August 2017

Science and the youth sector

Context matters for disadvantaged young people and informal science activities

Science and the youth sector

Context matters for disadvantaged young people and informal science activities

Renaisi

John Hitchin, Tessa Horvath and Olivia Petie

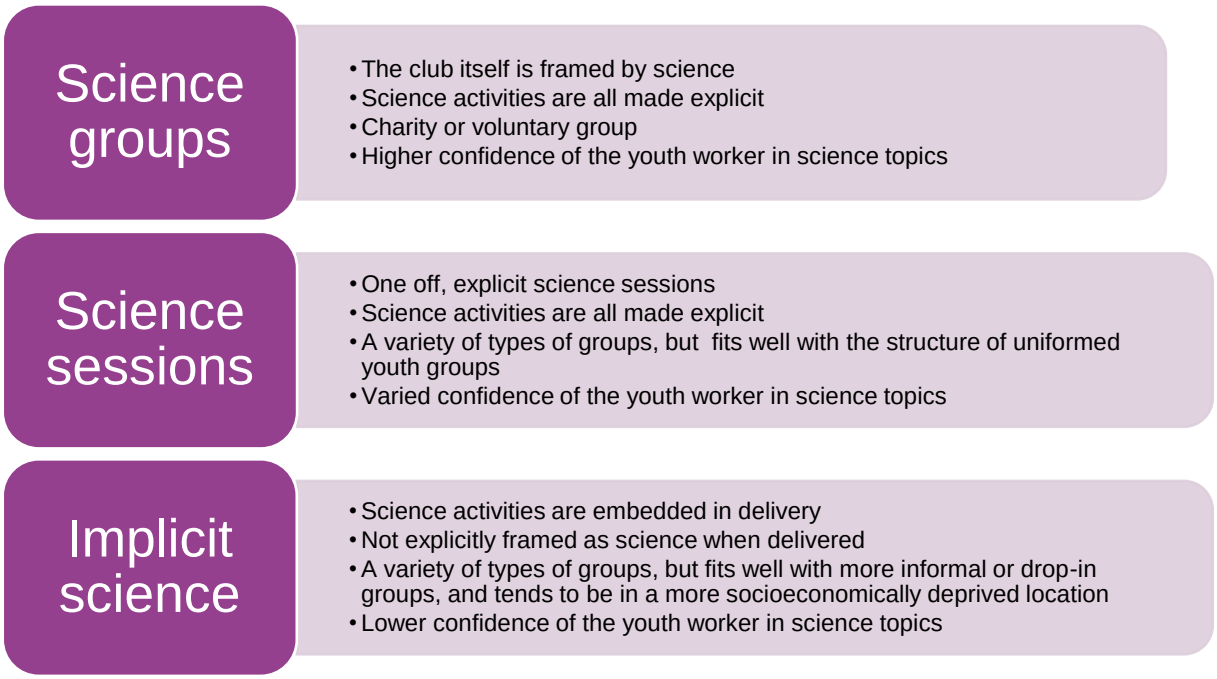
CONTENTS

1. EXECUTIVE SUMMARY

Informal science activities in out of school settings have the potential to influence young people's perceptions and attitudes about science and offer the opportunity to support them gaining wider skills.

This qualitative research with over fifty young people underlines that young people's previous backgrounds in, or experience of, science are important in shaping their engagement with informal science learning (ISL). The extent to which science has featured in the young person's background has a marked effect on young people's perceptions towards science in general, which has knock-on effects on their thinking about science in school and out of school settings. The research identifies five broad views of what science is for the young people, with science being explosive experiments, a technical body of knowledge, boring, hard, or a process (closest to the idea of the scientific method). These different views are important in shaping much about how young people engage with ISL activities and science more generally.

The research also identifies three approaches to delivering ISL and saw different skills learnt in different settings. It is clear that context matters.



Young people appear to view ISL experiences as fun, but there are different ways to engage with them, and their experiences of ISL are not consistent.

As well as influencing young people's perceptions and attitudes, ISL activities appear to be beneficial in six areas:

- strategic thinking
- perseverance
- confidence
- learning about specific scientific processes
- teamwork and
- creativity skills.

While the evidence that these activities influence aspirations is very limited, there is some early potential in them. This supports the need for systematic research into the longer term effects of different types of ISL activities in youth work settings on young people's science attitudes, aspirations and perceptions of. The concepts and framework of this study give a clear starting point for future work.

2. INTRODUCTION

The Wellcome Trust believes that science, technology, engineering and mathematics[1] are enabling. Science enables people to make sense of the world around them, enables people to make informed decisions, and enables people to pursue a wealth of exciting and fruitful career opportunities.

A 2017 report by The Joan Ganz Cooney Center at Sesame Workshop and the Frameworks Institute looking at science education in early childhood in the United States takes an ecological systems approach to understanding how children experience and learn science in those formative years, and what might restrict or be a barrier to their engagement.[2] This is based on the position that in influencing and educating a young person, the impact of interrelated environments is significant, complex and important to consider.[3] This same ecological approach was used in recent research published by Wellcome on engaging young people from disadvantaged backgrounds in particular and is widely accepted.[4]

In that ecological system, micro- and mesosystems sit immediately around a young person; as illustrated in Figure 1, the micro- and mesosystems have three key environments:

1. home, parents and siblings
2. schools, teachers and peers, and
3. their neighbourhood and community spaces they access.

This third space, which is the least clearly defined, is the subject of this report.

2.1 The evidence challenge

Despite the growing body of knowledge that Wellcome and others have been pulling together in recent years, there are significant gaps in our knowledge about the role of informal science learning (ISL) in the future aspirations, perceptions, attitudes and skills of young people.

[1] These subject areas are frequently referred to as 'STEM' or 'STEM subjects'. However, other Wellcome research highlights the barriers that this acronym can create, so throughout this report 'science' is used to refer to all the different science, technology, engineering and mathematics disciplines.
[2] McClure, E. R., Guernsey, L., Clements, D. H., Bales, S. N., Nichols, J., Kendall-Taylor, N., & Levine, M. H. (2017). *STEM starts early: Grounding science, technology, engineering, and math education in early childhood.* New York: The Joan Ganz Cooney Center at Sesame Workshop.
[3] Bronfenbrenner, U. (1977). Toward an experimental ecology of human development. *American Psychologist*, 32(7), 513–530.
[4] Wellcome Trust, (2014). *Experiments in engagement: Review of literature around engagement with young people from disadvantaged backgrounds.*

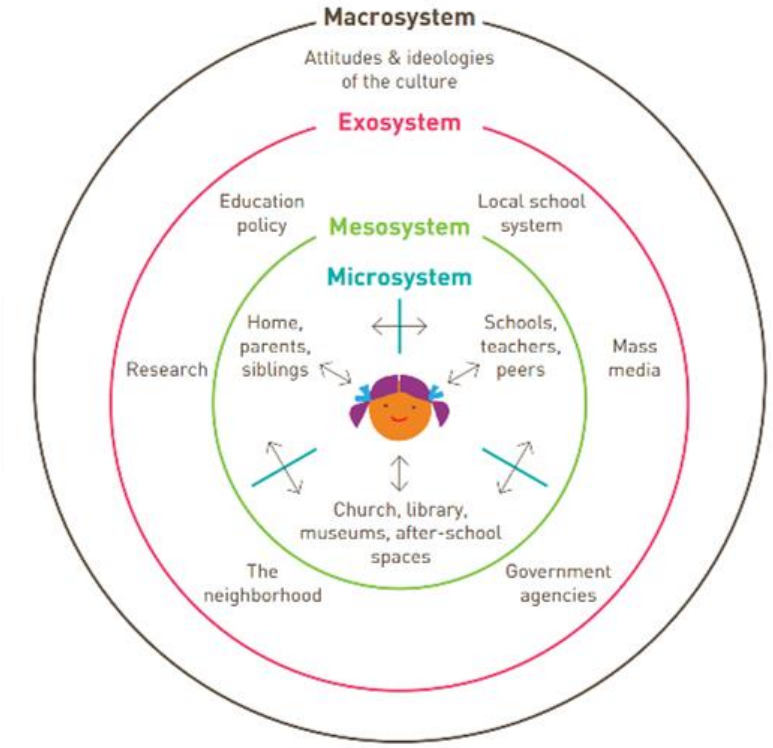


Figure 1 – Ecological Systems Theory, from McClure et al (2017).

