a collection of little changes that you can do to make maybe a wider thing more positive. To me it's all about 'What can you change within yourself?', 'What are the little steps that you can do?', whether that's through educating yourself into anything you're passionate about, making little changes... It's those little changes that really make a big difference”
(Community Makerspace practitioner).

“So, I think that comes into all of our programmes in that I'm always learning, I never have completed it, if that makes sense? Like I can run the same programme 15 times and I'm always going to learn something different and that's where like our team as a whole are very good at that”
(Community Makerspace practitioner).

- Continuously monitored programmes, both organisationally and in partnership with young people, to check their alignment with organisational core values around equity and social justice.



- Developed active, participatory relationships with local communities to develop programmes by running a series of initial workshops in local community centres, schools and with specific groups (e.g., young mothers) that developed over time into longer-term relationships and new offers.

“We worked really closely with the children’s centre next door to us, with the young mum groups. What they wanted to make was Christmas decorations or they wanted to make nice things for their kids and so we created a whole course around that. We slowly moved to the [makerspace] because it was just next door, but we understood that these are big steps for people. So, it started as ‘come and make a Christmas decoration’ and then moved eventually to a 6 week ‘women into tech and digital spaces’ course.”
(Community Makerspace practitioner).

“Rather than the doors are open for everyone... We’re actively going out into the community to find people to be a part of this” (Community Makerspace practitioner).

- Embedded inclusive values across every aspect of the organisation, from the physical space to the staffing and programming. For instance, the original building was co-designed by architects and young people from the local community, and the staff wanted to carry this ethos through to new developments such as a new temporary external installation.

“We had input from young people from the beginning as to what it should look like and they chose the name, they chose what we could do in it, we had a lot of discussions with them about how we would develop it... It really did have youth voice in it”
(Community Makerspace practitioner).



What worked well

- Having a strong, inclusive organisational culture and practices that were grounded in the organisation’s foundation principles of equity and social justice. These values were embedded through all aspects of the organisation’s work, from recruitment to delivery and evaluation.

“We are young-person centred and that’s how we approach things”
(Community Makerspace practitioner).

- An open and thoughtful culture of continuous professional reflection and learning helped ensure that the organisation continued to not simply maintain but also extend their practice in socially just ways.





What could be developed and improved next

- Further supporting and sustaining a culture of reflection and partnership. Community Makerspace practitioners recognised that the additional reflective space afforded to them by participating in the Making Spaces project and engagement with current research ideas had helped them to extend their practice and develop new approaches and were keen to find ways to continue this level of collective reflection.
- Extend partnership working across the wider city. Community Makerspace largely served the White, working-class communities who lived in its immediate locale, but wants to work across a wider geographic area and is extend their engagement accordingly.

“The area that we work in is predominantly white working class... And that wasn’t something, if I’m honest, I even thought about when I first started. It’s only when you sort of see a bigger picture and you’re like ‘hang on a minute. So, we’ve definitely like worked more across [the city] now. We already work in... the predominantly Black area, and we are trying to see as much spread across [the city] as we can with this [programme]... It’s a long conversation that’s ongoing” (Community Makerspace practitioner).



Learning Points 1b (Extending)

What and why?

Inclusive organisational cultures need to be embedded, owned and sustained across all areas and levels of the organisation. Leaders can help monitor this and ensure that there is sufficient time, resource and commitment to enable this culture to be embedded consistently across the setting and check that it is ‘live’ and continually evolving and developing.

How?

Leaders and practitioners can usefully focus on growing meaningful, long-term trusting relationships with local communities over time. It can be helpful to develop an organisational plan for cultivating a culture and practice of ongoing, active listening and learning from staff, young people and communities to counter complacency and identify existing and new areas for development.

Key reflective questions:

- How do we ensure and know that an inclusive organisational culture is embedded, owned and sustained across all areas and levels of our organisation?
- Does everyone have sufficient time, resource and commitment to be inclusive in their practice?

Do



Do

This section identifies five ideas and forms of inclusive practice that supported young people's engagement and outcomes. Case study examples show how the makerspaces initiated and extended these practices and provide suggestions for further development.



Idea 2: Creating safe, welcoming, sustainable and inclusive spaces

To support and advance equity and social justice, makerspaces need to be safe, welcoming, inclusive and sustainable spaces. Creating a safe space means not only protecting participants from physical harm (e.g., through health and safety practices), but also caring for participants socially and emotionally (e.g., ensuring that spaces are experienced as socially just, challenging all forms of discrimination and injustice). A welcoming and inclusive makerspace actively challenges injustices, values all participants as they are and for who they are, and actively supports participants to feel a sense of ownership and belonging. Sustainable spaces actively take steps to protect the environment, ensuring that their practice entails no or minimal damage. They also support long term social relationships and sustainable participation.



Case study 2a: Recognising how physical and social spaces can be complex and challenging

In the summer of 2021, after a series of online workshops that had been held on zooms during the various Covid-19 pandemic lockdowns, University Makerspace ran its first face-to-face (but masked) workshop for young people to help develop their skills and understanding in relation to digital making and Artificial Intelligence (AI). They wanted to make the course accessible and welcoming but had to choose between planning and running a workshop in their fit-for-purpose makerspace on the university campus on their own, or delivering it in a hired office space close to the local community with the help of their community partner organisation.

The University Makerspace's own space had been carefully designed and curated to encourage mixing between university staff and students from different disciplines and backgrounds, as well as to enable playful and welcoming public engagement activities. However, the use of their own workshop was prohibited due to Covid-19 restrictions of the University. They were apprehensive that the opportunity to hold a face-to-face workshop in an off-site space would mean that they had no control over the furniture, lighting or the look and feel of the office space hired for the workshop. They also understood that all the workshops they had held up until this point had been online and so were very different in nature (i.e., shorter, and with all the materials for the hands-on activities delivered to the homes of the participants). Nevertheless, they embraced the opportunity as a way to continue working with their trusted partner organisation to recruit young people to the workshops in a safe and inclusive way.

What the makerspace did

- Three practitioners (i.e., a STEM expert, events manager, and events assistant) developed a one-day workshop that, after some discussion, was held at an off-site, accessible venue located within the community from which young people were recruited.
- The makerspace partnered with an external community partner organisation who recruited participants and provided the space. The session was provided free of charge.
- Usual safeguarding checks and risk assessments were undertaken prior to the session. Facilitators were only informed of participants' special needs at the start of the workshop and in passing (e.g., "Call an ambulance if this boy starts to fit, as he has severe epilepsy and has been displaying some signs that a seizure may be coming on"), or not at all.



- Too many participants had been booked onto the workshop by the partner organisation which resulted in a shortage of IT equipment and a reconfiguration of the workshop's COVID parameters on the first day.
- The rented space was easy for participants to get to, but it was large, noisy and had no natural daylight. Tables were arranged in a large horseshoe. There were a few problems with sourcing enough chairs for the young people because the group was larger than expected.
- The workshop facilitators were introduced along with their pronouns, the toilets were pointed out, and then facilitators began the introduction to the workshop. The workshop leader started by explaining two objects that the young people had on their tables, a laptop and a robot, followed by a mini lecture on AI and coding.
- Young people were provided with shared laptops and robots and conducted structured tasks.
- At the end of the day, the groups presented their work by showing their coded robot to everyone in the room.
- Youth co-researchers and session participants met with researchers twice after the session, once face-to-face and once online, to debrief and analyse how the workshop went.



What worked well

- Knowledgeable experts: The STEM expert running the workshop was very knowledgeable, and the youth co-researchers reflected that it was an “interesting” and “informative” workshop and that they “definitely learnt something”.
- Attentive staff members: The staff members were attentive to the groups and went round helping them frequently (e.g., “What [the practitioners] did that was good was ask a lot of questions... Coming to check on us a lot”). There was also a moment when staff realised that a young person was disengaged from his group, so they moved him to another table which helped him re-engage.

What could be developed and improved next

- Carefully consider how the physical space and the structure and content of the session impact on workshops feeling safe, welcoming and inclusive.
- Make sure the physical spaces used are as welcoming as possible. Young people felt that while the session had covered some interesting content and they generally enjoyed the day, they did not find the physical space welcoming or relaxing: one young person still wore their coat and bag almost two hours in. They reported highly negative views of the office space where the workshop was held (e.g., “I felt a bit scared... It was just like a big white room”) and suggested that it might have felt more welcoming if it had been “decorated” or “warmer”.
- Give some ‘ownership’ of both the physical and social space to young people. While it is not always possible to change external, temporary spaces, hanging youth artwork or having a starter activity using flip-chart paper and coloured sticky notes (e.g., inviting young people to share their ideas, hopes and questions or concerns for the session) might help make young people feel more welcome in both the physical and social space. In their online sessions, the University Makerspace practitioners trialled using music chosen by young people to set the tone of the workshop, and young people suggested that being given the opportunity to play their own music might have helped make this new space feel more welcoming and youth centred.
- Ensure everyone is warmly welcomed and introduced. Icebreakers can provide helpful starts for youth sessions, particularly when combined with agreeing shared ground rules for collaborative working and sharing. In previous online sessions, University Makerspace practitioners used ice-breaker activities and check-ins and check-outs to help young people feel welcomed and engaged from the start. However, due to time limitations, staff turnover on the project, an unfamiliar set up, and the team's focus on the complex nature of the workshop content, these elements were overlooked in the new face-to-face session format. The young people suggested that it was important to ensure all participants (i.e., young people and staff) are welcomed and introduced to one another and that everyone knows everyone else's name (e.g., “I didn't feel that welcomed. I came late and everyone just looked up at me”). Steps like these can help young people feel more comfortable and more quickly build trust and relationships when starting work with a new group (e.g., “When they asked us questions yeah, I knew all the answers, but I didn't want to put my hand up. I felt embarrassed around a group of people I didn't know”).



- Ensure that facilitators are enabled to be relatable, friendly and caring, and consider how the physical and social space of the workshop can impact on the facilitator as well as participants. The young people said that they would have liked to feel more at ease with the facilitators and better able to relate to one another. Although the University Makerspace team worked with a variety of facilitators from different backgrounds and with different areas of expertise in earlier sessions, this facilitator had previously received good feedback from young people who took part in two of their online sessions, and the community partner specifically asked them to return. However, the event took place at the end of a period of national lockdown during the COVID-19 pandemic and the unfamiliar, clinical office space and the masked but face-to-face format of the workshop did not help create a warm, welcoming environment. In addition, the team had faced an extremely tight timeframe for preparing and delivering a complex STEM workshop, and on the day had found out that the group size was larger than they had requested, expected and prepared for. This combination of factors put the facilitators under a considerable degree of stress and did not help them to be as welcoming as they would have liked. The context also mitigated against building rapport and caring relationships.
- Allow time to develop relationships and rapport with young people. Unlike Community and Digital Makerspace, University Makerspace had just begun their work with minoritised local young people. The short-term nature of standalone workshops held during a pandemic where the interaction was mostly online meant they were just at the start of their journey to build trusted relationships with local young people. Building these kinds of relationships with young people takes time and experience for which there are no short-cuts.
- Mixing group and individual activities and offering young people choices on how they want to work. A few problems arose due to participants having to share one computer and one robot between two or three young people: the same young people tended to remain 'in charge' of the coding and a few complained that they did not get a chance to code. Groups generally remained the same for the entire day, and in one group, a young person on the autism spectrum felt bullied and ostracised by their group (e.g., **"The workshop was fun until my group decided to leave me by myself and then call me a snitch whenever I told an adult they were being rude and calling me names"**). The young person felt that the experience had not recognised their needs and had exacerbated their anxiety around working in groups and meeting new people. Mixing group and individual activities can help participants feel comfortable and safe, particularly those with defined needs, such as the autistic young person² who found group work challenging (e.g., **"The coding is fun but if you were able to do it individually"**). Ask partner organisations to provide information for participants with specific needs in advance to help facilitators tailor their communication.

