LAB_13 HANDBOOK

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Produced by Ignite!

An overview of the Lab_13 project, outlining the philosophy of Lab_13, key principles, how it works in practice and variations across the Lab_13 network; with the aim of aiding the establishment of new Lab_13s.

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Lab_13 Handbook

PURPOSE OF THIS HANDBOOK

This handbook is designed to give an overview of the Lab_13 project, with the aim of aiding the establishment of new Lab_13s across the international education sector. This document outlines the philosophy underpinning the Lab_13 project, how Lab_13 works and the variations across the Lab_13 network.

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1. LAB_13 BACKGROUND

What is Lab_13?

Lab_13 is a dedicated space in a school, managed by young people for young people, where investigation and experiment is driven by imagination. It is a space where scientific enquiry is not bound by the curriculum, but rather children are free to engage their own curiosity about science, technology, engineering and maths. All aspects of Lab_13 are directed by a committee of children, including decisions about projects and the recruitment of a scientist in residence who supports the children in their learning. Lab_13 is a space where children learn not just science, but **how to be scientists**.

How did Lab_13 start?

The concept of Lab_13 began from the international network of art spaces, Room 13, which began in Caol Primary School in Scotland in 1994. Designed as a space where children are able to take the lead, be creative and make decisions for themselves with the support of an artist in residence, Room 13 is now a network of studios which places creativity at the heart of learning and engages children around the globe.

In 2007, Ignite!, with funds from the former East Midlands Development Agency, set up a network of six Lab_13s across the East Midlands based on the principles of Room 13. Replacing the artist in residence with a scientist in residence, Lab_13 reworks the principle of pupil-led projects for the study of STEM. The project has since gone on to be taken up in various forms by schools across the UK, as well as in the USA, Ghana and Australia. Plans are also in hand to open Lab_13s in Finland, India and South Korea.

What are the aims of Lab_13?

Children now entering the education system with leave school in 2029 and will eventually take up jobs that haven't yet been invented; most of them will change jobs between 12 and 20 times in their working lives. They will lead changes in a world that we can only imagine and the solutions they find to challenges will require a combination of knowledge, innovation and imagination. For them to achieve their full potential in this rapidly changing environment, young people require key skills and attributes – resourcefulness, the ability to make connections, intuition, reflection and a preparedness to take risks. Many of the solutions and opportunities of the future will be found in STEM, but without imagination and creativity, we will merely repeat the mistakes of the past.

For over ten years Ignite! has built expertise in promoting creative thinking in communities and has discovered just how curious people are about STEM when it is delivered in a playful and engaging way.

Projects which seek to sustain young people's innate curiosity and enthusiasm for creativity through experimentation and invention have been particularly powerful in engaging children with STEM. This shift in perception is needed to encourage more children to enjoy STEM subjects and consider taking up STEM-related careers.

We are convinced that pupil-led discovery has a fundamental role in boosting enjoyment, attainment and lifelong engagement with STEM.

This view is supported by a 2013 Ofsted study, which stated:

> 'Science achievement in the schools visited was highest when individual pupils were involved in fully planning, carrying out and evaluating investigations that they had, in some part, suggested themselves'. [1]

Lab_13 is based on the principle that pupils are responsible for all aspects of the lab, including determining topics and methods of discovery. The purpose of this is to regenerate passion and interest in STEM and in time impact on numbers of STEM graduates and people regarding STEM as an important part of their working lives and culture.

[1] 'Maintaining curiosity: A survey into science education in schools: Age group: 4 to 19', *Ofsted*, 2013, Reference no: 130135.

What are the achievements of Lab_13?

Acknowledgement from experts

The Lab_13 model has been acknowledged by experts in the field of primary and scientific education, especially as an illustration of why interventions in formal and informal STEM learning are more effective at an early age. Lab_13 is recognised as increasing Science Capital in children and their families.