It is known that there is a strong role for social, cognitive and affective variables in forming interest in all subjects, including science. Further, this can be demonstrated in a variety of settings.[5] This suggests that there could well be an important role for youth workers who work with young people in out of school settings[6] in influencing young people's future choices. This is underlined by the considerable research and evidence on the relationship between interest in science careers earlier in childhood and the likelihood of gaining a science degree.[7]

However, research does not tell us much about what ignites an interest in science, what sustains it over time, and the role of ISL activities in influencing that interest.

There is evidence that ISL activities have the potential to stimulate curiosity about science and improve understanding of science concepts, but there is uncertainty as to whether it shapes aspirations. Recent research has also begun to question what the key variables in shaping future decisions are and whether 'science capital'[8] has a much larger role to play.[9]

The lack of good quality longitudinal data measuring the impact of informal science experiences on young people poses a significant challenge. This report sits within this area of study, but does not seek to address this challenge.

[5] Lent, Brown, Hackett (1994)
[6] The words 'youth workers' and 'youth work' can often be associated with delivery of statutory services. This report uses the term 'out of school settings' to refer to the diverse settings where adults (referred to as 'youth workers') help young people with their personal and social development, especially young people affected by disadvantage. 'Out of school settings' should be interpreted as a setting entirely distinct to school and 'formal' learning – it does not include homework clubs or afterschool clubs.
[7] Tai, R.H., Liu, C. Q., Maltese, A.V. & Fan, X. (2006). 'Planning Early for Careers in Science', *Science* 312.
[8] See 4.4 – Science background, for more on science capital.
[9] DeWitt, J. & Archer, L. (2015). 'Who Aspires to a Science Career? A comparison of survey response from primary and secondary school students'. *International Journal of Science Education,* 37:13, 2170-2192.

2.2 The role of Wellcome in supporting science learning

Wellcome has a history of investing in science learning and education in a variety of settings. It believes that all young people should have the opportunity to access, engage with and participate in science in a way that is relevant to them.

Wellcome's 2012 review of informal science learning shows that ISL experiences might be particularly beneficial for young people from socially disadvantaged backgrounds, who are more likely to find science subjects unengaging at school.[10] Therefore, work to = promote access to science for all should include many opportunities to learn about science in informal settings.

Building on the evidence from this literature, Wellcome began some work to empower and enable youth workers to include ISL experiences within their programmes, thereby engaging and enthusing young people with science. Traditionally sports, the arts and outdoor activities are used to engage disadvantaged young people and the youth sector has developed broad expertise in these areas. However, youth workers often lack the confidence to deliver science related activities.

2.3 This report

In 2015, Wellcome partnered with The Prince's Trust. The Prince's Trust had already identified science, technology, engineering and maths as key topics that they would be including in their offer to young people, and were therefore natural partners for Wellcome. Working collaboratively with The Prince's Trust, the Natural History Museum, At-Bristol, Glasgow Science Centre and the Centre for Life in Newcastle, Wellcome led the development of an ISL training programme for The Prince's Trust's Programme Executives working on the Fairbridge Programme.

The Prince's Trust training was revised in 2016 and rolled out for other youth workers. The intent was to support them to incorporate some ISL activities into their standard practices and approaches.[11]

This report presents research on the young people who took part in activities delivered by youth workers following their 2016 training. A qualitative research study was designed to explore four linked question areas about the experiences of those young people, as follows.

2.3.1 Attitudes

- Do ISL experiences have any effect on young people's attitudes to science?
- Do fun, engaging ISL experiences in a trusted out of school setting help to address the ideas that science is hard and 'not for me'?

2.3.2 Perceptions

- How relevant do the young people involved in the research consider science to be to themselves and their everyday activities?
- What value do they attribute to the ISL activities specifically and the opportunities that science offers generally to their daily lives, future study, training or potential careers?
- Do they see any transferability of science skills for other roles?

[10] Wellcome Trust (2012). *Review of Informal Science Learning.*
[11] Wellcome Trust (2016). *'STEM-ulating' Youth Workers. A collaboration with The Prince's Trust.*

2.3.3 Aspirations

- Have any of the young people re-evaluated science-related options they hadn't considered before or had previously discarded?

2.3.4 Benefits

- What value do the activities have for science-specific skills for the young people?
- What value do the activities have for personal and social development for the young people?
- Are there any negative impacts from the experience of the activities?

The findings presented within this report are based, almost exclusively, on interviews with 58 young people who had experienced the ISL activities within their out of school setting. This has been supplemented by a set of 20 interviews with youth workers from separate organisations, and some observations of the delivery of the activities. Further details on this process and some of the challenges can be found in the methodological appendix. Wider research is also referenced when used.

The report from this point is structured into five chapters:

- **Chapter 3 –** the background of the programme.
- **Chapter 4 –** the two significant contextual influences on the young people's experiences of these activities: the youth organisation that was implementing them and the personal background of the young person.
- **Chapter 5 –** the findings of this research: exploring the young people's perceptions of science, how the young people experienced the activities and what the young people gained from those experiences.
- **Chapter 6 –** the analysis of these findings, identifying the drivers of the different experiences of the young people.
- **Chapter 7 –** the implications of these findings.

3. THE PROGRAMME AND YOUTH ORGANISATIONS

In 2015, Wellcome partnered with The Prince's Trust, At-Bristol, the Centre for Life and the Natural History Museum to develop and deliver a training programme for The Prince's Trust's Fairbridge Programme youth workers ('Programme Executives'). The training was designed to inspire, empower and enable the Programme Executives to include science activities within their work.[12]

In the spring and summer 2016, an adapted version of the training was rolled out to youth workers from a variety of organisations at ten venues across the UK. The training sessions were hosted and delivered by a local ISL organisation and ran for two full days across a single weekend.

Training location	Delivery partner
Cardiff	Techniquest
Manchester	MadLab
Belfast	W5
London	Natural History Museum
Hull	The Deep
Newcastle	Centre for Life
Bristol	At-Bristol
Glasgow	Glasgow Science Centre
Birmingham	Thinktank
Liverpool	Catalyst

Table 1 – Training locations and the local delivery partner. Delivery partners included science centres, museums and aquaria

133 youth workers from a diverse range of organisations attended these training sessions. The objective was that they take the learning and confidence from that training to do some ISL activities with the young people they work with.

The youth workers came from a diverse range of over 80 different organisations from across the sector: local authority providers, local branches of national charities, small voluntary led youth groups, science-focussed youth charities, uniformed groups and further education providers.

[12] Wellcome Trust (2016). *'STEM-ulated' Youth Workers. Examples of STEM sessions developed by staff at The Prince's Trust.*

The light-touch and empowering approach that the training took meant that there were two notable influences on the young people who would ultimately receive the science activities.

1. The **youth workers had to opt into** the training, go to the effort of participating in it, and implement it in their practice. This created a bias in which organisations went, and which young people ultimately received the benefit.
2. There was **not a standardised programme** that the youth workers delivered when they returned to their organisations. They were instead able to pick and choose which topics/science activities they used, depending on their own and the young peoples' interests, and in a way that fitted with their organisational context.

These contexts are explored in the next chapter, as they influence the findings of this research.

4. THE CONTEXT AND INFLUENCES ON YOUNG PEOPLE

In attempting to understand how ISL activities could affect the attitudes, perceptions and aspirations of young people, there are a range of contextual issues that will influence how they experience those activities.

4.1 Youth worker perspectives

Before visiting the young people, researchers interviewed the youth workers to understand how they were implementing their science training. The research also observed the delivery of some of those science activities by the youth workers interviewed.

Youth workers had different motivations for getting involved in the training offered. For some their motivations were specifically related to science: either recognising the need to engage the young people they work with in science; it being part of their organisations strategic direction to include more science-based activities; or recognising that this is an area of interest for some funders at present. Other motivations were not related to science specifically; for example, they were looking for ways to broaden their offering, wanted to learn new activities to do with the young people, or thought the training course sounded fun and fitted in with their timetable.

Science was seen as a **knowledge gap** for most youth workers before the training, with the exception of those who ran science-specific groups, who nonetheless reported feeling more confident after the training.

The youth workers saw these activities as being as much about **personal and social development** (specifically referencing confidence and team work) as being about learning about science or having any influence on the attitudes the young people have towards science.

The use of inexpensive and **easily accessible materials** was a significant factor in deciding what activities to take forward from the training they were given.