²As recommended by the National Autistic Society, we refer to 'autistic young person' as opposed to 'young person with autism': <https://www.autism.org.uk/what-we-do/help-and-support/how-to-talk-about-autism>



Key Learning Points 2a (Initiating)

What and why?

It is not just the knowledge and skills that participants might gain from their participation in makerspace that matters. The physical/digital space and the social and power relations that make up a session are crucial and will strongly shape the extent to which young people feel welcome, safe and included.

How?

Practitioners may find it helpful to critically reflect both among themselves and together with young people and communities to understand how different participants experience the makerspace and relationships within these spaces. It can be helpful to reflect and plan for how to: support young people to feel more 'ownership' of the space; ensure each session includes a meaningful welcome for all; and recognise and address what helps different participants to feel un/safe. Ensure that all facilitators and staff have the required time, resource and understanding to be fully welcoming and inclusive.

Key reflective questions:

- How are we developing and growing meaningful relationships over time?
- How do we find out and address what makes different young people feel safe, welcome and included in our setting?





Case study 2b: Creating safe, welcoming and inclusive physical and online spaces

Community Makerspace had considerable experience of how to foster inclusive, safe and welcoming physical spaces, through the application of principles of participatory co-design to create physical and social spaces (see: Idea 3). Digital Makerspace had developed extensive experience of how to create safe and welcoming online learning spaces, as demonstrated by its virtual coding course.

What the makerspaces did

Physical spaces

- Attended to the aesthetics of physical space and in particular, fostering a “rough around the edges” and ‘playful’ feel to the makerspace. By doing this, Community Makerspace helped to create an informal atmosphere where young people felt empowered to ‘have a go’ and try things out.

“It’s not like an office space that’s just clinical, because you could have laser cutting being very tech. It’s that kind of like rough around the edges feel that makes [young people] feel a bit more able to play around” (Community Makerspace practitioner).

- Supported young people to feel ownership of the space, making sure it felt ‘known’.

“All of the young people know like where the glue’s kept and they know where they can get some scrap paper and they know where the wood is, and we direct them to go and find the bit of scrap wood that we can use... They know the space... It instantly gives them a bit more of an ownership over the space which then makes them feel more relaxed” (Community Makerspace practitioner).

- Carefully threaded principles of welcome and care (see: Idea 4) throughout the whole organisational space.

“So, it’s not just the young people’s team, it is also [name] who is on front of house, she knows the young people as well, she’s not just a receptionist, she knows who they are, she’s a local woman, she knows lots of their parents” (Community Makerspace practitioner).

“We always build our relationships with young people all the time, but it’s listening to them more than anything. It’s meeting them where they’re at and really understanding them and making them feel like they are heard. Because sometimes, I think it’s easy to just listen to them but not really listen to them” (Community Makerspace practitioner).



- Created spaces where young people felt safe to express and share concerns with adults who cared about them and could support their mental, emotional and social wellbeing, an issue that came particularly to the fore during the Covid-19 pandemic.

“I do really strongly believe that we need to be thinking about young people’s mental health... Although we will be using tech as our thing, it’s going to be much more around getting people... feeling comfortable to come and talk to us about how they’re feeling, we’re going to do a lot of workshops that’s about using colour to explore feelings and how can we all decide how we all want to communicate, like if you have got a problem, remembering that we’re here as safe adults” (Community Makerspace practitioner).

“You’re kind of like comfortable asking for help, which then makes you feel welcome because you don’t have to constantly be like ‘Should I ask? Should I not?’. Because they make it like you can and that you shouldn’t be ashamed to ask for help” (Matilda).



- Supported young people's mental health by providing a space built on long-term trusting relationships, where young people felt listened to, comfortable and safe to share issues and/or ask for help: trust was built with practitioners, and young people felt listened to. The makerspace also created workshops where young people could explore their feelings, express themselves and recognise difficult emotions. In addition, the space ran workshops with a social action focus that enabled young people to talk about issues they are concerned about (e.g., climate crisis, Black Lives Matter, homelessness) and to use making to help take action and explore these issues in a safe environment (see case study 5b). Provision included responding to needs as they arose, e.g., a bespoke programme for young people moving between primary and secondary school to support transition. All staff had mental health training and actively engaged in building relationships with schools, parents, social services and young people to help keep them safe and be aware of, and sensitive to, potential issues. Makerspace leaders also created links with a local mental health organisation to enable sharing of good practice and to support staff awareness and provide opportunities to seek advice when needed.

Online spaces

- Ensured that all online sessions included 'hellos', introductions, check-ins and check-outs to ensure all participants felt welcomed, known to one another, and to provide space for participants to share and convey how they were feeling.

"When you joined the Slack³ group, rather than just joining and everyone just carrying on and ignoring you, you'd introduce yourself, for example, with three facts or something along those lines. And that was quite nice as well because that carried on over a couple of months and new people were always joining" (Eileen).

"I think it was great that the staff like introduced themselves each morning and said like kind of who was the main point of contact for that day. So, they would come on each morning like 'hey everyone', you know crack a joke or something and be like 'I'm here to answer all your questions today'. So, it was kind of a nice yeah it was like a message to kind of wake up to each morning and know they were there to help you. And they did like you know always respond quite quickly to any questions I had and that made me feel like I could make progress with the course" (Callum).

³ Slack is an online communication programme, where members who are part of a project group can send direct messages to each other as well as participate in specific topical discussions with multiple members on 'channels'. Channels contain files and other information specific to that topic which organise the elements of a project, examples of channels in this makerspace programme included 'announcements', 'opportunities' and channels specific to types of coding such as 'fc-html'.



- Used a learning format and structure that enabled participants to work at their own pace through the learning, with extensive online support and opportunities for questions, answers and discussion provided through online discussion boards on the Slack group.

"They all knew that I work a lot and that I don't have much time, but I still do what I can. It was great to be able to log on whenever" (Frank).

"Because the way that it is structured with a Slack group, where there's mentors that are always on hand between working hours, there's always someone around, was really good. If you ever got up to a point where you were stuck with something, you were two seconds away from getting someone's attention and getting some help, which was really fantastic" (Noffie).

- Facilitators provided regular feedback to participants on their learning.

"Yeah, I think it helped build confidence in general, especially like when you're feeling isolated just knowing there was someone at the end of the Slack group if you had a question or if you wanted some just more general advice as well career-wise. I thought that was just really, really nice and helped, and again having someone else be like 'oh no you're doing okay' like this is really good, like well done for that. Everyone likes to hear that that's nice" (Eileen).





- Clear structure and outline of the session that helps guide participants.

“So, he [the mentor] explained on Slack before that, ‘this is what we’ll run through, this is approximately how long it will take, and this is what you need to open or get set up on your laptop’. So, it wasn’t a case of being thrown into a Zoom: you knew what was coming, so that helped” (Eileen).

- Ensured that all young people had the equipment, support and conditions for learning and participation.

“We have provided additional support where needed, such as refurbished laptops, paid for access to co-working spaces, conducted daily check-ins, explored mental health support, looked at confidence coaching, assisted with CV writing and interview preparation, advised on career options, introduced participants to people in industry, found opportunities (work and social) for them to participate in” (Digital Makerspace practitioner).

“My situation was obviously a lot different, with me working and not being in school. So, they really took that on board, and they would help me with what I needed” (Mushroom).

- Supported young people’s mental health by creating an online community/ space where young people felt safe and supported. Mentors/ practitioners built trusting relationships with young people and offered young people who were struggling the option to take a break and come back in a few weeks. The team actively took notice of when young people were disengaged and reached out to them to see if there was anything they could help with. Where appropriate, they offered young people support to find counselling services if they needed help. They also provided wider support to young people in their life trajectories, helping them to realise and achieve their ambitions (see case study 6b).

What worked well

- Both settings successfully built trust with young people, who felt that the physical and virtual spaces were welcoming, safe and caring spaces that supported their wellbeing, learning and autonomy. As a result, young people were able to develop their confidence, skills and agency within the spaces (see Impact section).

What could be further developed and improved next

- Both Community and Digital Makerspace wanted to extend their practice further, working with an external partner to support youth co-researchers to research and share young people’s views on how online learning spaces might be made even more welcoming and inclusive. Their recommendations follow.



Physical space

- Have a variety of different types of materials readily available that don’t need to be set up but can be used directly without supervision.
- Increase freedom for participants to use equipment how they want to, so they can create what they want, in whatever way they want.
- Provide open access that does not require ‘signing up’ (e.g., “Somewhere that you can just go, that you’re allowed to go to it, you don’t need to sign up, it’s always got space for people”).
- Provide accessible spaces in terms of travel and disability, ensuring that young people can access and move around the space easily.
- Have a variety of facilitators with expertise in different areas.

Virtual space

- Build in more opportunities for informal chats between participants before group sessions to help them get to know one another and build trust and familiarity.
- Co-plan the format of sessions with neurodiverse individuals to ensure their needs are met.
- Have icebreakers for group sessions but keep these optional for people who are socially anxious.
- Build in opportunities for small group collaboration and working so that quieter people can contribute.
- Ask participants directly what safety means for them, then use the suggestions to design session formats and set ground rules.
- Support with digital hygiene, for example, the removal of inactive accounts from online forums and groups, as well as guidance on creating a positive online presence.
- Ensure there is effective slur detection for online chat boards or provide guidelines around appropriate language and behaviour.
- Respect people’s pronouns (e.g., “I don’t think Slack gives you an opportunity to put your pronouns next to your name in like a big forum chat or anything. So may be some facility for people to do that would make it more inclusive”).



Key Learning Points 2b (Extending)

What and why?

Safe, inclusive and welcoming spaces, whether physical or virtual, are built on understanding, respect and relationships so these need to be core values and practices that are embedded throughout an organisation.

How?

Ensure that the organisation (both at leadership and practitioner levels) is building long-term, trusting relationships with local communities, young people and external partners. Consider how you can keep these relationships 'live' and two-way, so you can be continually aware of any aspects that stop or hinder participants from feeling welcomed, safe and included. It can be helpful to regularly identify and review particular areas as part of strategic planning e.g. embedding strong mental health provision throughout all programmes and practice.