Ofsted

In a recent Ofsted thematic study on science teaching in primary schools, the Lab_13 based in Irchester Community Primary School Northamptonshire was praised as an example of Good Practice. The report stated; 'Pupils have become young scientists, capable of carrying out their own enquiries, skilled at using scientific apparatus and confident in sharing their findings orally and in writing'.[2] The report also noted the cross-curricular benefit, with the Lab_13 helping to drive literacy development and communication skills as well as an understanding of project leadership and management. The positive impact of the Scientist in Residence on raising the confidence of teachers and the quality of the science lessons in schools with Lab_13s was also noted.

The Ofsted report of Irchester Community Primary School in 2012 stated that 'Lab_13 encourages creative thinking and higher level thinking in science and provides a keen point of interest for pupils'.[3]

ASPIRES research

The approach of working in primary phase was endorsed by the first reports from the ASPIRES research at Kings College London, where formative attitudes towards STEM subjects were identified as early as year 6, with most children not identifying as futures scientists.[4]

Primary Science Quality Mark

The Lab_13 at Irchester Community Primary School was awarded the Primary Science Quality Mark Gold Award in 2015, with their Science Lead also winning the title Primary Science Teacher of the Year 2015. The Lab_13 at Dovecote Primary School was awarded the Primary Science Quality Mark Silver award and the assessor declared: 'LAB 13 sounds fantastic! How fortunate the children are to have a dedicated place where they can freely investigate and develop their enquiry skills.'

[2] Brian Cartwright, Her Majesty's Inspector, National Lead, Science, 'Good practice example: Schools, Irchester Community Primary School', *Ofsted*, 2015, Reference no: 150020.
[3] 'Irchester Community Primary School Report', *Ofsted,* 25-26 September 2012, Reference no: 133601.
[4] Archer et al., 'ASPIRES: Young people's science and career aspirations, age 10-14', *KCL*, 2013.

Wellcome Trust

The importance of primary interventions is also highlighted in the Wellcome Trust's 2014 Education report *Primary Science – Is It Missing Out?*.[5] This was itself based on another Wellcome Trust research paper from 2013 that included a case study of the Lab_13 model.

The research studied the impact of the Lab_13 at Irchester Community Primary School and praised its ability to raise pupil's enjoyment of science and the engagement of the wider community with STEM. The report stated 'Children in this school said that they love science and that it is their favourite subject. They love the hands-on nature of the subject and the opportunities to get involved in big, practical experiments using scientific equipment. The children are inspired by being surrounded by adults who are passionate about science: from their class teachers to the science leader, the headteacher and the scientist-in-residence – and this enthusiasm spreads. The school is located in an area where most parents are unlikely to have stayed in full-time education beyond the age of 16 and few have science-related careers. However, science is now well-embedded in the wider community of the school, and parents frequently get involved.'[6]

[5] 'Primary Science – Is It Missing Out?', *Wellcome Trust,* 2014.
[6] 'The Deployment of Science and Maths Leaders in Primary Schools', *Wellcome Trust*, 2013.

Acknowledgement from teachers

Teachers and educators involved with the Lab_13 model have also recognised the benefits. Tracey Barton, a teacher at Dovecote Primary School in Nottingham, commented:

'The Lab_13 journey has had a huge impact on me as a teacher and science leader. My skills, understanding and confidence have grown immeasurably. The pupils and I have met wonderful scientists and creative, talented people who have been generous with their time, mainly because they see the potential of a pupil-led science lab. Staff in school have a unique resource to enable them to 'think outside the box' in science and get help in developing exciting science lessons. We are very lucky to have Lab_13. I am fortunate to have been involved'.

Raising attainment across the curriculum

The outcomes of the first phase of Lab_13s established from 2008 to 2011 were evaluated in terms of how the Lab_13s made an impact on pupils' attainment right across the curriculum, and passion for STEM subjects in particular. The results were externally evaluated by the National Foundation for Education Research in February 2011. Findings included:

- The effect of participating in a Lab_13 does not simply advance a student's interest and attainment of STEM subjects, though this is reported by head teachers; it also impacts on students' enjoyment of maths – 65% of students interviewed reported this.
- 69% of students reported that the Lab_13 experience was having a positive impact on how well they were doing in technology;
- Lab_13 has generated some highly motivated young people in the management of the Labs and through the investigations possible through the project. The best advocates for Lab_13 are the increasingly self-confident young people themselves.
- The powerful learning effect of practical hands-on experiments using tools and equipment in a personal capacity cannot be overstated. The opportunity that Lab_13 offers for the inversion of hierarchies normally experienced in schools is a key element of the success of young people who take a great deal of pride in their autonomy and personal agency in their own learning. These impacts related to enhancing pupils 'appetite' for STEM.