Many of the youth workers understood that the young people they worked with may be less likely to feel that science in school is relevant to them, accepting the rationale for Wellcome's work. There were, however, two quite different views about what to do about that. Some workers felt that **"science-by-stealth"** would be useful for the young people that they worked with, introducing the concepts and skills without trying to describe them as being about science. Others, however, felt that it was important not to hide the science, but to give young people **space and freedom to learn** about it on their own terms.

Some youth workers were embedding more science learning since doing the training (which took place in in spring and summer 2016), so interviews were conducted from August 2016 to January 2017 to try and allow for this. However, many had not done any ISL activities at the point of research or had only done so once. This highlights one of the consistent challenges of

understanding the impact of science education in informal settings – there is inconsistency in take-up, practice and approach by the organisations themselves.

4.2 Types of delivery

The interviews with youth workers, along with some descriptive information about the youth organisations that were engaged in this research, was used to identify three approaches to implementation.

The typologies below detail: how different organisations position science within their wider delivery, how explicit they make the science, what kinds of organisations are more likely to fall into each category, and the level of confidence the youth worker is likely to have in delivering science.

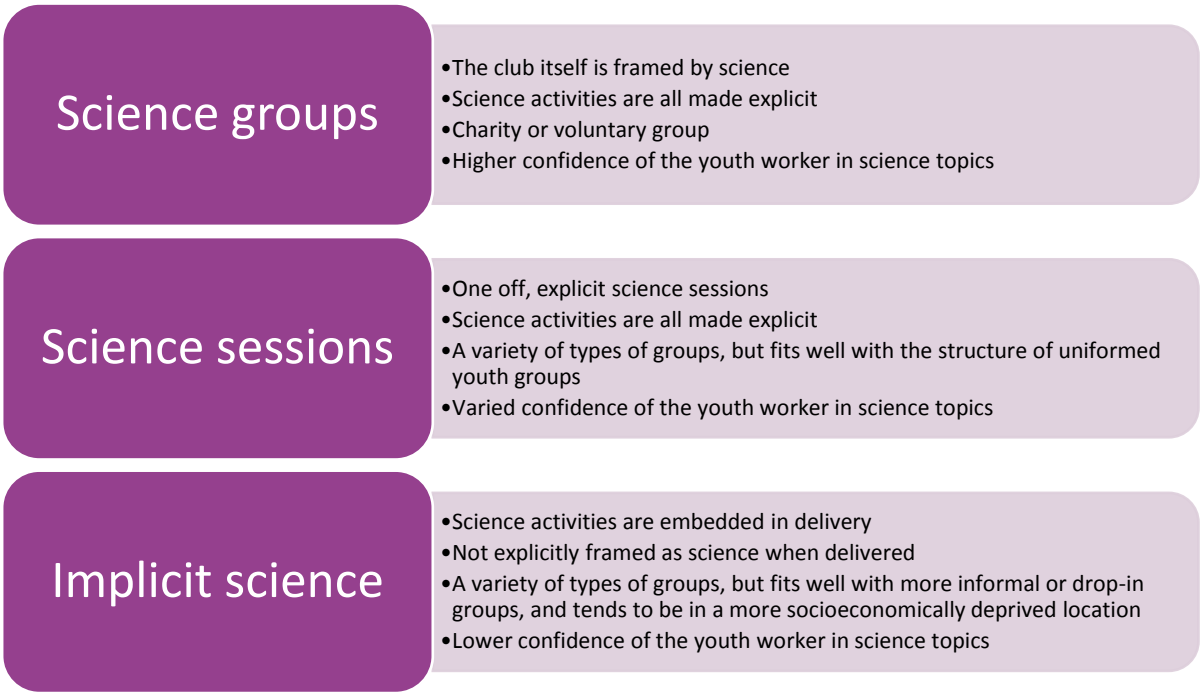


Figure 2 – Types of science delivery in youth groups

4.3 The young people

Wellcome's training was ultimately intended to benefit young people from more socio-economically disadvantaged backgrounds. However, the take-up of training was quite varied and some groups that received the training worked in less deprived areas.

This research sampled youth organisations that would allow direct interviews with the young people taking part in ISL activities. Accordingly, our sampling technique focused on the *youth organisations*, not on the *young people* themselves. The sample did include:

- all ten areas where training took place
- the spread of deprivation levels worked with by organisations that attended the training and
- a combination of local authority, voluntary sector, and uniformed groups.

However, the sample should **not** be considered as representative group of young people who participate in youth organisations. It is worth noting that:

- the research participants were all between the ages of 7 and 15 with the average age being just under 10 (given the importance of that age in other research, this may be an important[13])
- girls were oversampled at a ratio of 3:1 and
- the research participants were primarily of a white background – few youth organisations in the sample worked with children and young people from a BME background.

See 8.1.4 for more details on the sampling challenges.

4.4 Science background

Science capital is a concept that has been developed in recent years. It has been driven by the ASPIRES team, led by Professor Louise Archer, previously based at King's College London, now at the Institute of Education at University College London. The initial work looked at the science and career aspirations of 10- to 14-year-olds in the UK.[14,15] As a concept, science capital helps explain why some young people participate in post-16 science and others do not. In real life, it can be considered as the science-related knowledge, resources, attitudes and experiences that people acquire.

In this research, we explored four areas of analysis that have some similarities to the science capital concept. These four areas were used to understand the existing science background of the young people we interviewed. It is clear that these overlap with science capital as can be seen in the figure below, but they were not designed to replicate it.

Eight dimensions of science capital

- Science literacy
- Science-related attitudes, values and dispositions
- Knowledge about the transferability of science
- Science media consumption
- Participation in out-of-school science learning contexts
- Family science skills, knowledge and qualifications
- Knowing people in science-related roles
- Talking about science in everyday life

Science background questions

- Experience of science-related activities
- Current hobbies
- Future career interests
- Parents' or carer's jobs

[13] Archer L et al (2010). "Doing" Science Versus "Being" a Scientist: Examining 10/11-Year-Old Schoolchildren's Constructions of Science Through the Lens of Identity. *Wiley InterScience Science Education*; 94 (4): 617–39.
[14] http://www.kcl.ac.uk/sspp/departments/education/research/Research-Centres/cppr/Research/currentpro/Enterprising-Science/01Science-Capital.aspx
[15] Archer et al (2013). *ASPIRES: Young people's science and careers aspirations, age 10-14*, King's College London.

These answers were combined to create three ‘levels’ of science background – high, middling and low – giving a relatively even spread of levels across the group. The science backgrounds[16] seen in this research were diverse.

It is clear that, of the sample, those young people with higher levels of ‘science background’ were typically situated in less deprived areas. This was particularly the case when looking for parental influence and background. The experience of different activities was more diffuse across the socioeconomic spectrum, highlighting the link between socio-economic status and parental influence.

The ASPIRES research highlighted the importance of science capital in influencing future choices. This research is using ‘science background’ to understand how it relates to young people’s experiences of ISL activities.

[16] Information about this analysis can be found in Annex 1.

5. RESEARCH FINDINGS: SCIENCE IN A YOUTH WORK SETTING

With the context set in the previous chapters, this chapter now looks at the main findings of the research, and three areas of focus for understanding the experiences of the ISL activities.

1. What were the young people's perceptions of science?
2. How did the young people experience the activities?
3. What did the young people gain from those experiences?

The following chapter looks at how contexts, science background, perceptions and experiences interact.

5.1 Perceptions of science

5.1.1 When you hear the word 'science', what do you think of?

When the young people were asked what they think of when they hear the word science, there were five broad responses they gave. These were explosive science, technical science, boring science, hard science and science as a process and are illustrated in the table below. Only one young person used the word 'fun' in their description and nobody used the word 'creative'.

Idea of science	Example
Explosive science	*"I think of little test tubes and like green stuff and explosions and weird things that should not normally happen, like if you press through it with like cables and it makes a sound."*
Technical science	*"Forensic, biology, chemistry, physics and chemicals, atoms, alkali, marine biology, the human body."*
Boring science	*"I don't like science... Science is kind of boring with experiments and doesn't have any games."*
Hard science	*"I don't know why but I think it's more of like a writing thing and for some reason I just think it's gonna be difficult … I already find maths a bit tricky but when I hear science I don't do it very often and I think it's gonna be so hard."*
Science as process	*"Experiments, logic, strategies, teamwork, thinking and coming up with lots of ideas which could help the science get better."*

Table 2 – Different views of 'science'

These five views can be grouped together to those that saw science primarily as a body of knowledge (that may be technical, boring or hard) and those that saw it primarily as a process or activity.