Key reflective questions:

- How do we identify, monitor and address instances when young people may not feel safe, welcome, included?
- Is there a particular area that might benefit from a 'deep dive' to help inform further development?



Idea 3: Working in participatory ways with young people

Participatory approaches provide ways for young people to play an active and meaningful role in planning, designing and decision-making within a given setting. Participatory ways of working help young people to be heard and enable their views to make a difference and shape outcomes. These approaches are based on a recognition and respect for young people's knowledge, expertise and experiences, and involve meaningful power sharing, so that makerspaces work in partnership 'with' young people, rather than doing things 'for' or 'to' them.



Case study 3a: Starting to consult with young people

University Makerspace decided to start out by consulting with local young people from under-represented communities. With the assistance of an external community partner organisation, they ran two workshops with young people aged 11-16 from minoritised communities. After these initial sessions, University Makerspace decided to explore how they could develop their practice to work in a variety of participatory ways. In particular, they wanted young people to contribute to developing their future sessions and programmes to ensure that the topics and themes would be relevant and interesting to local youth.

"We are clearly not experts in running youth programmes or engaging with marginalised young people. I think that's partly because that's not really been our purpose so far"
(University Makerspace practitioner).

What the makerspace did

- University Makerspace convened a group of young people drawn from those who had attended a previous session. Fifteen sketched-out potential workshops were presented to the group as prompts for discussion, feedback and iteration. The young people then worked in smaller groups to focus in-depth on four of the prototype workshops.
- Youth were provided with an online survey and a Padlet page⁴ to provide anonymised quantitative ratings and qualitative feedback on each of the proposed sessions. They then discussed their thoughts about the relative merits of each workshop as a group. They also discussed timings, frequency and other logistics to ensure that future sessions would fit in with their school requirements and social lives.
- The young people were then invited to share their own ideas for materials and making-themed workshops. Responses included ideas for workshops on the science of texture in food, music production, and henna and temporary tattoo art.
- University Makerspace held a second workshop with the young people to get more in-depth feedback and test out one of the workshops on 3D design, and to refine the content, format, delivery style and tone via another anonymous survey and group discussion.

⁴Padlet is an online tool where participants can collaborate in real-time on a virtual 'notice board'.



What worked well

- The young people provided valuable feedback and views that the practitioners would not have been able to generate on their own.
- The structuring of the sessions and ideas provided a useful scaffold for the sessions. Practitioners felt that this way of working over a couple of sessions helped to develop stronger communication and trust.

What could be further developed and improved next

- Move from consultation to co-design. Practitioners had aimed to move from the initial process of in-depth consultation to co-design and planned to implement the group’s ideas for workshops in the next iteration of their programme.

“I’m hoping that for the spring session we’ll be able to introduce new content that’s based entirely on what the people who’ve been involved in previous sessions have fed back”
(University Makerspace practitioner).

“In future... We’d be able to give more space to actually programming what young people want to see rather than us coming up with the idea”
(University Makerspace practitioner).

When it came to the next iteration, however, the feedback from community partners and young people was that they wanted a career-oriented session rather than more making workshops, so the co-designed making workshops remain an area for further development.



- Develop longer-term participatory approaches to working with young people. Practitioners realised that it would be difficult to create bespoke one-off sessions that reflected all of the young people’s ideas for workshops; they could consider ways of partnering with others to help them to develop longer-term, participatory approaches that could lead to co-designed programmes. Steps could include finding partners to help conduct initial research in partnership with communities to build mutual understanding and identify potential areas of interest, then convening co-design groups to develop plans and implementation.
- Achieve social justice goals, which would require buy-in by senior management. Securing long-term funding for the youth-led programme would allow for long-term mentoring and engagement of the young people and their communities.



Key Learning Points 3a (Initiating)

What and why?

Participatory approaches are an important element of inclusive practice as they can help challenge traditional unequal power dynamics and enable young people to have more agency and say in what happens in a makerspace. This ensures that provision meets young people’s interests and needs in ways that are supportive and appropriate.

How?

If you have limited existing experience or expertise in this area then you may find it helpful to identify and develop partnerships (e.g., with relevant community organisations) that could help start your learning journey. It can feel more manageable to begin by consulting with and learning from young people, with a view to building up to more participatory approaches as you gain understanding and experience. Be particularly aware of uneven power dynamics within attempts at consultation and co-design – reflect carefully on how to ensure that privileged staff and participants do not set the agenda and control the narrative. You may find resources on how to share authority helpful – please see the ‘Key Reflective Questions for Practitioners’ table in the recommendations section for resource links.

Key reflective questions:

- Who can we partner with to learn more about how to develop participatory approaches?
- How can we be sensitive to power dynamics and ensure that privileged staff and participants do not set the agenda and control the narrative?



Case study 3b: Youth-led programming

Community Makerspace had a long history of collaborative working with young people: “I would say that from the beginning of [Community Makerspace] it’s been a young people co-designed, co-led project... We’ve learnt that actually there’s no point having a project for young people if they’re not consulted or they can’t feel that they can tell you if it’s not very good, and you need to be resilient in that if a young person tells you that they’re not really enjoying your workshop you need to understand why rather than be upset. And that’s just embedded in the whole of the centre” (Community Makerspace practitioner).

However, they wanted to extend their practice further still and go beyond collaboration by working with young people in a more sustained way to co-design new programmes that centred around social justice issues that the young people cared about. They worked with an external partner to access funding to develop and deliver a youth co-designed programme of sessions.

What the makerspace did

- Young people were recruited as youth co-researchers and received a voucher payment for their time, as well as a piece of recording equipment which they selected from a list of options including cameras, tablets and voice recorders.
- Youth co-researchers met virtually and in-person with the facilitators to receive training in research methods and, over the course of five sessions, were supported to conduct their own research.
- The youth co-researchers began by thinking about what made a good making workshop and explored social action ideas they felt passionate about. Young people designed research plans and collected the views of adults and peers in their communities, including the public, friends, and family, to feed into their research around community and technology. Over five weeks they developed their ideas into a workshop plan that was then discussed as a group.
- Based on the data collected, together with their own expertise, the young people co-designed between them a set of eight workshops for Community Makerspace, which centred around different social causes and used a range of technologies to engage different audiences. For instance, Matilda’s workshop involved using a digital embroidery machine to make something to protest against racism, while Maya developed a making workshop focusing on women’s rights, and Phranke’s plan involved making products to help those in need such as the homeless.

“We have been learning how to design our own programmes, and how technology is used in our everyday lives. We did this by interview[ing] people and having openness to new ideas and working together” (Phranke).

- As part of the programme, young people developed their interviewing skills which they later applied across different programmes at the centre, including interviewing staff about another project and assisting the comms team on gathering data at one of the centre’s public-facing events.



What worked well

- Young people really enjoyed the experience and felt that their expertise and contributions were recognised, valued and respected (see Impact section). Several gained notably in confidence.
- Rather than just being consulted, young people felt they had genuine agency and authority in setting the agenda and informing and co-designing the workshops, workshops that were developed to address social justice issues that they cared about.
- The extended five-week programme provided enough time, space and resource for young people to develop their ideas both individually and through group discussions. The impact of the approach continued beyond the specific programme, as the young people shared their skills in wider ways with the organisation.

What could be developed and improved next

- Implement and deliver the co-designed workshops as part of the organisation’s programme.
- Explore how to further extend and embed the co-design approach more widely across other programmes in the Community Makerspace, ensuring that the approach is sustained and does not remain a one-off activity.



Key Learning Points 3b (Extending)

What and why?

Extending participatory approaches across all aspects of the whole organization, from individual sessions through to programming and governance, can provide a powerful and effective way of embedding an inclusive culture within a makerspace.

How?

Organisations that have embedded co-design and participatory approaches within individual programmes may find it helpful to next extend these principles to wider organizational governance – please see the ‘Key Reflective Questions for Practitioners’ table in the recommendations section for resource links.

Key reflective questions:

- To what extent is co-design and co-production embedded across our organisation?
- To what extent do young people and local communities have a meaningful role in governance?



Idea 4: Fostering caring pedagogies & relationships

The most important thing about a makerspace is not its equipment or resources, it is the people and the pedagogy. The outcomes and experiences that young people derive from participating in makerspaces will be profoundly shaped by the relationships that they experience and the sorts of pedagogy (i.e., teaching and learning practices) that they encounter. This idea is particularly influenced by extensive research and writing on the importance of caring pedagogies and relationships and how these can shape the experiences, outcomes and learning of young people within a wide range of learning settings. In this report we conceptualise caring pedagogies specifically as those which take account of relations of power and injustice, which recognise injustices and respectfully centre young people and their needs, looking after them emotionally, culturally and pastorally and supporting their wellbeing, progression and outcomes. In other words, caring approaches form part of social justice educational approaches.



Case study 4a: Considering young people's needs in a trainer design workshop

University Makerspace developed this workshop as part of a series of five workshops that would be delivered as an online 'autumn school' for young people in their local community, in collaboration with a community partner organisation. The workshops were held virtually as England was in its second lockdown due to the Covid-19 pandemic. It was essential for University Makerspace to consider young people's needs whilst interacting online due to the possibility of 'Zoom fatigue' or lack of equipment and think of techniques to be able to foster caring relationships whilst connecting virtually.

What the makerspace did

- Developed a hands-on two-hour virtual workshop with a footwear designer exploring design through making. Young people made their own trainer or sneaker sculpture using household recycling waste.
- The session ran as a virtual workshop and the facilitators posted materials and information about the workshop to the young people beforehand.

"We sent out everything down to scissors, pens and pads of good quality art paper... Things that we didn't want to assume that people had at home. We decided to do resources boxes with as much kit as possible and make them quite generous so that there would be enough left over for people continue doing the activity after the session had ended. But it was really about equity and the resources that people had... We wanted it to be as accessible as possible" (University Makerspace practitioner).

- Included a question-and-answer session between the designer and the young people, and a chance for the designer to introduce the young people to her workspace, in order to build rapport.

"The nice thing about [practitioner's name] workshop was she was based in her studio, so she could show everyone around" (University Makerspace practitioner).

- Ensured that the facilitator was experienced in working with young people and understood their community context.

"We particularly tried to look for makers that were based [where the participants are from] or who were BIPOC [Black, Indigenous and People of Colour]. This practitioner did actually come from quite an academic background, but her studio was [in the local area]. We knew that she'd run workshops before with young people and she was highly recommended to us by someone who runs another youth programme" (University Makerspace practitioner).



- Used icebreakers to help build relationships between the young people and the facilitators and to help everyone to get to know each other.

“The ice breakers were... We had a little visual with cat faces with different faces and asked them which cat they were feeling like today, to get a sense of people’s emotional states when they were coming to the workshops. And then we did a similar thing for a check out to see how people were feeling at the end. We also did ‘If you had a super-power what would it be?’ [...] to get them all chatting, to try and encourage conversation between them rather than with just engaging with the deliverer. Because you’re putting them in to breakout rooms together to chat and they don’t necessarily know each other... So, giving them the chance to get to know each other a little at the beginning that might help... To break the ice a bit” (University Makerspace practitioner).