Data from Irchester Community Primary School in 2013 compared the attainment of Lab_13 committee members with their peers in their end of year SATs. In all areas (Science, Maths, Reading and Writing), Lab_13 committee members surpassed their peers.

Y6
(11 from cohort of 41) taking SATs summer 2013
Data teacher assessments - first half academic year (Sept 2012 – Feb 2013)

	Science		Maths		Reading		Writing	
Level	school	Lab_13	school	Lab_13	school	Lab_13	school	Lab_13
4+	68%	100%	80%	100%	80%	100%	61%	91%
5+	10%	18%	17%	36%	59%	64%	7%	18%

Raising awareness of STEM careers

The National Foundation for Education Research study also found that:

- 69% of students reported that their interest in following a career in technology had been boosted by Lab_13 and 64% cited the same impact for their interest in maths related careers.
- 82% of students said that Lab_13 had heightened their awareness of STEM careers (with 39% reporting that it made a 'big difference');
- 84% said it had raised their interest in pursuing a STEM career (with 36% reporting a 'big difference').

Pupil Feedback

'*We have learnt life skills as well like, how to be entrepreneurs and presenting.*' Ellie, Management Committee member, Lab_13 Irchester.

'*Without Lab_13 I think I couldn't cope – I'd have to be taught things instead of investigating and learning for myself in groups and that has given me a good push this year.*' Morgan, Management Committee member, Lab_13 Irchester.

'*In the classroom, we are not allowed special sorts of equipment, for instance, microscopes, acid, chemicals and even lego robots controlled by computers! In Lab_13 we can use these things every day, and do our own investigations.*' Management Committee member, Lab_13 Irchester.

'*I think it does improve performance, and the science has helped me with maths as well. It helps with everything.*' Management Committee member, Lab_13 Gillespie.

'*I think Lab_13 has changed my life, because I used to think science was something that I would never have taken part in, but hopefully when I grow up I would like to be a scientist*', Keegan, Management Committee member, Lab_13 Dovecote.

2. HOW LAB_13 WORKS

We believe that there are five essential components to establishing a Lab_13 – we define these as follows:

- The commitment of a champion at senior level
- A space that can be dedicated to the management by children
- A management committee of pupils
- The Scientist in Residence
- Questions prompted by the curiosity of pupils of all ages.

The commitment of a Champion at senior level

Lab_13 is a project which requires the support of the senior leadership team for success and sustainability and must be embedded into the school's fundamental view of itself. Lab_13 is not an 'add-on', but thrives when it is seen as an integral part of the school. This approach clearly requires the 'buy-in' of the Headteacher, and the commitment of colleagues. Champions of Lab_13 also appreciate that the day to day running of Lab_13 is a responsibility of the Student Management Committee working with the Scientist in Residence, and again the Champion adheres to the principles of 'Student Voice' and the benefits that derive from such responsibilities.

Champions have a critical role in the sustainability of Lab_13 and will devise strategies for this, including the earning potential of CPD and other courses.

The champions of Lab_13 are variously the Headteachers, Science Lead Teachers and Parent Governors.

EXAMPLES

The Lab_13 at Gillespie Primary School in Islington, is championed by the Headteacher who has created a strong network of neighbouring schools to share and contribute to the CPD opportunities afforded by the Lab_13 and the SiR. A parent governor with personal and professional contacts to very high profile science communicators is also a powerful and public advocate.

The Lab_13 at Irchester Community Primary School is championed by the Science Lead, who won the Primary Science Quality Mark Primary Science Teacher of the Year Award in 2015. Again, the role of the Headteacher in committing staffing budget to Lab_13 is critical; the return for the school is high profile connections to new national initiatives for testing and prototyping.