5.1.2 Science in school and the ISL activities

These five categories also described young people's perceptions of science at school and the ISL activities they took part in (see Table 3), and there was a relationship between their ideas of science as a concept, science at school and ISL. However, they did not overlap neatly and 'science as a concept', 'science at school' and the ISL activities should be considered separately. The interplay between these ideas appears to influence the perceptions young people had about science.

'Fun' was a word that was used universally to describe the ISL activities that they took part in. They also frequently described science at school as fun, particularly when they talked about the process or activities of school science.

Ideas of science	Science in school	ISL activities
Explosive science	There was variance in the degree to which school based science was perceived to fit the idea of science as being about 'explosions', 'Bunsen burners' and 'chemicals'. Some said they did this type of activity in science at school where as some said they rarely did experimentation at school.	Many young people saw these activities as being active and at times explosive, but not in the same way as school science.
Technical science	Young people regularly used scientific concepts to describe science in school.	Young people rarely used scientific concepts to describe the informal science activities.
Boring science	Some young people felt that science at school was boring. This was often related to the written element of science at school. Most enjoyed science experiments at school but some said they did not get to do them.	None saw these activities as boring
Hard science	Some said they found science at school hard, but reflected that this was often challenged when they did the experiment and found it wasn't as hard as they thought.	Some said they found the ISL activities challenged their initial perception that science would be hard.

Ideas of science	Science in school	ISL activities
Science as process	The young people did not discuss the process of testing and learning at school in any detail, although a few said that science at school was about 'learning new things'.	If there was a clear process of experimentation in the activity the young people tended to see it as science.
Fun/creative (this was never used to describe 'science as a concept', so is not in Table 2)	Science at school was frequently described as fun – especially when the young people did experiments.	Some young people perceived the activities to be 'art and craft' rather than science. When the element of experimentation was explicit they perceive it to be science.

Table 3 – Science in school versus ISL activities, depending on the view of science

5.2 Experience of the ISL activities

The young people took part in a variety of ISL activities. These can be categorised into

- those that were goal oriented and contained a competitive element
- those that were goal oriented but had no competitive element and
- those that were creative or experimental and neither goal oriented nor competitive.

Many of the ISL activities involved using materials to create an object designed to behave in a certain way, or using existing objects to reach a specific goal. For example, they made pop rockets and parachutes that would then be tested to see how they behaved; they used marshmallows and spaghetti to build a structure; and they used balloons to create static electricity to move a can. Within the sample observed in this research, the majority were goal oriented activities.

Goal oriented activity – competitive element

These activities had a specific goal or end product that the young people are aiming to achieve, and there is a competitive element to this either in teams or as individuals.

Example:

Create a boat from the available materials that will float in a tub of water. The winner is the person whose boat can hold the most marbles before it sinks.

Goal oriented activity – non-competitive

These activities had a specific goal or end product that the young people are aiming to achieve, however there is no explicit competitive element.

Example:

Make a cupcake in a mug. The young person must estimate what mixture of different ingredients will create a cupcake when placed into the microwave. There is no competitive element, but the goal is to create an edible and nice tasting cupcake.

Creative activity

These activities do not have a specific goal or end product that the young people are aiming to achieve; instead the focus is on experimenting with different materials to see what happens.

Example:

Mix corn flour, water, and food colouring to create a slime mixture that can be played with.

For most of the young people they had not done these specific activities before. A very small number had done a similar activity at school or with another youth group. In youth groups where there was a scientific focus for the club these activities may be like others they have carried out before. However, in youth groups with a wider focus these activities were highlighted as being different to the types of activities the young people usually do.

5.2.1 Learning through experience

The young people overwhelmingly described the activities as ‘fun’ and ‘exciting’. The four aspects of the activities that young people most frequently described enjoying were:

- the process of creating or making something
- the satisfaction of seeing the final product
- the use of team work in completing the activity and
- the novelty of doing something new.

Alongside enjoying the experience, the activities offered the young people opportunities to develop several different skills such as teamwork, creativity, perseverance, strategic thinking, and more. Many of the young people did not explicitly recognise that they had developed these skills, although they may have described working in a team or being creative in the activity.

Some could identify things they had learnt or could reflect on how their skills had developed through doing the activity. This suggests that more young people may have developed the skills mentioned in some way, or that additional skills may have been developed that the young people were unable to reflect on themselves.

The youth workers also described how the activities could contribute to the personal and skills development for the young people. Some of the skills that the young people reflected on were also identified by the youth workers such as teamwork and confidence.

This section of the chapter shows an important move from 'fun' to 'learning through experience' and highlights the challenge of novelty in creating the learning experiences.

Going through the process

When asked to describe the **process** they had been through in the activity, most of the young people could describe the steps they had taken. For many this process was what they particularly enjoyed or found fun:

> *It was very fun because you were building something, see. You were actually building something from scratch.*

For others, it was a specific part of the process that they enjoyed, such as the excitement of putting the lid on a pop rocket before it explodes, or mixing different substances together. Overall the making and doing of the activity was a key aspect of what made it fun for the young people. This was particularly prevalent in the goal oriented activities. Of the young people who took part in the solely creative activity, the process itself was not highlighted as being what they specifically enjoyed.

Fun was not the only descriptor for the activities. A key experience that moved the children from fun to learning something specific was the experience of **trial and error** within the ISL activities. For goal oriented activities specifically, the young people described the process of thinking through how to create or manipulate the object(s). There was a clear idea of how they wanted the object to behave when they had finished. This led them to reflect on the process of making the object and whether it achieved what they wanted it to. Many described the ISL activities as hard or challenging and noted that they involved a process of working something out by thinking it through and testing. The young people showed a sense of reflection on the challenge of the activities and the element of working out a strategy to approach:

> *You have to put your mind to it.*

> *It shows you strategies for building things. You have to really think about strategy.*

They were also able to describe the trial and error process that they went through to reach the result:

> *I try and make it smaller so if it's tall it can wobble off. Because if you put too much weight and it falls it will be really bad. If it's small it's easier. My first time we did a big one but then at the last minute it broke and it was really frustrating. Then when we did the small one it was better than we thought.*

In this sense the young people reflected on trying one approach to reach their end goal, learning something, and subsequently trying a different approach. Most liked this element of

challenge, and while they described it as ‘frustrating’ this didn’t usually detract from it being ‘fun’.

> *It was fun but sometimes frustrating again. I kept on getting it wrong. I’d done everything and then I’d put it down and the pens were leaking so I had to go back. But it was really fun.*

Instead of detracting from the fun, this element of challenge made it satisfying or rewarding when they achieved what they wanted do in the activity (for example, when their pop rocket fired, or egg case protected the egg when they dropped it).

> *The balloon one was horrible for me, until it finally worked out.*

In the instances where there was disappointment and they did not achieve what they hoped through the activity (if their rocket didn’t take off, or their egg wasn’t protected by the case), then this led to reflective learning:

> *When it falls over you get frustrated…I learnt that trying to go small and concentrating is better.*

But frustration could lead to a negative experience of the activity if they didn’t receive help, and it was clear that this activity was not happening in isolation:

> *[I didn’t learn anything] because I didn’t really know what to do. I needed someone to help me.*

Those who had done the activities before, either through having a second chance to try at something or having done the activities elsewhere, had a different experience to those who were experiencing them for the first time. These young people generally found the activities less challenging but still ‘fun’ and sometimes rewarding as they already know how to do it:

> *The first time we did it I realised because we get tape and a cup, I had to put tape on the bottom to cushion the fall of the egg, so every time I do this first. It’s fun.*

Through the process of trial and error the young people demonstrated learning methods and, at times, **strategic thinking**. Upon completion of the activity the young people were often able to reflect on something specific they had learnt from going through the process. For some this came from reflective learning as they went along, while for others it came from doing the activities more than once, enabling them to consolidate their understanding of how to do the activity.

> *We had to think about which order…it goes. And if I add too much of this, is it going to make it all gummy?’* [Cupcakes in a mug]

In this sense, the young people could identify that they had learnt something specific, such as, how to build a parachute. By going through the process of trial and error the young people demonstrated the ability to learn specific things based on their experiences of getting it wrong beforehand; many reflected on the value of **perseverance and patience**.