- Used music to help create a relaxed and youth-centred feel to the workshop.

“Music was another thing we tried out [...] So we had music at the beginning and then in any quiet making moments, which worked well to give the workshops a more relaxed tone and less of a classroom feel” (University Makerspace practitioner).



- Built relationships between adults and young people by giving everyone the same tasks to work through at the same time.

“The facilitators were making alongside the young people which I think it made people more comfortable” (University Makerspace practitioner).

- Centred the workshop around young people’s interests.

“We had feedback from our youth advisors that fashion and digital tech were the two areas that they were particularly interested in. So, this workshop was just really highly rated in terms of content, so we were trying to really centre it around young people’s interests” (University Makerspace practitioner).



- Dedicated staff in the workshop to focus on pastoral care and recognising that some young people might want or need to communicate in different ways.

“We had the deliverers to focus on the making side of things and then we [other practitioners] did the more social side, like the check-ins and check-outs and encouraging people. One of us would be on the chat and we would say if you don’t feel comfortable saying things verbally then you can write in the chat box, and we’d often post prompts on there and little comments... We’d get people to respond to questions with emojis if that’s how they felt more comfortable” (University Makerspace practitioner).

- Recognised inequalities around technology and resources and thought carefully what they could do to be inclusive.

“Thinking about digital exclusion and people perhaps not having the same kit as each other, we were quite careful about how we worded that in the sessions; we didn’t want to make a distinction between people on laptops or people on phones... It was never about not having something, more of ‘Let us know what you’re here with’. We always had back-up ideas for if people came on phones or without hardware. For example, in one session there was so few people who came with the software or a laptop we decided to run it as a group activity where we learnt to use the software together and it actually worked well” (University Makerspace practitioner).



What worked well

- Sending essential materials to the young people in advance ensured that everyone had what they needed and could participate on an equal footing.
- The workshop was centred on young people’s interests and hobbies, connected with their lives and provided opportunities for career development.
- Icebreakers helped to build relationships between the young people and staff members and helped the group to get to know one another.
- Check-ins and check-outs helped to create a safe and caring space where the young people could share their emotional needs.
- Young people had the opportunity to participate and communicate in the online session in a way that they felt comfortable to do so.
- External facilitators were experienced in running online sessions for young people and could inspire the young people.

“The woman who ran it was really cool. I looked her up afterwards and used her research in my A-Levels. It was completely inspired by what we did in the session” (Anonymous Participant).

“It lined up well with what I was already doing at school” (Anonymous Participant).

What could be developed and improved next

- The workshop had quite a high ratio of adults to young people due to last minute dropouts. In future if this happens, guest speakers could be invited to join later on or extra facilitators could turn their cameras off.
- People who had problems with Wi-Fi connection missed instructions, so to improve, written instructions could be sent in advance along with the resource boxes.
- Build longer-term relationships between pastoral staff and young people across sessions so that when particular session facilitators change (in line with changing topics and specialisms of sessions) there is some continuity of relationships and support.



Key Learning Points 4a (Initiating)

What and why?

Caring relationships are an important part of equitable practice within makerspaces and can make a significant difference to young people's outcomes and experiences.

How?

Practitioners may find it helpful to reflect on the question: What do we need to know and do in order to really care for particular young people in our setting? It can be useful to organize a discussion with colleagues to share ideas and experiences on what would a caring relationship look like in our setting? And how can we create a culture and context that values and supports caring relationships between staff and young people?

Key reflective questions:

- What do we need to know and do in order to really care for particular young people in our setting?
- What do caring relationships look like in our setting? How do we extend and build on these further?



Case study 4b: Mentoring and caring for young people

Digital Makerspace had an ethos of being responsive to, and caring for, the young people they worked with, which drew upon their work as a physical space embedded in its community. Although the physical space was closed due to the Covid-19 pandemic, the practitioners at Digital Makerspace continued to demonstrate caring and develop relationships with their participants by providing extensive support and encouragement tailored to the individuals' needs, interests and particular circumstances.

What the makerspace did

- Digital Makerspace developed an online community within their coding programme through the provision of themed channels and group chats using an online communication programme.

“When I joined the course, I wasn't expecting to get to this point. I thought it would end up just being a course that I would complete, if that, and then just go about my life. But honestly, I met some really great people, and it was a better experience than I expected. It's more of a community than a course where they just abandon you, which I really did like” (Anonymous participant).

“Whenever you need help, you can just reach out into one of the channels, or direct message” (Anonymous participant).

“I really I thought it was quite good how the Slack was, it was like divided up, there was the opportunities, the intros and the sharing things, a general one and then there was the chats specific to coding problems. So, you felt that you knew where to go and ask the technical questions, you knew where you could just ask for help or general guidance” (Eileen).





- Digital Makerspace provided each participant with a pastoral mentor who could help support participants' wellbeing, mental health, progression and wider outcomes.

"They offered to refer me for like counselling and stuff... I appreciated them offering that support" (Callum).

"I think they did amazing, at least for me you know getting everybody involved – they worked wonders for my mental health... They were just there to talk to, you know not necessarily about the problems I'm having, but just there to talk to" (Frank).

"For me personally, my main take away from the course was that having mentor relationships was really important. Just having someone who every couple of weeks is just checking on where you're up to and what you're doing" (Eileen).

"I felt comfortable enough to go back to the mentors, even sometimes outside working hours and say, 'Ah, I feel like I've been trying so much, and I am still not getting anywhere', and they would respond to me and say, 'Yeah, you can still do this'. I messaged her, I'm pretty sure it was outside hours, and I was just like, 'Ah, I am feeling really upset, because I feel I am doing all this work and I am not getting anywhere'. And she was just really understanding and just reassured me that I will get something. Now I really do feel like I will" (Anonymous participant).



- Mentors kept track of young people's engagement and reached out to those who might be struggling through direct messaging.

"I didn't expect them to be doing what they were in terms of chasing people up, making sure that people were on track and feeling confident. If anyone's lagging behind, if anyone's gone quiet for a while [...] they will follow it up" (Kallo).

"Every single morning, they would actually say, 'Do you need any help? Do you need any help?' It was really good, because it felt like they were constantly on it" (Isaac).

- Practitioners and mentors engaged in active relationship building with young people, including supporting their wellbeing, individualising content and recognising young people's strengths.
- Digital Makerspace's caring approach is well illustrated by the case of one participant, 'Mushroom', a young woman who was working full time in a fast-food restaurant when she started the course. She found it hard and tiring to balance work with the programme demands and around the middle of the course, as she put it, "I kind of lost focus and I didn't participate as much in the course as I wanted to". She did not approach any of the staff, "I didn't really talk to any of the mentors... So, it was easy for me to fall off, because I don't feel anyone would really notice, basically". However, her mentor reached out and Mushroom started to re-engage, "And I hadn't responded to anyone in a while and [mentor] was like, 'Ah, please come back. You can do this', and she was basically saying that she would help me get into a role and that makes me feel she catered to my situation, she knew what I had gone through and that I really did try for that application". Mushroom started engaging more with the mentors and attended more sessions. As the relationships grew, so did her learning and engagement, "When I started speaking with more of the mentors, attending some of the sessions and basically getting to know more people, I felt more inclined to stay and learn". By the end she felt that she had 'really solidified' her place on the course, which she successfully completed and went on to gain new tech-related employment.

What worked well

- Digital Makerspace provided not only high-quality online learning but also a caring and supportive community and pedagogy which placed relationship-building at its heart.
- Despite all communications being virtual, young people felt looked after, supported and "not alone".
- The course was particularly successful in spotting signs of disengagement and providing individualised, caring support to help participants to re-join and complete the course.

What could be developed and improved next

- Extending caring pedagogy into other programmes. Like many settings, a key challenge facing Digital Makerspace is how to extend and embed their practice beyond the current funded programme.
- Identifying young people needing additional support. While most young people felt that the practitioners knew them well, a few were less confident about the extent to which the programme staff fully recognised their experiences, strengths and identities.



- Extending the caring approach to helping young people consider and monitor their goals and intentions from the start of the programme. Some young people suggested that they would have liked support to help them set goals or intentions at the start of the programme to make sure that they were staying on track and keeping up with the group.

“No one really asked me like what I kind of hoped to achieve by the end of it and as a result I couldn’t envisage what the end would be” (Callum).



Key Learning Points 4b (Extending)

What and why?

Caring approaches are important for supporting young people’s wellbeing, engagement and outcomes.

How?

Embedding caring relationships can mean moving beyond care at an individual, interpersonal level and embedding caring practices and structures into provision at an organisational level. Makerspaces might find it helpful to reflect on different types of care and the extent to which these are embedded across provision, such as whether care is provided to individuals and/or collectives, if it tends to be specifically focused (e.g. supporting skills development) or is more holistic (care for the whole person), what the care is designed to support (e.g. social, emotional, physical or other forms of wellbeing) and whether it is reactive or proactive?

Key reflective questions:

- To what extent are different forms of care embedded across all our provision?
- To what extent are our caring approaches reactive or proactive?



Idea 5: Supporting young people’s agency and social action through making

Makerspaces can provide valuable opportunities for young people to engage in making in ways that support their agency and social action. This idea was influenced by existing work conducted with young people from excluded and minoritised communities who have used making in ways that recognise and value their identities and cultural knowledges, draw attention to injustices and promote social justice through rich, innovative designs and creations aimed at improving people’s lives in fair and sustainable ways.

- We use the term **‘agency’** to refer to a young person’s capacity to act and take action in their learning and lives, which also links with the extent to which they experience a sense of ownership and ‘voice’ in their making.
- By **‘social action’** we mean young people’s capacity to engage in actions that are directed at social change, specifically in support of social justice and the social good.

(See the glossary at M4kingspaces.org/glossary for more terms and definitions)



Case study 5a: Supporting young people’s critical citizenship through making

University Makerspace developed a series of five workshops that would be delivered as an ‘autumn school’ in collaboration with a community partner organisation. The workshops were all conceived to involve ‘an element of social action’. Based on the feedback from and interests of young people involved in developing the workshops, most related to themes of environmental sustainability and one focused on ‘The Art and Science of Face Filters’. This latter workshop was piloted in August with two groups of young people living locally, and then delivered as part of the autumn school in November.

What the makerspace did

- In the workshop, participants used freely-available SparkAR software to make their own face filters for Instagram or Snapchat as a way of learning about how facial recognition technologies work. Young people then explored the limits of facial recognition technologies by using craft and household materials (e.g., face paint, sticky tape and hair extensions provided in a resource pack posted to participants beforehand) to create a Computer Vision (CV) Dazzle look designed to stop cameras from recognising a human face. They also discussed the beneficial and controversial ways in which their biometric data is being collected and used in both public and private spaces.