A space that can be dedicated to the management by children

Ideally, the Lab_13 should be a separate space which is solely dedicated for use for Lab_13 projects. It should not be a corner of an existing classroom but an adapted space where pupils can go and feel like scientists. Lab_13s usually contain display features, such as a Curiosity Corner or Cabinet, a questions board and lots of display boards. Ideally there is also a water supply, a gas supply, bench space and also comfortable chairs, storage and tea/coffee making facilities. It is important that, as the Management Committee will be responsible for taking care of this space, they should have a say in what it contains.

And Lab_13s are open to pupils at different times; one thing they all agree on is that the space isn't there for overspill or alternative classrooms for overcrowded schools, nor for 'ordinary' science lessons.

Signage is important, and we encourage all Lab_13s to adopt the logo for their space: _lab_13

Different Lab_13s have approached the issue of space according to their own requirements.

EXAMPLES

Lab_13 Dovecote was created out of three cupboards knocked together – they also have an outdoor area which includes a garden and an under-cover area.

Lab_13 Rosehill uses the Art Room, which is separated from the main school.

Lab_13 Gillespie is located in a former staff room and prep room.

A Management Committee of pupils

The management committee is an integral part of Lab_13 as it ensures that the pupil-led approach. The management committee takes on a range of responsibilities, including:

- Programming
- IT and Communications
- Fundraising and Budget Management
- Event Planning
- Recruitment
- Media and PR

The committee is generally made up of children from different year groups so that there can be continuity when children move on to secondary school.

Management committee members are peer elected; pupils who would like to be on the committee put themselves forward for the role and then are initially selected by their classmates. The replacement of committee members is handled by the committee, with new members taking control of interviews and decision making.

The Scientist in Residence

The Scientist in Residence is a key resource for a Lab_13 and is crucial for long-term sustainability. The role of the Scientist in Residence is to facilitate the learning of the children, to support their curiosity and to enable them to lead their own experiments as well as overseeing the general health and safety of the children. The Scientist in Residence supports the management committee to coordinate guest visits, develop links to the local wider community and engage in nationwide programmes. Scientists in Residence have been very successful in enabling pupils to work with local universities and industry leaders as well as coordinating attendance at events, conventions, visits to labs and STEM fairs.

The Scientist in Residence is recruited by the management committee and has a duty to follow the decisions taken by the management committee. It is important that the children do not see the Scientist in Residence as another teacher but as a separate resource who allows them to indulge their creativity.

Different Lab_13s have approached the Scientist in Residence concept in different innovative ways:

EXAMPLES

Lab_13 Irchester initially attracted 8 guest Scientists in Residence over the course of one month to generate interest.

Lab_13 Gillespie combines a part-time Scientist in Residence with volunteers from the local university.

Lab_13 Dovecote employs a part-time Scientist in Residence on a TA salary and also has two horticulturalists who work with Lab_13 children on projects in the school allotments.

Lab_13 Ghana offers four voluntary Scientist in Residence positions covering two Lab_13s, where all accommodation/travel costs for visiting UK Scientists in Residence are covered.

Questions prompted by the curiosity of pupils of all ages

Children are naturally curious, and so Lab_13s are never in short supply of questions and topics of research. Since a key principle of Lab_13 is the pupil-direct approach, using pupils' curiosity as a basis for experimentation is key. Different Lab_13s approach this in different ways:

EXAMPLES

Lab_13 Gillespie has a Questions Wall to which all pupils can contribute. Experiments are led by pupils' curiosity; for example, prompted by question from one of the Management Committee members, pupils calculated how long it would take a snail to travel one mile. A parent's question about the supposed health benefits of Manuka Honey led to pupils running a study in collaboration with Imperial College and the British Pharmacological Society. This study was peer reviewed, published and presented at the Cheltenham Science Festival.

Lab_13 Irchester has a Questions Board to which all pupils in the school are encouraged to contribute. They have also run a Questions Week, where each class focused on coming up with questions such as 'How do our eyes work?', 'Why do shoes get smelly in the rain?' and 'What is the difference between a microscope and a telescope - they both make things bigger?' and trying to find out the answers. They also have Giant African Land Snails which are used for ongoing projects.