> *I learnt from the roller tins how hard it is to actually do it. I learnt you don’t always get your way if you know what I mean. You have to really work at it but when you get it it’s good.*

> *[I learn that] you just have to keep going. You have to keep carrying on with what you are doing.*

[For the dominoes activity] we all had to be patient and wait our turn and make sure we didn't knock them over.

Creativity

Another fun element of the process that the young people highlighted was being creative. For some, they saw the activities primarily as an act of creation – similar to art and craft. They framed the process of the activities in a different way to those who enjoyed the systematic building or doing something, instead highlighting the creativity behind the activity:

It was very fun. I liked that we get to create and make our own designs.

While the creative element for some of the young people was an element of fun and enjoyment, for others this was felt to be a skill they were developing or something needed to complete the task. This young person reflects on how the activity depends on using your **creativity skills** to think about how best to approach the problem of balancing the spaghetti and marshmallows:

And with this activity [spaghetti and marshmallows] it's about how creative you can be.

Teamwork

Many of the activities observed had a **teamwork** element to them, particularly those that were goal oriented and competitive. However, it was not just those that were goal oriented and competitive in which working with others was highlighted as a fun aspect. For example, in the quote below the young person worked as a team to mix different ingredients together that created a slime substance the young people then enjoyed playing with:

I think it made it more fun because you got to like all work together and help each other and it just makes it more fun to do to around people.

In several instances, the young people reflected that it was beneficial to approach the task using **teamwork** as this enabled them to think through how to approach it together. This led them to reflect that they can achieve more when working together than working alone.

We learned how to work together. We learnt that it's better to work together than on your own.

Many others also mentioned working in a team as part of the process or as an element to the activity that they enjoyed. While this does not explicitly show that they learnt something from this experience, or could reflect on this, the teamwork element was still strong within the activities.

Confidence

The young people highlighted seeing the **final product** as another aspect of the activity that was fun for them. For some this was that they liked what the final product was, such as the slime created:

That was so fun because you hold it and it will stay completely hard and if you leave it, it drips down and it's horrible, but it makes your hands nice and soft.

While others expressed satisfaction in discovering something new, or fascination by the final result:

I think it was really cool because I've never seen a cap blow off so fast before. I enjoyed most counting down to when it went pop.

The way it draws spirals without using the pen…It's really cool to think how it moves round by itself and creates [images] like that.

Regardless of whether there was a specific goal intended at the end of the activity, the young people found the end product to be a fun aspect of the activities.

For some young people, the fact that the activity was **something new** that they had not done before was also a key reason for why they enjoyed it and found it fun. This was sometimes because it offered variety to the types of activity available to the young people, or because it gave them access to activities that may normally not be accessible to them.

Through this process, some young people explicitly said that they felt they were **building confidence** through doing the activities. This was achieved through the process of creating something in itself, and through a sense of achievement from seeing their creation achieve what they wanted it to, especially when the creations were tested in a competitive environment.

It's hard for it to stay up. It's sort of like building your confidence because you're building up and up and up – and building your confidence to make it go bigger. It's about your confidence.

I like it [competition] for 2 reasons. One of the reasons is that it builds up your confidence levels.

Linked to confidence, many described their sense of surprise at how straightforward it was to do these types of activities. Through doing the activity, some of the young people found that it **challenged their initial perception** that it would be hard and difficult. They perceived the outcome of the task that they were hoping to achieve to be hard, but they found through doing it that it was easier than they thought. In this sense the young people did not explicitly reference confidence, but reflected on how their initial perceptions had been challenged:

I've learnt like that it's not just that you need all this stuff that's complicated. That it's so easy. A pen, a pot and a circuit and that's it!

Science learning

In a few instances, the young people reflected that they had learnt about **science processes** that had enabled their creation to behave in the way they were expecting or not, for example, they referred to static electricity as the force that enabled the can to move for the can race activity. However, reflections on this type of learning were only evident in a small number of cases.

Yeah the balloon thing was really cool. I didn't realise you could rub it on your hair or yourself to make static.

One young person also reflected that the activities contained experiential learning that could be beneficial for future aspirations. As the activities provided an opportunity to try out the skills and processes needed for certain jobs within the science sector, the young person reflected how this might be beneficial experiential learning:

Say if you want to be a builder when you're older. You can experience how to, what materials to use.

5.2.2 Changing attitudes, perceptions and aspirations

As discussed, the young people showed a range of different attitudes and perceptions towards science. From the data gathered, the long-term change in attitudes, perceptions and aspirations cannot be tracked. However, through applying the data to the corresponding literature a relationship can be seen between the experiences of the young people; the skills that they gain; and how this may lead to changing their attitudes, perceptions and aspirations towards science. Additionally, some youth workers described how they felt that the ISL activities had encouraged the young people to change their perceptions and attitudes towards science.

Attitudes and perceptions

Having taken part in the ISL activities at their youth group, most of the young people expressed an interest in doing more similar activities again in future. Some young people reflected on the benefits of doing ISL activities outside of a school learning environment, in particular that the youth group setting was more fun than doing them at school. Other comparisons the young people gave were that the ISL activities were more accessible, offered a different learning approach, or showed them new activities that they had not done before.

Additionally, among those young people for whom the science element of the activities was not made explicitly clear there were mixed responses of whether they would consider the activity as science. This means that many of the young people did not associate the activities with what they consider to be science, or what science is like at school. Therefore, this raises the question of whether young people's their attitudes towards science and perceptions of it will be challenged, if the so not consider the activity to be science related.

Figure 3 – words used to describe the informal science activities

Figure 4 – words used to describe science at school

By comparing the young people's idea of science as a concept with their view of science at school and the ISL activities, some patterns emerge. Though not mutually exclusive, this research highlighted the following relationships:

Ideas of science	Relationship between perception of science and science at school	Relationship between perception of science and ISL activities
Explosive science	This view was connected to experiments at school. For those that saw science in this way: • Some reflected that science at school was 'better' or that there were 'better quality experiments' than ISL activities • Others felt that science at school had too few experiments, or that it was boring because of writing etc.	If a young person viewed science at school in a positive way through experimentation, then they did not see the ISL activities in this way; they referred to them as arts and crafts.
Science concepts	If young people saw science as concepts, then school science was seen as more in-depth/advanced learning than the ISL activities.	These young people saw the ISL activities as 'being science' only when they recognised science concepts within it (for example, static electricity or gravity). They were less likely to see some activities (such as parachute building) as science.
Boring science	Those who considered science boring often described it as boring at school and they did not do much experimentation.	For them, ISL activities were: • a new experience that they don't get to do anywhere else • much more engaging, fun, practical and enjoyable than science at school • more effective for learning than writing.
Hard science	This concept was not widely used to describe the ISL activities, and so there is no relationship between ISL and school contexts in this view of science.	
Science as process	There were no clear relationships for young people who saw science in this way between school and ISL, but these young people reflected that the process of thinking through how to do the ISL activity to create the desired result suggested that the activity was 'science'. "it's sort of science. It's experimenting and creating."	
Fun/ creative	No young people described science as a concept as 'fun/creative' but they did separately describe the science at school and ISL activities in this way.	

Table 4 – the relationship between different perceptions and experiences of science

These descriptions are reflective of the literature. Success in science exams is perceived by young people as more related to hard work than English or maths. This could be particularly important because science is often seen as difficult by young people.[17] Additionally, young people particularly enjoy experimentation, but those from disadvantaged backgrounds are likely to have fewer opportunities for this[18]. While the young people considered the ISL activities to be hard in some way, this word was less prominent and did not detract from the fun of the activity.

Aspirations

In the literature, the three aspects that young people highlight as having the most impact on their aspirations are

- families and the home
- hobbies and activities pursued outside of school and
- lessons and teachers within school.[19]

Therefore, offering an opportunity for the young people to develop an interest in science outside of school and pursue it as a hobby, may go some way to influencing their aspirations.