- The discussions resonated with young people, for example, one young woman talked about the need for more diverse and representative training datasets for facial recognition technologies and concluded that more female and BIPOC engineers were needed in the development of these technologies in the future.

“I think if we have more databases on people from ethnic minorities, for example, you start your facial recognition from people, don’t you? You recognise, like, the common facial features. And I think if the government or if people are able to expand it a bit more, it would give more accurate results, instead of basing it on white stereotypes, if that makes sense, of what people actually look like” (Workshop participant).

What worked well

- Participants enjoyed the intertwining of social action themes with technology, creativity and making.
- The workshop’s combination of digital technology and visual arts seemed to be highly engaging for the participating young people.
- The community partner also supported a group debate on social and technological issues in the other sessions, which helped build a strong theme of critical citizenship across the programme.

What could be developed and improved next

- Enhance integration between workshops. Although the face filters workshop was part of a series, the other workshops were on different topics, thus missing an opportunity to build their understanding further and to offer opportunities or support to young people to build on what they had learned in their lives and other contexts.
- Develop a more explicit focus on supporting young people’s agency and social action to help them to address issues that concern them and their communities. Although the workshops addressed social action themes, their focus was more on supporting critical citizenship (e.g., understanding issues in order to make informed choices) rather than on action *per se*.
- Deepen understanding of key themes, for example, around surveillance, privacy and racism, and offer opportunities to try out these technologies and others in the community.
- Shift from practitioner designed and driven workshops to the co-production of workshops with young people (see: Idea 3).



Key Learning Points 5a: Initiating

What and why?

Helping young people to engage in meaningful making, supporting them so that their creations address issues that matter to them and their communities in ways that are equitable and sustainable, have been shown to be effective and inclusive ways of working with young people in makerspaces, building their agency and helping them to make a difference through their making.

How?

With some relatively modest pre-planning and consultation with young people, practitioners can build social action themes into making sessions to enable young people to use their making to address their interests and issues that they care about. Further ideas and inspiration can be gained from looking at examples of how other settings have done this – please see the ‘Key Reflective Questions for Practitioners’ table in the recommendations section for resource links.

Key reflective questions:

- How can/do we use consultation with young people to integrate social action themes into making sessions?
- How do we make sure that social making is tailored to young people’s interests and issues that they care about?





Case study 5b: Supporting young people's social action through making

Community Makerspace tries to embed agency and social action into everything they do, a practice that flows organically from their core organisational commitment to social justice (see: Idea 1). Themes of youth agency and voice were embedded into the everyday life and fabric of the organisation, with young people playing an active part in the design and build of outdoor installations and new physical spaces at the centre. The space's commitment to social action and social justice was also manifested in the design and focus of their making sessions, as the following practitioners explained.

“[We will] be doing some work over the summer, so we'll just be kind of transferring feelings onto laser cutting stuff and thinking about what did COVID do or what does Black Lives Matter mean to you? We're going to be doing a lot of that kind of exploring and we're going to do heavy stuff around music and using music and podcasting to convey feeling” (Community Makerspace practitioner).

“In every kind of session, we're always thinking... We're always asking the young people what it is... 'What is it that you're passionate about? Why are you passionate about it? If there's something wrong with that situation, what can we do to change it?'” (Community Makerspace practitioner).



What the makerspace did

- Community Makerspace's embedding of social action was evidenced across various programmes. For example, one session began with a discussion around what social action looked like asking, “**What does it mean to you? And what are all the different things you care about?**”. The young people made placards relating to causes that they cared about using a range of tools and technologies. They then concluded by reflecting on the skills they learned and used that day and what they could make next to help address an issue that they cared about.
- Two young people, Ella (aged 10) and Emily (aged 11) extended their interests through their making workshops, focused on climate change, and worked together to create a portfolio of products to raise awareness and communicate their message. This included designing and making laser cut keyrings and using a vacuum former to create soaps shaped like polar bears and icebergs, “**Every time you washed your hands it would signify how the ice was melting**”. They also created laser-cut pictures and a jigsaw puzzle on the same theme which were included in a display at the centre.
- Another young person, James (aged 12) looked at homelessness in the city, an issue that he cared passionately about. In response, he designed a prototype backpack bed that could be carried and was raised off the floor for more comfortable sleeping.
- Themes of social action were also woven into standalone sessions, for instance, young people designed keyrings as part of a social action campaign day representing their concerns about racism, climate change, political oppression/freedom, transphobia and other topics, and then created animations on the issues that could be shared more widely.

What worked well

- Support for young people's agency and social action was infused throughout Community Makerspace's programming and culture, from one-off sessions, to long-running programmes, and the everyday design and management of the internal and external spaces.
- This approach was youth-led, supporting and facilitating the interests, passions and concerns of young people rather than being imposed or pre-decided by staff.
- As a result, young people grew in confidence and agency through their participation (see: Impact), with their making benefitting themselves and their communities.

What could be developed and improved next

- Explore ways to help support, amplify and extend young people's voices and action into wider spaces, beyond the immediate setting of the centre.
- Support young people to become not just co-designers but leaders of the causes and action that they wish to support through their making.



Key Learning Points 5b (Extending)

What and why?

Social action making can support young people's agency, outcomes and impact.

How?

Makerspaces that have integrated social action themes into making sessions might consider extending practice by reflecting on ways of amplifying young people's voices and their social action making more widely, beyond the setting and programme. For instance, how might you be able to create a wider platform for their work? (e.g., using social media, networking, publicity, wider partnerships?) What scope might there be to share this work with others both within and beyond their communities? How might you support young people to use their making as a springboard for developing their impact and/or leadership in relation to particular causes or issues?

Key reflective questions:

- How can/do we amplify young people's voices and provide a platform for their social action making more widely, beyond the setting and programme?
- How can we support young people to use their making as a springboard for developing their impact and/or leadership?



Idea 6: Building capital, skills and pathways for progression

Makerspaces can provide valuable opportunities for young people to develop a range of capital and skills in areas such as, but not limited to, science, technology, engineering, maths, art, crafts, creativity and beyond. The capital and skills that young people build through their participation in makerspaces can support their pathways and progression in life and can benefit themselves, their communities and wider society in diverse ways.

- We use the term '**capital**' to refer to diverse forms of resource, knowledge, experiences, behaviours and relations, including cultural, social, economic and symbolic forms.
- We use the term '**pathways**' to refer to young people's onwards life trajectories, from the short-term (e.g., immediate next steps and experiences) through to longer-term life goals and outcomes.

(See the glossary of social justice terminology at [M4kingspaces.org/glossary](https://m4kingspaces.org/glossary))



Case study 6a: Showcasing diverse STEM professionals

University Makerspace asked teachers and young people for feedback on a planned series of educational after-school club sessions that they were thinking of developing. However, the teachers and young people conveyed that they would rather have the sessions focused on providing them with careers education support to help them get a better sense of future career options, which they felt was particularly urgent given the uncertainty caused by the pandemic. University Makerspace therefore changed their plans and instead created a one-day careers workshop (i.e., 'Meet the Makers'), featuring a panel of young London-based professional makers. The makers were chosen on the basis that they challenged narrow, traditional ideas of STEM careers by representing diverse communities and through their fusion of creative and STEM approaches in their work. They were asked to help highlight possible future routes for participating young people.

What the makerspace did

- The Meet the Makers event gave students a taste of the kinds of careers they could pursue using creative, practical and technical skills. Speakers included a designer who makes educational robots and uses design to make life easier for older and disabled people, a textile designer and self-taught embroiderer, a systems engineer working with virtual reality (VR) headsets, and a physiotherapist-turned-silversmith and jewellery designer.
- The makers gave students a glimpse of their day-to-day work lives, provided a sneak peek into their studios, and shared their personal stories of the different routes they'd taken into their successful, creative and practical careers.
- Students and teachers had a chance to quiz these experts about what they had studied at school and university, getting their first job, and their personal tips for success in their industry during a questions and answers session and after the event by email.
- Supplementary careers resources were also provided including a list of recommended websites and institutions offering careers information, job opportunities, internships and apprenticeships in the arts, sciences and technology.



What worked well

- The event directly responded to the interests and needs expressed by young people and teachers and introduced the young people to a range of creative, STEM-influenced careers and engaging professionals.
- Meeting the makers helped build young people's social capital as they made new social connections and gained direct understanding from the makers about their careers and trajectories.

What could be developed and improved next

- Build on one-off events and explore ways to extend the encounters further.
- Consider how to provide longer-term, personalised support and mentoring to young people to help support them in the next several steps of their career progression.
- Connect STEM skills development across workshops into a more coherent and holistic programme of support. Also explicitly connect STEM skills to the jobs of makers that are showcased within the programme, forming a framework for young people's progression.
- Embed diverse representations of STEM skills and how these are used by people in a wide range of settings across all programmes, not only within careers-focused events.
- Weave in and open up discussions of inequality and barriers to STEM participation throughout and across programmes, ensuring that young people are supported to engage with, explore and challenge injustices (e.g., racism, sexism) within their making, and to equip them with strategies for challenging the inequalities they may encounter in such careers.



Key Learning Points 6a: Initiating

What and why?

Building young people's STEM-related capital and skills can benefit them, their communities and wider society in many ways, enabling them to be active citizens and make a difference in the world, along with equipping young people with knowledge and skills that can help them to access employment.

How?

Many makerspaces will already be helping young people to develop STEM-related knowledge and skills but sometimes this may be insufficient on its own to make a difference to their trajectories and outcomes. It can be helpful to ask young people what broader forms of support they might want, need and find helpful for their lives and progression?

Key reflective questions:

- How do we ask about and act on what broader forms of support young people want/ need for their lives and progression?
- What do we and/or young people count as 'success' in terms of progression and outcomes?





Case study 6b: Supporting young people's STEM skills and employability

Digital Makerspace built extensive careers and job readiness support into their coding programme package. They recognised that participants wanted not only new STEM knowledge and skills but also practical help and resources to help them translate these skills into the labour market.

What the makerspace did

- Digital makerspace developed young people's technology and coding skills through an online learning programme comprising an 8- to 12-week part-time introduction, and a 10-week full-time advanced programme. They also integrated extensive additional support aimed at building employability and job readiness.
- The course was delivered through weekly Zoom workshops on how to develop a CV, how to job search effectively as well as improve interview skills. Specific elements included:
 - Portfolio workshop. A session exploring what made a good portfolio (i.e., both creative and technical), ways and places to host and share portfolios, what employers and collaborators want to see.
 - Confidence coaching sessions. These were offered on either a 1:1 basis or in a group format, and included topics such as how to approach interviews, wellbeing, and ways and techniques to build confidence in yourself.
 - Careers focus. This included support with writing CV's, job applications, developing interview skills, and portfolio and presentation advice, answering questions about particular schemes, and showcasing a variety of job opportunities and career pathways.
 - 1:1 CV and application support with a colleague from the local council.