Lab_13 Ghana garners topics for the term from questions put forward by pupils which are then decided upon by the Management Committee and the Scientist in Residence. Projects they have explored include collecting recyclable materials, and then designing and making these into rafts. In response to a meningitis outbreak in the region, pupils learnt about the disease and conducted a series of public lectures. Inspired by a partial eclipse, pupils conducted projects on the movement of the moon.

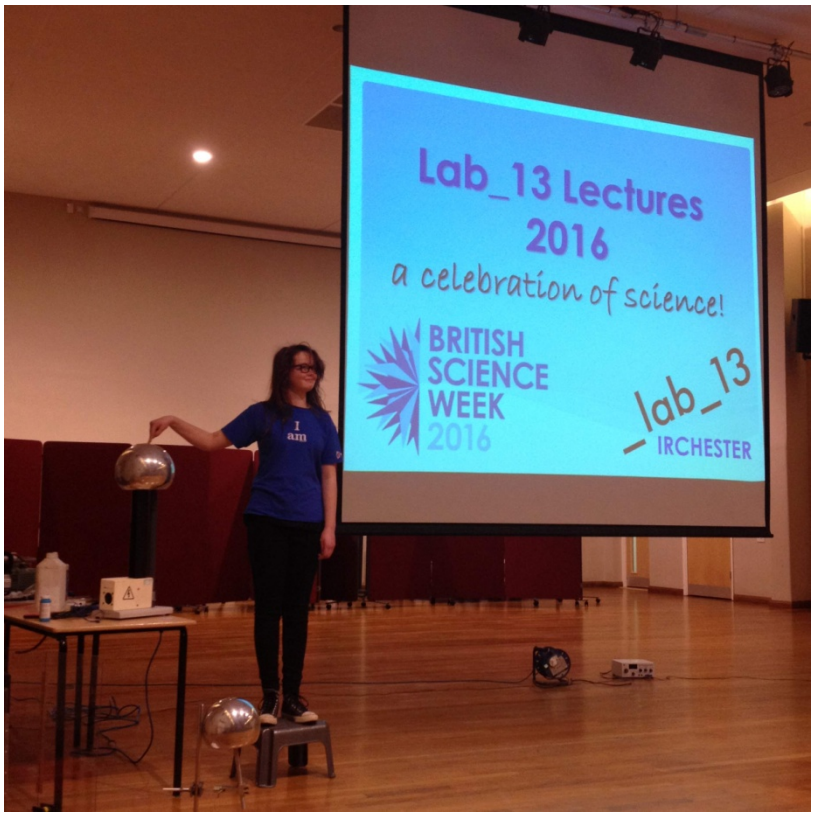
Lab_13s also are encouraged to diffuse their work to the local community. This often takes the form of newsletters and social media channels such as twitter and the Lab_13 Wordpress Blog (https://lab13network.wordpress.com/). Many Lab_13s have come up with other innovative ideas to share their work.

EXAMPLES

Lab_13 Irchester hosts annual Lab_13 Lectures, which are delivered to peers and pupils from other local schools and of which at least 50% are delivered by pupils.

Lab_13 Gillespie hosts an annual Science Spectacular event, which includes demos delivered by pupils and scientists for parents and the local community.

Lab_13 Ghana regularly host community lectures on various pertinent issues, inviting experts from the local university. They also often take experiments out into the community, encouraging people to engage. For example, they gave out solar shades to encourage people to safely observe a solar eclipse. The Lab_13 space is opened up to other schools as they host Open Days for pupils and enrichment sessions for teachers.



Funding

How to make Lab_13 a long term and sustainable programme is our greatest challenge – but every challenge is an opportunity. Whilst we believe that Lab_13 is a worthwhile and valuable investment for pupils and schools, different Lab_13s have varying financial arrangements. The following model is our ideal as we suggest it demonstrates the value that local stakeholders could have in the success of Lab_13.