Some young people reflected on how doing ISL activities might be valuable in encouraging young people to change their career aspirations:

> *I think it's really important because not everyone knows they want to do something in science. A lot of people here have never really done anything to do with science so it's good because it takes into consideration that not everyone is really into it and knows advanced stuff. It can teach people things that scientists would know without making it like too formal or uncomfortable.*

One young person reflected on how science at school can encourage young people to want to pursue a career in science:

> *I think it's really fun and I think it encourages everyone to become something in the future…when maybe it encourages them to maybe learn more and maybe, and maybe it encourages them by giving them the courage to study something and look into it more.*

The perception of science as being 'difficult' stands out in the literature as an important negative factor in reasons why young people are not interested in studying science and pursuing this further in future. This is particularly prevalent in females, who despite demonstrating high attainment, are more likely to lack the confidence to want to pursue science.[20]

In their experiences of the ISL activities carried in out of school settings, some young people specifically highlighted that they were developing their confidence which may have an impact in their confidence to pursue a science-related career in future. These findings highlight some potential routes for aspirations to be altered, but no evidence that it has been.

[17] Wellcome – Science Education Tracker Report.
[18] Wellcome – Science Education Tracker Report.
[19] Interim Research Summary, ASPIRES Project.
[20] Wellcome – Science Education Tracker Report.

6. FROM CONTEXT TO EXPERIENCE

There are two key influencers of young people's experience of the ISL activities; both are contextual factors:

1. the **science background** of the young people before they started the activities and
2. the type of **out of school setting**.

6.1 Science background

The science background of a young person appeared to influence how they viewed science, and therefore the activities. This is the biggest driver of perception, and can potentially prevent changes in perception. The different levels of science background and how this impacted the young people's perceptions of science and experiences of the activities are described below:

Young people with higher science background

- were positive about science, and did not see it as a concept that was either boring or hard
- saw science as being explosive or explicitly stated that they enjoyed experiments
- tended to be more negative about science at school because they felt it focused on the body of knowledge more than the processes
- found a range of things fun about the activities, but never their novelty
- did not change their perceptions of science, nor confidence, nor did they explicitly appreciate the creative elements of the project and
- mentioned patience, perseverance, strategic thinking and teamwork as benefits from the activities.

Young people with middling science background

- had very mixed views on whether they liked science, but tended to see it as technical subject and a process
- particularly enjoyed the practical and making element of the activities and the opportunity to see an end product, and
- saw a wide mix of benefits from the activities, but tended to gain confidence and have their perceptions challenged.

Young people with lower level of science background

- tended to see science as being explosive and technical
- were more likely to be unsure that the informal activities were science at all, meaning that they did not engage with them as such, and

- did not change their confidence and perceptions, but were more likely to think about what they had learnt in terms of creative or strategic thinking.

These findings underline the importance of the science background and experiences of the young people in this setting. When planning ISL activities, it is therefore important to appreciate that different groups of young people will respond in different ways.[21]

6.2 Perceived benefits in different out of school settings

In this section we consider how the perceived benefits of ISL activities vary across the three different out of school settings – science groups, science sessions and implicit science.

Young people saw potential for **strategic thinking** benefits in all settings (e.g., from trial and error, or iterating activities). Given this was inherent in all the activities, it makes sense that it was seen regardless of delivery context.

The *science group* setting was quite different from the other out of school settings. Young people in these settings said that the activities continued to build their **confidence** and **creative skills**, perhaps due to the existing science knowledge of the young people, who are likely to be building on their science knowledge rather than engaging in something for the first time. The creative element of the activities appears to have resonated with them.

The other two types of setting yielded remarkably similar perceptions of benefits, especially around **science processes** and **teamwork**. The difference between the two came in the evidence of **perseverance and patience** in those young people who experienced *science sessions*. This is perhaps because they had the whole session to explore the concepts and will have had them explained to them, whereas for those who experienced *implicit science* may have engaged in the activity and then moved on.

	Strategic thinking	Perseverance and patience	Confidence	Science processes	Teamwork	Creativity skills
Science groups	✓		✓			✓
Science sessions	✓	✓		✓	✓	
Implicit science	✓			✓	✓	

[21] Wellcome Trust, (2014). *Experiments in engagement: Review of literature around engagement with young people from disadvantaged backgrounds.*

7. CONCLUSIONS AND IMPLICATIONS

This research has highlighted some important findings that can be grouped around the key research questions, alongside some wider implications.

7.1.1 Attitudes to science

- Young people's attitudes towards science are shaped by a variety of perceptions, further supporting the analysis of the ecological model. For the young people involved in this research, there was a distinction between their views of 'science' at school and the science activities in the youth organisations.
- In some instances, the ISL activities could have the potential to change wider science attitudes, breaking down the view that science is hard and 'not for me'. But to do this the science must be made explicit, the activity must remain fun, and it should focus more on either the explosive or process views of science, that seem to be most different to science at school, for those who do not like science at school.
- There is potential that if the young person already has a stronger science background, or a strong view that science is quite a formidable body of knowledge, that they would not identify the ISL activities as 'proper science'. As a result, ISL activities would not shift their attitudes towards science (i.e., from being boring to being a process) even if they enjoyed them, but it might increase their confidence in science within their existing attitude.

7.1.2 Perceptions of science

- The use of science background within the analysis of this research highlights that there is a very wide range of views among the young people of the relevance of science to themselves. Some talked about visits, online videos, parental influence and other experiences, while others made no real connection between science and their lives.
- The activities were fun, and there were instances of young people discussing a science benefit that they saw as transferrable to future study or employment. This link was most obvious in those with a stronger science background, and when experiencing a focused science session.

7.1.3 Aspirations

- Due to the one-off intervention of this research, it is impossible to know whether the ISL activities have any influence on aspirations of the young people. The findings are consistent with those of science capital research, suggesting that positive experiences of science in out of school settings could begin to add to the ecology of influence around aspirations. There is no evidence yet from this, or any other research, as to whether or not ISL activities can have a notable impact on aspirations.

7.1.4 Personal, social and emotional benefits

- This research has highlighted six potential benefits for young people from the experience of informal activities:
    - strategic thinking
    - perseverance
    - confidence
    - specific science processes
    - teamwork and
    - creativity skills.

It is worth noting that while there were few negative effects identified with this research, there was a clear potential for some young people to see ISL activities as not ‘proper science’, limiting the potential for these activities to change their attitudes about science.

7.1.5 Implications

There is clearly a distinct set of experiences that can be gained from ISL activities, which depend upon the context of the young person themselves (their science background) and the context of the delivery of the activities. Context matters, and there was no single approach to delivering the activities identified by this research.

The informal youth work space is an important part of the ecosystem of influence on young people. It was easy to introduce science activities into out of school settings at relatively low cost and in ways that were almost universally enjoyable to young people. It has clear potential to broaden and nuance the views of young people about science.

The model taken to encourage ISL relies heavily on the youth worker or volunteer. It is important to understand more about their motivations and views on delivering such activities before making further decisions about how to invest in influencing the skills, attitudes and perceptions of young people. An issue that was identified by this research was the different views of youth workers on the value of introducing science by stealth to young people. By making the intention of the activity less clear to the young person, there is a potential risk to the transition, securing or challenging of perceptions and attitudes about science. It is worth being cautious of using science by stealth approaches for the groups that may need help in changing or reframing their attitudes and perceptions.

Without longitudinal work, there is very little evidence on whether these approaches make real changes to the aspirations of young people about science. This needs addressing through an approach that is both systematic in its tracking of young people, but also able to distinguish between the different types of informal settings that the ISL activities are being delivered in.

Future funding of such activities should test the concepts identified in this research through evaluative or other mechanisms. These should assess whether the frameworks introduced by this research are widely useful and whether a change in the skills, attitudes and perceptions of young people can be evidenced systematically.

8. ANNEX 1 – METHODOLOGY

This study was built around an interview set of 58 young people who had experienced the ISL activities within their out of school setting. This has been supplemented by a set of 20 interviews with youth workers from separate organisations and some observations of the delivery of the activities. Wider research is referenced when used.

8.1.1 Document review

A full and structured literature review was not undertaken as part of this study, as previous work commissioned by Wellcome Trust, and referenced throughout the report, had been conducted in 2014. Therefore, a simpler document review was completed, exploring themes such as science capital, young people's interest in science and the challenges of engaging disadvantaged young people in informal science learning. This aimed to contextualise our research within the literature and helped to guide the remainder of the project, but was not designed to produce a standalone output.

8.1.2 Observed training sessions

In order to understand the delivery of the training sessions and the sort of content that might make up the ISL activities, the research team attended two training sessions, one in London and one in Glasgow. At the sessions the team observed delivery, the different activities on offer, and the youth workers engagement with these. This was not designed as a mechanism to judge or assess the training, but rather to help the formulation of topic guides and tools in the later stages of this research.