- Industry session. This explored what it was like working in a team, what it was like working as a coder, skills and approaches for getting into coding work for and with other people.
- Public speaking and presentations. How to create content, how to deliver it and how to deal with nerves.
- Open sessions. This covered whatever the young people were struggling with, as requested by young people (e.g., help with coding, job readiness, job preparation and job searching).
- Creative coding. This showcased different kinds of uses of coding, looking at unusual projects involved in the creative industry and art.
- Career days. Here specific questions from young people were answered and discussed as a group.
- The feedback from the participants was favourable.

"I went to the programme mainly just wanting to learn HTML, CSS and JavaScript and that was it. I feel that I got a lot more out of the whole course, because I learnt different aspects, not just those basic things. I learnt how to make a CV better. I learnt how to job-search, how... And just a little bit more about myself. From now I learnt that I actually like working from home and that's something I didn't actually consider before. So, overall, I learnt a lot more than I expected, so I got a lot more out of the course than initially anticipated" (Mushroom, course participant).

"I think the main thing that I got was confidence because I wouldn't have had the confidence to apply for the job I'm literally in now, let alone actually pass the interview and everything if I hadn't have done that course" (Noffie, course participant).

"I'm really grateful to have had the opportunity to do this course and for it to have helped get me a position on an apprenticeship much quicker than I anticipated" (Course participant).

What worked well

- Young people gained significant new STEM skills and also felt well prepared for the job market (see: Impact).

"Before this programme, I didn't have much direction. I wanted to get into tech but figuring out the necessary steps was difficult; I wasn't sure I could do it. This programme changed that: the mentors helped me figure out how to reach my goal and gave me the essential skills to get there. I'm now a lot more confident in myself, my coding skills and ability" (Mushroom, course participant).

What could be developed and improved next

- Provide opportunities to meet people from different industries who use coding in their job.

“Guest speakers or something from the industries that we wanna work in to see how they got into it and how they were able to apply the learning” (Callum).



Key Learning Points 6b: Extending

What and why?

Building capital, skills and pathways to progression benefits young people’s development, options and outcomes.

How?

Practice can be extended when approaches for building capital move from individual, one-off tailored sessions into more embedded, longer-term provision that can support young people’s progression in multiple ways. Makerspaces may find it helpful to reflect on questions such as: what do we and young people count as ‘success’ in terms of a young person’s progression and outcomes? How do we support and capture this?

Key reflective questions:

- To what extent is the support we provide delivered through one-off vs. embedded, longer-term provision?
- How do we support and capture impact?

Evaluate





Evaluate

This section discusses the development of a new survey that was designed to help makerspaces map and reflect on their progress towards an equitable culture and experience for all young people.

Evaluation is a valuable, but never neutral, exercise and process. Attention has been drawn to how evaluation involves relations of power and representation, hence linked to forms of injustice and oppression. For instance, often the individuals and communities who are the ‘objects’ of evaluation are not those deciding what questions should be asked and how success should be defined and measured. As a result, evaluation can play a part in perpetuating inequitable systems and relations and has led to individuals and communities being represented in negative terms, for example, as ‘deficient’.

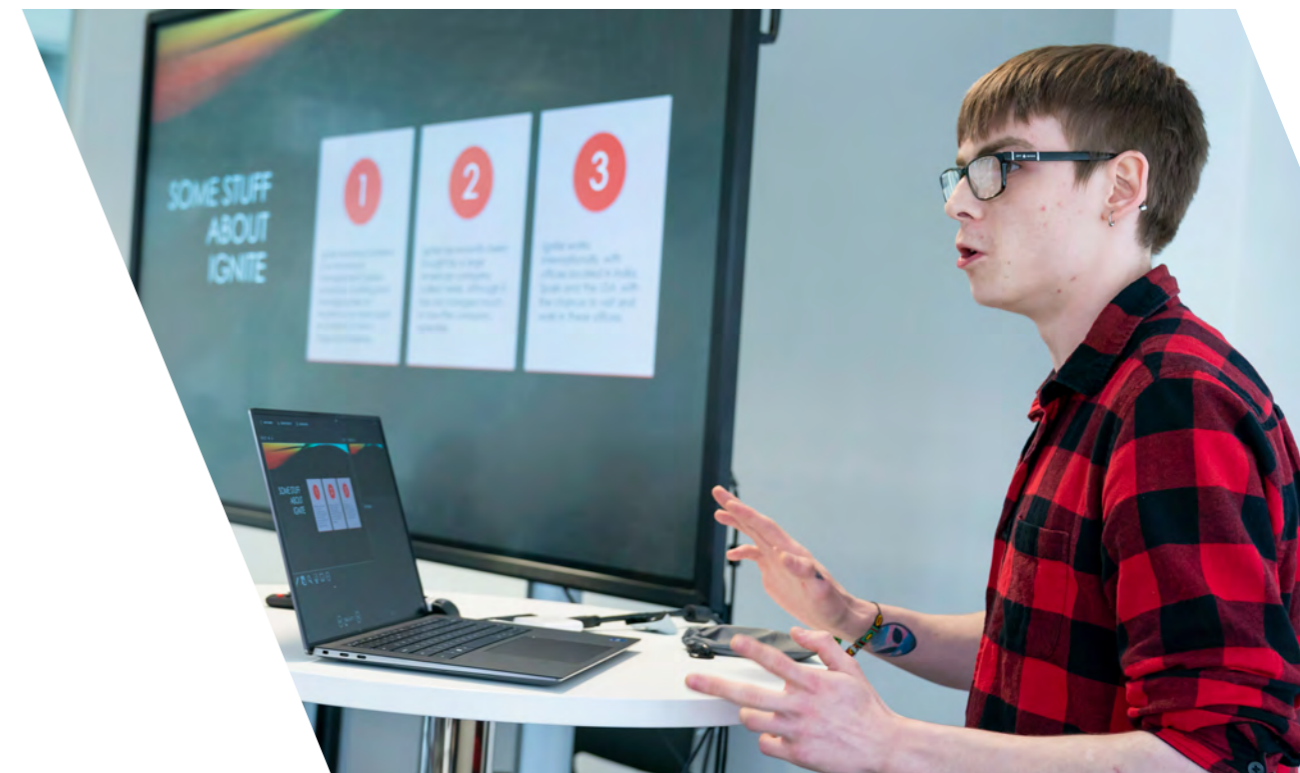
Equitable evaluation approaches are designed and implemented in ways that are commensurate with the values of equity and social justice. Rather than ignoring historical, socio-political and cultural contexts, they acknowledge the central role such contexts play in the lived experience of individuals and communities, seeking to centre and amplify the voices and experiences of the ‘subjects’ of evaluation.

Equitable evaluation privileges the lived experiences and voices of minoritised communities and engages these individuals in determining which outcomes should be valued and how they could be captured⁵. It utilises definitions of rigour and validity that acknowledge and respect diverse perspectives and epistemologies, and the messiness of experience⁶. When developed and implemented in this way, evaluation can serve equitable ends, challenge systems of oppression and promote social justice.

⁵ Garibay, C., & Teasdale, R. M. (2019). Equity and evaluation in informal STEM education. In A. C. Fu, A. Kannan, & R. J. Shavelson (Eds.), *Evaluation in Informal Science, Technology, Engineering, and Mathematics Education*. *New Directions for Evaluation* (Vol. 161, pp. 87-106): Wiley Periodicals and the American Evaluation Association.

“By working with the Making Spaces project we have been able to share our work in a more purposeful way, which has allowed us to gain more funding from other sources. This has been able to support us to make our [Young people’s making] project into a programme of activity. Through being able to develop our practice we have been able to develop the programme in a way that we would not have had capacity to do before”

(Makerspace practitioner).



⁶ Bang, M., & Vossoughi, S. (2016). Participatory design research and educational justice: Studying learning and relations within social change making. *Cognition and Instruction*, 34(3), 173-193. doi:10.1080/07370008.2016.1181879. Equitable Evaluation Initiative, (2021). *Shifting the Evaluation Paradigm: The Equitable Evaluation Framework*. San Rafael, CA.



Case study 7: Developing an equity-focussed survey for makerspaces

The Making Spaces project team decided to try to create a survey tool that could help provide makerspace practitioners with data to support their professional reflection and progress towards more equitable practice and inclusive organisational cultures. We also were interested in the potential for such a tool to help support reflection and development of equitable practice across the field more broadly.

What the team did

- The team began by reviewing a range of existing evaluation tools which captured themes, topics and experiences relating to equity and social justice, including tools which partner makerspaces were already using. This review helped the team to identify potential points of connection and gaps within and among existing tools and enabled the team to learn from both qualitative and quantitative approaches to evaluation in makerspaces and beyond.
- Based on this learning, the team developed a draft survey that sought to capture:
 - Young people’s perceptions of their experiences within their makerspace and the extent to which they felt that these were inclusive, welcoming, safe; how supported they were and how valued their identities were; the extent to which they were helped to build valuable knowledge, skills, experiences and relationships.
 - The extent to which they felt that their makerspace experiences supported their agency and progression and related to a range of potential equitable outcomes.



- Extensive consultation was conducted with teenage young people to develop an initial version for wider sharing and input. Multiple drafts were shared with practitioners from partner makerspaces to ensure that the terminology was clear and that their equity-related aims were represented in survey questions.
- Online discussion sessions were conducted with eight young people aged 11 to 18, which went beyond cognitive testing, that is to say, exploring their understanding of the questions, to more in-depth shaping of the survey. For example, young people recommended more comprehensive response choices including ‘N/A’ and ‘Prefer not to answer’, as well as suggesting items (e.g., ‘I feel safe here’) that they felt would reflect aspects of their makerspace experience that were important to them.
- A modified version of the survey was then the subject of consultation with a further 12 young people who preferred to give written feedback. They were asked specifically to attend to the response choices, as well as providing feedback on clarity, repetition and whether or not the survey captured their experience. This feedback led to further wording amendments, as well as the removal of some questions and addition of others. Finally, six young people carried out a final ‘pre-pilot’ round of testing to check for survey completion time and clarity.
- The survey was then piloted with 24 young people from Community Makerspace, 24 from Digital Makerspace and a further 66 young people drawn from across a summer programme in a natural history museum, a library makerspace, afterschool programmes and an art gallery.
- Initial results from the pilot were promising and suggested that the survey is likely to be a useful tool to support development of equitable practice in makerspaces. Young people’s responses corroborate earlier feedback suggesting that the items are not only applicable to their experiences and are understandable, but also that they are capturing their experiences and perspectives. In particular, the survey can provide practitioners with data about the extent to which young people experience their spaces, activities and culture as inclusive, caring, safe and welcoming, as environments where their identities are valued and nurtured, and where their agency and progression are supported. The survey also gives insight into the extent to which participants view the makerspaces as places that connect to their community and the things that matter to them.
- Feedback from practitioners highlighted that this standardised approach is not only applicable to different spaces and programmes but that it will also be helpful in identifying areas for action, as well as being useful to monitor progress over time.