- Business sponsorship (40%) ideally one industry supporter, though it could come from a consortium or via Business in the Community or local Chamber of Commerce;
- Or contributions as value in kind from local universities, and consortiums of STEM institutions and organizations, see below.
- The school contribution (40%) could come via pupil premium, or from a local family of schools with some shared access to the Lab_13;
- The management committee's own fundraising efforts, and other earning potential courses (20%) from special events, sales of kits, summer school activities, sales of CPD courses etc.

In this model, the case to be made for business sponsorship (or CSR) includes:

- Closer involvement in STEM education and skill development for a future workforce;
- Positive PR and community relations;
- Valuable workforce and skills development opportunities as STEM ambassadors and role models;
- Direct involvement in the local STEM agenda through education and training, for initiatives like Science City, festivals and other celebrations and international exchanges.
- New initiatives, we note for example that Nottingham is soon to become a national resource centre for additive manufacturing (technology for 3D printing). The link to Lab_13 and opportunities from installing a 3D printer for students' own projects will add considerable value and learning.

An alternative model is to seek grant aid, particularly at the beginning, to establish the Lab_13 and to prove its value.

There is considerable scope for additional support in kind; links to local universities, STEM ambassadors and input from industry personnel can all contribute to special days, weeks of work experience, science communication experience etc. Donations of equipment and expendable resources can also contribute to budgets.

Please keep Ignite! informed of new opportunities for financial support, and we will attempt to co-ordinate proposals and bids; or if you prefer to go solo, we are happy to provide evidence and case studies.

EXAMPLES

Lab_13 Dovecote was set up with funding from the East Midlands Development Authority via Ignite! which covered initial costs for setting up the space and appointing a full-time Scientist in Residence for one year. Dovecote is now funded through sponsorship from local industry, Bio-City, and further contributions from school funds, pupil premium, fundraising efforts led by the Management Committee and grants from funding bodies such as the Ogden Trust.

Lab_13 Rosehill is supported by a public engagement grant from the UK Science and Technology Facilities Council (STFC) – the role of the Scientist in Residence is part-time.

Lab_13 Irchester is supported through the school's staffing budget. Our understanding is that the Scientist in Residence has replaced one Teaching Assistant post in the school.

Lab_13 Gillespie is devising a new funding and support strategy (as at 2017) with grant aid from a local foundation to develop a partnership across a number of schools.

Lab_13 Ghana was set up with funding from the Lightyear Foundation, a grant from the Wellcome Trust and through a Kickstarter fundraising campaign. It is now financially supported by the Kwame Nkrumah University of Science and Technology.

3. LAB_13 NETWORK

Over the years, a strong network of Lab_13s has developed. We are working to further develop this; we have a vision of a network of international Lab_13s working together on creative projects which allow children to develop their curiosity through STEM. This will include a collaborative online learning platform, exchanges of Scientists in Residence and pupils and would build on the links Lab_13s have already made.

There are many science enquiries, investigations and research experiments that children raise in Lab_13 that would benefit from the knowledge, expertise and experience of other Lab_13s. If the management team in Lab_13 want to explore the life cycle of mosquitoes there are obvious links to projects in Ghana and Finland.

EXAMPLES

The Management Committees of Lab_13 Irchester and Lab_13 Gillespie have met on several occasions to discuss how Lab_13 works in their schools, their projects and their ideas for future developments.

Lab_13 Ghana organises competitions which both Lab_13 Irchester and Lab_13 Gillespie have participated in.

4. FURTHER INFORMATION

Acknowledgements

The development of the Lab_13 International network is partly the vision of Cathy Bereznicki, a past Chair of Ignite! who died in February 2016. We are grateful for a legacy from Cathy and wish to honour her memory by realizing the potential of young scientists across the world.

Finally, we wish to pay tribute and acknowledge the commitment and vision of the Lab_13 champions, Scientists in Residence and Student Management Committees who have been promoting their Lab_13s since 2009. Learning to be scientists is a great opportunity; demonstrating that science is a part of our everyday lives and an entitlement in our education is a great legacy of Lab_13. Proving that children can conduct real science in their own way and in their own space is what makes Lab_13 unique.

Contact Details

If you're interested in setting up a Lab_13, or would like more information, please contact Rick Hall:

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