8.1.3 Youth worker interviews and setting up visits

Once the training was completed, the research team conducted telephone interviews with youth workers who had attended the training. The aim of these was to understand youth workers perspectives on training and how they have implemented the activities since then. It was hoped that these interviews would be a good opportunity to connect with youth workers at different organisations and arrange opportunities to visit the youth groups.

8.1.4 Sampling challenges

The team initially sought to randomly sample two of the youth workers who attended the each of training sessions, as there was no good rationale for any greater level of targeting in the sample other than a regional spread. However, many youth workers had not implemented the activity yet, did not respond or were unavailable to talk, or in some instances had since left the organisation. This resulted in further rounds of sampling which frequently encountered the same issues. Additionally, of those who were willing to engage in the research, some did not think it appropriate for the researchers to visit to observe the activities and speak to the young people. This was particularly the case with those working with more vulnerable groups of young people such as young carers or those in prisons. There were significant difficulties with timing the

sessions for visits, as some had already done some science activities but wouldn't be repeating soon, or others were not planning on implementing until after the timeframe of the project.

Due to these issues, it was decided to contact the entire sample of youth workers who attended the training. The same issues were encountered, but it resulted in a much larger number of youth workers being interviewed, and the research team was able to gain access to observing sufficient youth groups and speaking with a high number of young people. This means that the most engaged or willing to help youth groups were part of the research. Therefore, findings should not be considered representative of the organisations trained or the young people reached.

Given the sampling focus on youth organisations there were also sampling challenges with the young people involved in the research. This was further compounded by the methodological approach whereby researchers only interviewed young people who were attending the activity on the day of the research and had received parent consent in advance. While there was an initial attempt to be random in interviewing young people, the small number of young people attending some of the sessions, the practical challenges of randomisation, and the ethical need to obtain consent from the child and their parents, meant that in reality there was a clear degree of willingness to be involved built into the participants. This resulted in an inherent oversampling of certain groups. Despite gaining a good spread of organisational types and geographies, the research has oversampled younger participants. The research participants were all between the ages of 7 and 15 and there was an average age of just under 10. Girls were oversampled at a ratio of 3:1, and there was also only one area out of the ten involved in the research where young people from a non-white background were interviewed. This research did not collect personal data from the young people sampled, therefore their socio-economic background has been assumed based on matching the postcode of the delivery organisation to the various national Multiple Deprivation indices. [22] There was a range of different socio-economic backgrounds represented by the organisations that gained the training, and by those sampled in the research (more information about these organisations can be found in Annex 3 – Youth organisations).

In summary, the varied nature of the out of school settings in which this research took place, how the programme was established, and the young people's experience of the research process will all have influenced the generalisability of the findings within the report. The young people are not representative of all young people. Rather they are a sample of those who took part in the activities at the youth organisations that attended the training provided by Wellcome. As well as this, the ad-hoc way in which the ISL experiences were implemented meant that those who took part in the research had made an explicit effort to deliver the activities in advance of the research; this could be further influencing the findings.

8.1.5 Visits to youth groups and interviews with young people

The visits to the youth groups combined observation of the activities with interviewing the young people involved. A semi-structured interview guide for use with the young people was created and can be found in Annex 2 – Data Collection Tools. This was based on observations from the training sessions and youth worker interviews, as well as insights from the initial document review. The interviews were conducted on-site, with a digital recorder when possible, and only after consent had been gained from a parent/carer. The interviews sought to explore the

[22] Taken from English Multiple Deprivation Index, Welsh Multiple Deprivation Index, and Scottish Multiple Deprivation Index.

background of the young people, their science knowledge, experiences of the activities, and their views of science more generally.

An observation tool was also created for when the researchers attended and observed activities at the youth groups. Using an observation tool allowed the team to better capture how the activities were implemented across different youth settings and contexts.

8.1.6 Young people interviews – point in time

It is important to acknowledge that these interviews with young people were one-offs. The informal, drop-in and, at times, irregular approach of many of the youth work organisations that took part in the research made the ambition to track their future experience challenging and considerably resource intensive. This will influence the degree to which claims about any longer term effects can be made, and this has been reflected in the findings and conclusions of the report.

8.1.7 Data analysis

In order to analyse the data, almost all interviews were transcribed. Some young people did not wish to be recorded, and so for these the interviewer took detailed notes throughout and these were used instead. The transcriptions and interview notes were used to create a framework analysis of the data, built initially around the structure of the topic guide. This was done to allow the data across different themes such as age, deprivation level, science background and type of youth group to be analysed. As the analytical process was developed, further columns of analysis were created, and in one area in particular, 'science background', a new variable was created.

The first area of analysis was a list of **science-related activities**, where the young people were asked to identify if they had done any of the activities and when. These included, but were not limited to: visiting science museums, zoos/aquaria; going to after school science clubs; doing experiments/using science kits at home; and science related media on YouTube.

The young people were also asked to self-identify both their **current hobbies** and their **future career interests**, which highlighted a range of science and science-related topics in both areas.

Finally, the young people were asked to describe their **parents' or carers' jobs**, and throughout the interview there were times when the influence of parents on choices or views was highlighted.

In the analysis of the data, a score was created for 'science background' by counting the number of instances of science activities that a young person had undertaken, and then adding a count for each positive response to having a science hobby, a science or technology career aspiration, or a parent with a science or technology profession. This score, out 20 says nothing about the quality or relevance of the background to the young person, but was instead designed to capture the relative range of experiences of science that was apparent in the interviews. This created three 'levels' of science background – high, middling and low. This definition is obviously tentative, but helps provide a context for understanding young people's prior experience or personal connections with science. It shares some similarities with the principles of science capital, but the researchers were clear that it is the same as science capital.

Once the initial analysis was undertaken, a simpler, coded framework was created to allow for analysis across cases and some tentative typologies to be created.

9. ANNEX 2 – DATA COLLECTION TOOLS

9.1 Youth worker training - observation tool

9.1.1 Introduction

This observation tool is intended to guide Renaisi researchers during Wellcome Trust youth worker training observation sessions. This activity will be led by the researcher, who will ensure that interference with the training is kept to a minimum.

Researchers will adhere to Renaisi's standards of research ethics of confidentiality and anonymity of participants.

9.1.2 Aims

The aim of these observations is to understand or gain evidence of:

- what activities take place during the training
- what questions youth workers have and why
- how delivery options are framed/ pitched to young people
- the motivations youth workers exhibit or describe for undertaking training
- the presentation methods of Wellcome Trust's training and
- any other issues that are raised during training.

The data gathered from these observations will contribute to the overall understanding of youth workers' motivations for delivering STEM[23] activity. This work will primarily inform formation of young people topic guides for interviews conducted later in the project.

9.1.3 Preliminary observation data

Location:	Number of attendees:	Number of organisations:

[23] science, technology, engineering and maths; 'STEM' is an acronym commonly used by those working in science education, engagement and policy. It was not used throughout the body of the report as other Wellcome research has shown that it is not widely used or understood within the youth sector.

9.1.4 Activity observation tool

Activity

Descriptions of activity

Questions and motivations

What questions are youth workers asking about delivery?

Evidence of motivations of youth workers for taking part in the training

Presentation and tone

How delivery options are framed or pitched by the trainers i.e. not the description of activity, but the described benefits, approaches and reasons for using science in this way in youth work training.

What is the style and method of presentation of training?

Additional

Any other issues raised during training

9.2 Youth worker interview – topic guide

Aims

- *Inform young people's topic guide/interviews*
- Understand the motivations of youth workers to take up Wellcome Trust STEM activity guidance
- Identify what interventions around STEM were used before (if any)
- Identify what youth workers think young people are getting from the intervention
- Understand the experience of delivering STEM activities so far
- Perspective of impact on young people
- Identify any changes in attitudes of young people toward STEM

9.2.1 Intro/welcome

- Introduce Renaisi
- Background to research project
- Explain reason for interviewing them
- Confidentiality and anonymity
- Obtain permission to record

9.2.2 Organisation and individual role

- Organisation
    - Name
    - Size
    - Location
    - Focus on any group of young people
    - Develop understanding of how the organisation works

- Individual
    - Individual role
    - Experience in the role

- Activities and responsibilities
    - Describe activities
    - Methods for choosing activities
    - Role of STEM in activities **before** Wellcome Trust training
    - Other primary focuses (sports, arts, culture etc.)

9.2.3 Motivations

- Awareness
    - Understanding of how awareness of Wellcome Trust training was gained
    - Understanding of how it was described and pitched
        - Messenger
        - Content
- Rationale
    - Describe motivation for doing the training
    - Probe on:
        - Young person needs around science
        - Young person requests around science
        - Their personal/ professional development
        - Other attendees
    - Encouragement and enablers
    - Barriers to undertaking and why these may have prevented attendance

Not going to talk about the experience of the training unless there is anything in particular that they want to mention and raise

9.2.4 Experience

- Use of training in practice
    - Opportunity to use the training
    - Which elements
    - What drove decisions to use those elements
- Experience delivering STEM activities so far
    - Response from young people
    - Strengths and benefits of using it
    - Barriers and challenges
    - Use of STEM activities not practiced in training (i.e. from additional online WT sources or independently developed)
- Confidence in delivering STEM activities after training

9.2.5 Impact

- Perspective of impact or potential impact on young people
    - Interest in the sessions
    - Changed attitudes to science
    - Changed attitudes to other topics
    - Changed behaviours in other sessions
    - Wider influence/ impact

9.2.6 Visit

- Explain that we want to visit some areas to understand impact of young people
- Ask if they could accommodate us
- Emphasise we're keen to flexible and can fit around their timetable
- Follow up with email

9.3 Young person interview - topic guide

Aims

- To gain an insight into the young person's interests, personality and background
- To develop typologies of young people, understanding how different YPs respond to the activities and why
- To explore what the young people feel they have gained or lost from the STEM activities.

Interviews to be informed by interview with the youth worker to understand what activities they have done and how they have been delivered.

9.3.1 Intro/welcome

- Introduce self & Renaisi
- Background to research project
- Explain reason for interviewing them
- Confidentiality and anonymity
- Obtain permission to record

9.3.2 About them (to understand their overall interests and influences)

We will use a simple A3 'personal map' with younger children – either filling in a template, or drawing. This section to be very brief to get to know the YP and to situate the other questions

Age	
Hobbies	
Parents/family: jobs, interests, activities	
Friends: Activities with friends	
Job interests	

9.3.3 About the youth group

- Reasons for attending the youth group
- Length of time attending
- Types of activities they do
- Favourite activities and reasons
- Least favourite activities and reasons
- Youth worker approach – likes/dislikes

9.3.4 Activities and interest in STEM

Interest/participation in informal STEM [*For younger children use cards with pictures and ask them to sort them into two piles: done or not done. Explore which was their favourite and why – keep to 5 minutes].*

	Done / not done	When	Why	Interested / Not	Why
Visiting science museums, zoos/aquaria					
After school science club					
Doing experiments/using science kits at home					
Fixing/building things at home – bikes/engines					
Nature walks					
Online / computer programming					
Science related media on YouTube					
Science activities at community / faith groups					

9.3.5 STEM activities delivered through youth group [key section]

Look at YW interview in advance to identify which STEM activities they have done (list of activities is appended) and whether it's been 'one off' activities or sustained programme. For each activity explore the following.

- Overview of activity
    - 3 words to describe it
- Description how they did it
    - Processes they went through
    - Working with others
- Enjoyment and interest
    - Aspects they enjoyed/found interesting
    - Aspects they didn't
    - Youth worker approach
- Interest in doing more of this type of activity
    - Reasons
    - Places would like to do more (e.g. youth club, home, school)

For sustained science programmes, then explore the above prompts (especially learning prompts) for the course as a whole.

9.3.6 Views of STEM

This section is designed to explicitly explore views of STEM and ways that the activities have contributed to this.

- What do you think of when you hear the word science?

- Interest in STEM in school
    - 3 words to describe science at school
    - Enjoyment and interest in science in school
        - Aspects they enjoyed/found interesting
        - Aspects they didn't
        - Types of activity
        - Teachers
- Similarities/differences with science in school and the youth club activities

9.3.7 Demographics

Interviewer to fill out as far as possible and ask young person if any gaps

Gender	
Ethnicity	
Location	
Youth service	
Post code	

9.4 ISL activity – observation tool

9.4.1 Introduction

This observation tool is intended to guide Renaisi researchers during the STEM activities delivered by youth workers. This activity will be led by two researchers, who will ensure that interference with the activities is kept to a minimum.

Researchers will adhere to Renaisi's standards of research ethics of confidentiality and anonymity of participants.

9.4.2 Aims

The aim of these observations is to understand or gain evidence of:

- What activities are taking place and how is it being pitched
- What is young people's level of engagement in the different activities?
- How are youth workers framing the activities?
- The delivery methods
- Identify any challenges of delivery
- Are they structured/ unstructured? Formal/informal?

9.4.3 Preliminary observation data

Organisation:	Location:	Number of young people:	Time of activity:

9.4.4 Activity observation tool

Activity

Descriptions of activity
Activity 1
Activity 2
Activity 3
Activity 4

Engagement

What activities are young people engaging in? What activities are they less engaged in?

How are the youth workers framing these activities?

Delivery

How are the activities being delivered?

What's working, what's not?

Additional notes

9.5

10. ANNEX 3 – YOUTH ORGANISATIONS

The following table highlights the organisations that received training in ISL activities. Those highlighted in purple were interviewed in advance of a visit, and so young people from those sites were interviewed. Those highlighted in green were interviewed, but a visit could not be arranged.

Workshop	Organisation
Belfast	Bella Bambinos After School
	Girlguiding Ulster
	Holy Trinity Youth Centre
	The Prince's Trust
	RNIB
	St John Vianney Youth Centre
	The Boys' Brigade
Birmingham	Girl Guiding
	Bordesley Green Primary School
	Career Options
	Changing Lives
	City Road Primary Academy
	Community Perspectives
	Kamjam Youth Arts Project
	Open University
	Scouts
	The Gap Community Centre
Bristol	4th Chipping Sodbury Brownies
	Girl guides
	The Prince's Trust
	Youth Links
Cardiff	Alison House Youth and Play Project
	Caerphilly Youth Service
	Caerphilly County Borough Council
	Ceredigion Youth Service
	Conwy Youth Service
	Full Circle Education
	Stephens and George Charitable Trust
	YMCA Swansea - Youth Dept

Workshop	Organisation
Glasgow	Boys Brigade
	City of Edinburgh Council
	City of Glasgow College
	Fuse
	Glasgow Life
	Gumption Girls
	Healthy n Happy Community Development
	Lambhill Stables
	NHS Lanarkshire
	The Tall Ship at Riverside
	Toybox
	West of Scotland Regional Equality Council
	Youth Carers
Hull	Army Welfare Service
	Child Dynamix
	Endeavour Training
	Franklin College
	Freelance
	Hedon Youth Group
	Hull Children's University
	Hull City Council
	Hull College
Liverpool	Canal Boat Adventure Project
	ChAPS
	Communities First
	Girlguiding
	National Youth Agency
	NYA
	Orford Youth Base
	Princes Trust
	Riverside College
	Salford Youth Service
	Self-employed
London	22nd Hampstead Sea Scouts
	Africa Hearts
	Descendants
	The Prince's Trust
	Rainbow Head
	Rugy Portobello Trust
	St Hilda’s East Community Centre
	Young Hackney
	Young Lewisham Project

Workshop	Organisation
Manchester	Factory youth zone
	Girlguiding North West
	IncludEd
	Kids in Space
	Mosses Centre
	Salford Foundation
Newcastle	Barnardo's
	Barnardo's Palmersville
	Brandon Carrside youth and Community Project
	Hirst Active Youth
	Keyfort/Neuropartners
	Northbourne Street Youth Initiative
	Oasis Aquila Housing
	Opportunity UK
	PROPS North East
	Salford City Council - The Beacon Centre
	Teesdale YMCA

August 2017

Version 1.0

Wellcome exists to improve health for everyone by helping great ideas to thrive. We're a global charitable foundation, both politically and financially independent. We support scientists and researchers, take on big problems, fuel imaginations and spark debate.

**Wellcome Trust, 215 Euston Road,
London NW1 2BE, UK
T +44 (0)20 7611 8888, F +44 (0)20 7611 8545,
E contact@wellcome.ac.uk, wellcome.ac.uk**

The Wellcome Trust is a charity registered in England and Wales, no. 210183. Its sole trustee is The Wellcome Trust Limited, a company registered in England and Wales, no. 2711000 (whose registered office is at 215 Euston Road, London NW1 2BE, UK).