What worked well

- The survey helped to highlight specific areas in which young people felt that their respective makerspaces were creating inclusive and supportive experiences and identified areas that practitioners might usefully focus on further.
- Practitioners also felt the survey responses would support their reflective practice and planning for further development of their spaces and programmes.
- Working in partnership with young people and practitioners across a range of programmes and spaces helped produce a survey that seemed to be applicable and work across spaces, programmes and international contexts.
- Providing both online and paper copies of the survey was welcomed by participants.

What could be developed and improved next

- In its current form, the survey is too long and needs to be reduced to a more manageable length that will work for a wider number of spaces and programmes. Further statistical analyses could help inform judgements about what items can be excluded.
- Next steps will involve discussing responses in depth with practitioners, to gather insight into their interpretations of the data and what they might do in response. This process will also help start to identify the supports they might find most beneficial in this process.
- Future work needs to extend the co-design of the survey including developing tools to aid in survey administration and interpretation of results. Consideration could be given to making the survey more modular in order to support practitioners who would like to focus on improving a particular aspect of their practice.

Impact





Impact

Towards the end of the project, we asked practitioners from our three makerspaces to reflect on their work with Making Spaces over the two-year duration of the project. We also collected data from young people who had taken part in programmes that had been informed by ideas of equity and inclusion. As summarised below, practitioners and young people who had participated in the project reported a number of benefits and positive outcomes.



What did practitioners gain from taking part in the Making Spaces project?

“The Making Spaces project gave us the space to trust our gut, take risks, and interrogate our programmes more rigorously” (Makerspace practitioner).

Our analyses of data collected from practitioners highlighted three main outcomes, which are outlined below and illustrated with quotes from practitioners.

Practitioner Impact 1: More inclusive and participatory practice

Encouraging inclusive and participatory practice, such as co-design with individuals from a wide range of backgrounds, was a key focus of the project, and important to equitable ways of working.

“We have, as a result of Making Spaces, embedded co-design with young people into all our applications for funding and strategising. This approach is fundamentally different” (Makerspace practitioner).

“We have been aware for a long time that we wanted to be more inclusive of young people from disadvantaged backgrounds. Carrying out the project with specialists and experts in this field has given us knowledge and experience of best practice” (Makerspace practitioner).

Practitioner Impact 2: New knowledge and understanding

Practitioners increased their understanding about how to work more equitably with young people, often pushing their practice into new territories.

“Making Spaces has allowed us to think about how we operate as an online makerspace as we transitioned out of a bricks and mortar venue. It has been a highly valuable in how to build and retain an online community” (Makerspace practitioner).

“Our partnership with researchers from the Making Spaces team gave us valuable insight into new audiences that we were working with, and allowed us to access knowledge and information that we did not have the time or expertise to produce ourselves” (Makerspace practitioner).



Practitioner Impact 3: Innovative practice

While our partner makerspaces were at different places on their journey towards more equitable practice, they all were able to innovate and develop new forms of practice.

“As an organisation we loved working on this project. The impact on the culture of [our makerspace programme] with young people has given us space, language, tools and time to think more creatively and purposefully about the work we are delivering” (Makerspace practitioner).

“As practitioners, everyone involved in this project has been pushed to develop their own practice and think more deeply about how and why we engage young people in makerspaces” (Makerspace practitioner).

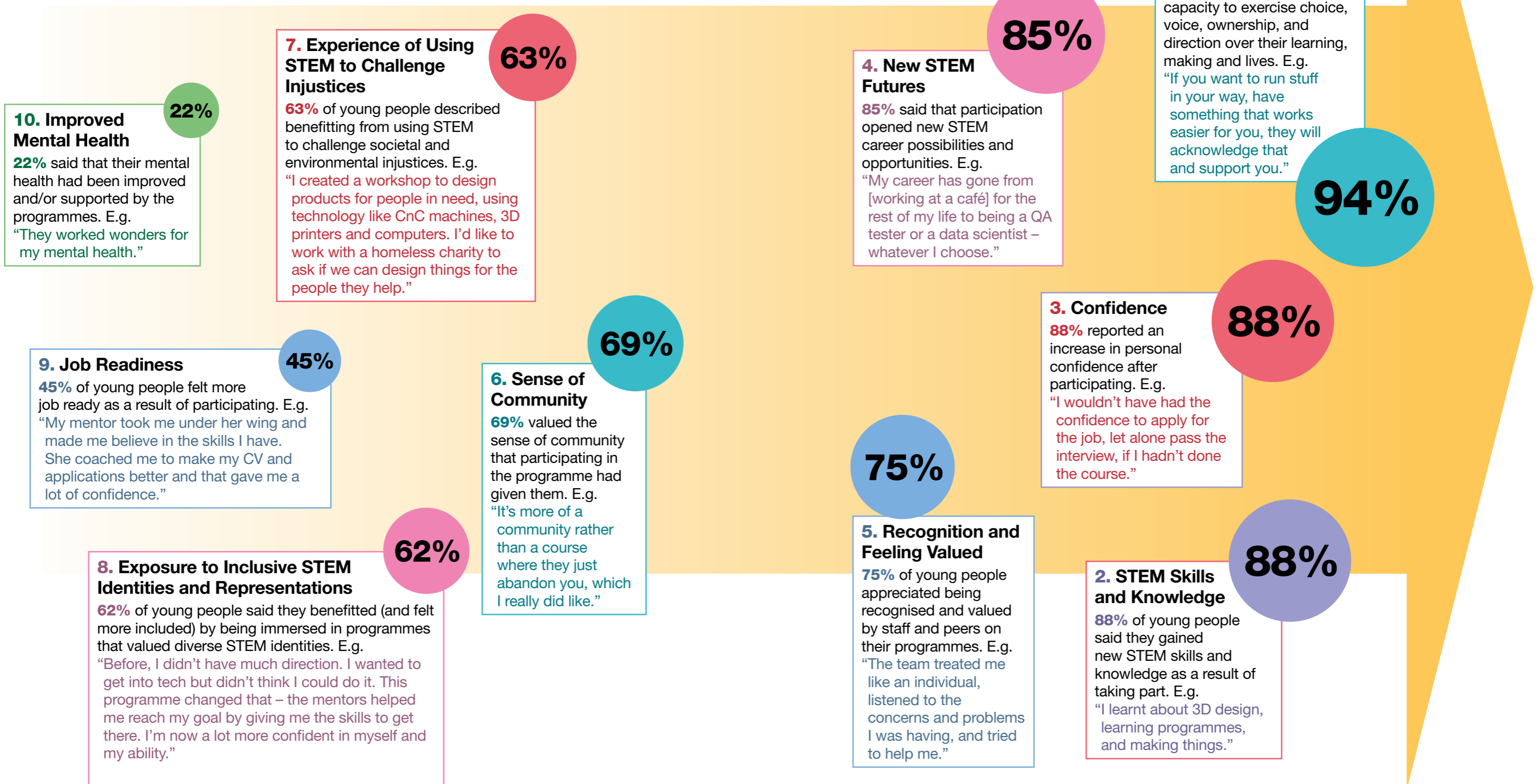
“We have been able to develop the [makerspace] programme in a way that we wouldn't have had capacity to do before, which has allowed us to gain more funding” (Makerspace practitioner).





What did young people gain from participating in makerspace programmes?

Data was collected from young people who had taken part in programmes informed by ideas of equity and inclusion, specifically young people attending online or face-to-face programmes lasting at least one month between June and October 2021. Our analyses revealed ten key areas in which young people believed they had benefitted as a result of participation in the makerspace programmes.





“The young people felt like they were equal researchers and that they were doing the project with UCL, not that they were being researched. They felt that their ideas were valued, and they were heard”
(Makerspace practitioner).



Community impact

Alongside outcomes for the individual young people and practitioners involved, the makerspace programmes also had positive impacts on their communities. Below are two examples of the benefits that equitable practices in makerspaces can have for wider communities.

- One youth co-researcher described an example of how he had applied the skills he had learnt to an event that he was helping to plan and run:

“The discussions we had were really important and I have applied it to a conference panel style event that I am running and everything that we talked about, like making a space safe and inclusive, is on my mind. The event is for LGBTQ+ musicians and people working in the music industry, about how we can make the industry more inclusive and include the queer scene... We’ve clarified on the ticketing page that there are gender free toilets available”
(Callum).

- A practitioner described a project that aimed to bring creativity to the local area near the makerspace and work with the local residents to improve the area. Part of the project was to make an iconic piece to go outside the community centre in order to inspire pride in the local area and put the area on the map, “making it sort of a go to destination, because it’s always a bit ignored by the rest of the city”:

“So, we worked with a group of local people to create a manifesto of what they wanted the piece to be and then designed it. [They] decided to create a big sign saying ‘[local area name]’, a bit like the Hollywood letters. They were in these different layers; all different colours and the front layer had this reflective paint. You could light draw onto it with your phone or watch or something when it was dark. The whole co-design process had really been followed, from creating a manifesto, talking about what people wanted, mind-mapping, including everyone’s ideas and achieving the goal – we worked with people at every step of the way, right through to fabrication” (Community Makerspace practitioner).



Recommendations



Recommendations

General recommendations for stakeholders

Funders who are interested in supporting more equitable, inclusive and increased STEM participation might wish to consider how they can:

- Ensure that the activities and programmes that they fund are **informed by the six ideas** outlined in the report.
- **Support cultures of critical professional reflection** among makerspace staff and volunteers who work with young people, ensuring that practitioners have adequate time, resource and tools (such as the Making Spaces project Key Reflective Questions) to do so.

Makerspace practitioners may wish to:

- **Engage in critical reflection**, either alone or with colleagues, using the Key Reflective Questions and ideas summarised in the main report.
- **Explore some of the wider resources** listed in the report.
- **Connect** with other makerspaces to share ideas and develop a wider community of practice.
- Consider setting up a **youth advisory board** so that young people can be partners in reflection and planning.

Young people who are interested in helping makerspaces to be more equitable and inclusive might want to:

- Use the experiences and case studies from young people in this project as conversation points to **kick start discussions** with **peers** and **practitioners** about how best to support the equitable participation, engagement, voice, and agency of young people in their makerspaces.



Key reflective questions for practitioners

This table summarises ideas for developing equitable, inclusive practice. It draws on insights from three partner makerspaces. The final column also includes links to further useful resources that can help practitioners to develop and embed equitable practice in their spaces.

Idea	Why?	Key Reflective Questions		Useful resources/ links
		INITIATING equitable practice	EXTENDING equitable practice	
1: Develop a social justice mindset and culture.	The equitable potential of your practice will be shaped by the mind-set and values that practitioners and leaders adopt.	How can we ensure that all staff develop a shared, deep understanding of equity and social justice issues?	How do we ensure and know that an inclusive organisational culture is embedded, owned and sustained across all areas and levels of our organisation?	Use the YESTEM Equity Compass to guide reflection and discussion. ¹ Check out Active Impact's resources for inclusive practice with disabled young people. ² Find ideas for equity-focused activities and approaches from MakerED . ³ Explore Diversci resources that support practitioners to embed a culture of equity in their organisations. ⁴
		How are we creating and sustaining an organisational culture that values and practices critical professional reflection?	Does everyone have sufficient time, resource and commitment to be inclusive in their practice?	
2: Create safe, welcoming, inclusive spaces.	Young people need to feel safe, welcome and included for successful engagement and outcomes.	How are we developing and growing meaningful relationships over time?	How do we identify, monitor and address instances when young people may not feel safe, welcome, included?	Find out about humanising approaches to virtual learning . ⁵ Learn from libraries about creating safe, welcoming and inclusive places. ⁶ Be inspired by this makerspace that will be located in an affordable housing complex. ⁷
		How do we find out and address what makes different young people feel safe, welcome and included in our setting?	Is there a particular area that might benefit from a 'deep dive' to help inform further development?	
3: Work in participatory ways with young people.	Participatory approaches help challenge unequal power relations, support young people's agency and promote inclusive organisational cultures.	Who can we partner with to learn more from about how to develop participatory approaches?	To what extent is co-design and co-production embedded across our organization?	Learn how to set up an equitable youth board . ¹ Gain inspiration for using participatory, youth-led approaches from the Science Museum of Minnesota . ⁸ Find out more about sharing authority with young people ¹ and about techniques aligned with a participatory approach . ⁵
		How can we be sensitive to power dynamics and ensure that privileged staff and participants do not set the agenda and control the narrative?	To what extent do young people and local communities have a meaningful role in governance?	
4: Foster caring pedagogies and relationships.	Caring approaches are important for supporting young people's wellbeing, engagement and outcomes.	What do we need to know and do in order to really care for particular young people in our setting?	To what extent are different forms of care embedded across all our provision?	Reflect on how pedagogical approaches can signal caring. ⁵ Consider how caring and supportive relationships can strengthen young people's programmes at science centres . ⁹
		What do caring relationships look like in our setting? How do we extend and build on these further?	To what extent are our caring approaches reactive or proactive?	
5: Support young people's agency and social action through making.	Social action making can support young people's agency, outcomes and impact.	How can/do we use consultation with young people to integrate social action themes into making sessions?	How can/do we amplify young people's voices and provide a platform for their social action making more widely, beyond the setting and programme?	Check out the STEM Justice Toolkit created by young people at the Science Museum of Minnesota . ⁸ Discover practices that support ethical sense-making . ⁵ Learn about how DIVAS for Social Justice supports young people to make change in their communities. ¹⁰
		How do we make sure that social making is tailored to young people's interests and issues that they care about?	How can we support young people to use their making as a springboard for developing their impact and/or leadership?	
6: Build capital, skills and progression.	Building capital, skills and pathways to progression benefits young people's development, options and outcomes.	How do we ask about and act on what broader forms of support young people want/ need for their lives and progression?	To what extent is the support we provide delivered through one-off vs. embedded, longer-term provision?	Reflect on use of body language in interactions to support building skills. ⁵ Discover how 'career ladder' programmes, at places like NYSci and Museum of Science and Industry , support young people's STEM skills and progression. ⁹
		What do we and/or young people count as 'success' in terms of progression and outcomes?	How do we support and capture impact?	



Further Details

Useful Projects and Resources

- ¹ The international **YESTEM (Youth Equity + STEM) project** addresses equity issues in informal STEM learning. Their **website** contains a number of useful resources applicable to makerspaces including the Equity Compass, professional development opportunities, recommendations for setting up an equitable youth board, and guides to equitable practices such as co-designing and authority sharing.
- ² **Active Impact** is a project based in Gloucestershire, UK. They have a **bank of resources** to help guide inclusive practice with disabled young people, and also offer professional development workshops on developing inclusive practices in community organisations. See: <https://www.activeimpact.org.uk/support-and-guidance-for-inclusion/>
- ³ **Maker Education Initiative (MakerED)** is based in California, USA. They focus on providing training and resources to those wanting to integrate making into learning environments. Their **website** contains a wealth of ideas for equity-focused activities, approaches, pedagogies and more.
- ⁴ The **Diversci framework** (diversci.eu) was developed by the Equity@Ecsite group (now called Diversci) to support science centres and other science engagement organisations to move towards a culture supportive of diversity, equity and inclusion. The **website** includes resources and recommendations to support practitioners at all levels across an organisation and provides links to an associated community of practice.
- ⁵ **The Blue Dandelion pedagogical zines** blend collaborative research and art to create freely available resources that support socially just educational practice, within and beyond the classroom. Designed by and for educators, the zines contain insights and ideas relevant to makerspace practice including:
 - Humanising approaches to virtual learning (creating safe and inclusive spaces online)
 - Intergenerational teaching and learning (techniques aligned with participatory approaches)
 - How aspects of pedagogy such as use of language and supporting learners emotionally and cognitively can signal caring ('Teach, Play, Code')
 - Use of body language in interactions in making environments and the impact this has on building skills
 - How to support 'ethical sense-making and expansive STEAM learning'



Inspiring places and programmes

- ⁶ Where makerspaces are situated can send powerful messages about who is welcome. Libraries are often perceived as safe, welcoming and inclusive places. The **Idea website** and **this government page** contain lists of libraries hosting makerspaces in the UK.
- ⁷ A new project is developing a truly accessible, multi-generational and community-based **makerspace located in an affordable housing complex** located in the Northeast of the USA.
- ⁸ The **Kitty Anderson Youth Science Center (KAYSC)** at the Science Museum of Minnesota has the mission of empowering youth through science, using participatory, youth-led approaches to do so. The KAYSC also places a strong emphasis on supporting youth agency and encourages young people to create projects about issues they care about. Their STEM Justice Toolkit is one example of such activity.
- ⁹ 'Career ladder' programmes, in which young people from the community are trained to deliver activities in science centres and museums, build skills and support young people's progression in and through STEM. Two such programmes are the **NYSi Science Career Ladder** in Queens, NY and the Museum of Science and Industry's **Science Minors and Achievers** programme (in Chicago). Evaluation of these programmes has identified not only the way in which they support skills and progression but also that caring and supportive relationships are key to their success.
- ¹⁰ Forward is a social justice makerspace co-created with the local community in Brooklyn, NY and run by **DIVAS for Social Justice**, whose focus is on supporting youth and adults to make change in their communities.





Glossary

This glossary defines terms used in the report as understood by, and relevant to, the Making Spaces project. You can find more definitions in our online glossary aimed to support social change: <https://m4kingspaces.org/glossary/>

Agency: A young person's capacity to act in their own learning and lives, which also links with the extent to which they experience a sense of ownership and 'voice' in their making.

Capital: Refers to diverse forms of resources, knowledge, experiences, behaviours, and relations, including cultural, social, economic, and symbolic forms.

Critical citizenship: An understanding of social issues that enables young people to make informed choices. A step below taking action to make positive changes in the community as per social action.

Critical (professional) reflective practice: Approaches to professional practice that involve questioning one's own taken-for-granted personal and cultural assumptions and practices and engaging with issues of power, privilege and oppression in order to support equity and social justice.

Dominant: Those individuals, organisations and communities in possession of the most power, privilege and control in society.

Equality: Approaches that treat communities in the same way, for instance, providing the same resources and opportunities to all.

Equity: The differential provision of resources according to need, ensuring that everyone has what they require to succeed. Part of a process of actively moving everyone closer to social justice by 'levelling the playing field'. This approach treats communities differently according to need, for example providing more resources to those who need more due to being minoritised or excluded by society.

Inclusion/inclusive practice: Processes and practices that seek to value and respect people for who they are, treating them with dignity and care, ensuring that their needs are met, and that unjust systems, practices and barriers are removed so they are able to participate actively and equally, without disadvantage or detriment.

Makerspace: an informal multipurpose site designed for collaborative hands-on learning and creative production, with or without tools. These innovative learning spaces offer the opportunity to share materials, skills and ideas to address technological, personal, community and societal goals.



Pathways: Refers to young people's onward life trajectories, from the short-term (e.g., immediate next steps and experiences) through to longer-term life goals and outcomes.

Pedagogies: teaching and learning practices. For example, caring pedagogies are those that support young people emotionally, culturally and pastorally to foster wellbeing, progression and positive outcomes.

Practitioner: Someone who works (either paid or as a volunteer) within a makerspace and is actively engaged in supporting participants within the organisation. For example, a practitioner might deliver a makerspace programme, support participants with their making and/ or they might work in a pastoral context.

Minoritised: The people, cultures and communities that are excluded, disadvantaged and marginalised by the dominant and privileged. The term deliberately draws attention to the role of the dominant/privileged in creating these positions and conditions.

STEM: Science, technology, engineering and mathematics.

Social action: Young people's capacity to engage in actions that are directed at social change, specifically in support of social justice or the social good.

Social justice/socially just: The processes and outcomes of transforming power relations and removing injustices in society regarding the distribution of wealth, opportunities, privileges, respect and outcomes. These approaches focus on identifying and challenging the structures, practices and relations that produce and sustain injustices.

White privilege: The unquestioned and unearned set of advantages, entitlements, benefits and choices bestowed on people solely because of their whiteness. Generally white people who experience such privilege do so without being conscious of it.

Acknowledgements

Phase 1 of the Making Spaces project was made possible through funding from Lloyd's Register Foundation and our partnerships with the three makerspaces whose efforts and contribution were invaluable to the project. A huge thank you to the whole team at:

'Community' Makerspace

'Digital' Makerspace

'University' Makerspace

Thank you to all the practitioners who designed and developed makerspace sessions and shared their practice, experience and insights with us:

Asa	Mark
Clara	Mike
Dot	Rachael
Fiona	Sara
Jack	Sarah

It was a pleasure working with the youth co-researchers who produced outstanding work and showed remarkable levels of understanding of equitable practice and commitment to developing makerspace programmes. We'd like to thank all the young people who worked with us, including the following who provided us with a pseudonym:

Callum	Matilda
Carlos Torres	Maya
Cloud10	Mike
Dave	Mushroom
Eileen	Noffie
Frank	Oscar
Gaimaniah	Phranke
Isaac	Ralph
Karen	

Thank you to our external advisory board members who helped to inform our work:

- Ana María Ramírez
- Anna Bird
- Ayşe Inan
- Edna Tan
- Heather King
- Kat Braybrooke
- Kim Foale
- Nettrice Gaskins
- Shirin Vossoughi

Thank you to our funders Lloyd's Register Foundation, and in particular to **Tim Slingsby**.

Thank you to those who helped to co-ordinate the photographs featured in this report, especially:

- Alan Hamer (ahphoto.co.uk)
- Eight Creative Agency (eight.org.uk)
- Rafaela Teixeira Osawe

This report was designed by:
Cavendish Design and Advertising
(cavendishdesign.co.uk)

This report can be cited as follows:

Archer, L., DeWitt, J., Freedman, E., Thomas, K. (2022). Developing equitable practice with youth in makerspaces: Ideas and case studies from the Making Spaces project. London: University College London.

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The Making Spaces
project is funded by
Lloyd's Register Foundation:

