

# **BRLSI Researchers: Enthusiastic enquirers into science, learning and life**

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## **Abstract**

This publication describes the academic, practical and personal learning journeys of teenagers and postgraduate research students from the University of Bath (UoB), researching and learning together over a period of 7 months. The project arose from the Bath Royal Literary and Scientific Institution's (BRLSI) Youth Activities programme for young people to raise aspiration and knowledge of Science, Technology, Engineering and Mathematics (STEM). BRLSI Youth Activities offers 'hands on' learning workshops for children, and informal and formal training for undergraduate and postgraduate students in communication skills with reference to STEM. A team of volunteers and researchers from BRLSI, local universities and the community provide workshops and support to inform the aspirations of children, engender a feeling of well-being when learning, show STEM as offering interesting careers and show local communities that STEM research is something relevant to their own local areas.

The BRLSI Youth Activities Programmes bring self-selected children and young people, from different schools (and home-schooled), together and provide them with challenging and fun learning opportunities. These learning opportunities are not directly related to the existing school curriculum. They take place in the context of hands-on, discovery-learning activities where everyone is equally valued as able in their own way to provide help and support for other people to learn as well as themselves. In addition to sharing and developing STEM knowledge and research skills the intention is to encourage all participants to develop their ability to work in a team, gain confidence to present and organize their learning and act as an expert knowledge-creating researcher and learn more about them selves.

with a desire of the UoB Public Engagement Unit to extend the effectiveness of its own programme.

The intention was also to contribute to the development of an ethos in university research departments that values the involvement of local non-specialists of all ages and knowledge levels in developing effective and relevant research projects.

The programme provides and opportunity for postgraduate students to develop as supervisors and mentors. All the postgraduate researchers concerned with the BRLSI Researcher pilot programme were recruited from UoB Architecture and Civil Engineering Department so the young researchers were encouraged to focus their enquiries on the built environment. Their research was varied and relevant to local communities. It included an analysis of the causes of the 'black crust' which disfigures the surface of the city's iconic building material (Bath stone), encouraging local people and visitors to take a greater interest in the urban environment and its history, the development of alternative building

materials and an effective way of nudging householders into reducing energy consumption and thus costs. The geology trail was also completed.

The programme is in its first year. The journey has only just begun but for those who participated it has already been a life changing experience.

## Preamble.



### **'BRLSI Researchers: Supporting enthusiastic enquiries into science, learning and life'**

This project has involved developing educational practice, which puts the young person and their interests at the centre of learning.



BRLSI Youth, in collaboration with the University of Bath's Public Engagement Unit and Department of Architecture and Civil Engineering, secured a small EPSRC grant to pilot an innovative educational opportunity for young people (13yrs+) researching the Built Environment and developing their reflective research journals supported by PhD/Post-Doctoral students.



Participants met monthly for 7 months to develop their research, devise experiments to test their hypotheses, implement experiments and analyse results, as they would in a university context.



The PhD/Post-Doctoral students acted as research supervisors and the young people as researchers.



The sessions included time for reflection, 'supervision', participation in a research group, introducing skills researchers need to be effective, and opportunities to present to an audience.



### **All participants in the project learned from, and with, others.**

The young researchers developed their knowledge of themselves, what it is to be a researcher, deepened their understanding of their own learning processes, and developed their confidence and ability to generate and research questions of interest to them. The PhD/Post-Doctoral students refined and deepened their educational practice and understanding of supervising knowledge creating research, communicating and sharing knowledge, and supporting learning. The project leaders researched their educational influence in learning and this innovative educational opportunity to improve it.

In Autumn 2014, Paul Thomas (originator and convener of BRLSI Youth Activities), in collaboration with Paul Shepherd (Department of Architecture and Civil Engineering of the University of Bath) secured a small grant the University of Bath's (UoB) Public Engagement Unit. The purpose was to enable young people and postgraduate students to work together to develop their expertise and knowledge as life-long learners by researching questions of personal interest. The plan was for a project to offer 6 monthly workshops and a mini conference. As with all good plans and educational research the project evolved and continues to do so fueled by the knowledge and understandings created. The story of the project is told through the accounts of some of the research and learning of the participants.

As researchers we have a responsibility to make our knowledge publically accessible. This publication is one of many forms we are using to communicate to a wide and diverse audience with an enthusiasm for developing learning opportunities for young people and postgraduate students to develop their knowledge of science, research, and themselves as life-long learners contributing to and benefitting from their own learning and that of others. We hope you will read this publication, as we want to:

- Commemorate what we did, how we did it and what we learned
- Disseminate our work, not only the findings but also our journeys as researchers
- Share our work with a wider audience so other people can learn from what we have learned and know that research is something achievable
- Influence educators and academics.
- Give other people the chance to get involved with this type of research
- Transcend the immediacy by contributing to the durable, searchable database of the British Library

We begin by setting the scene in Part 1 by introducing you to the principle participants, the context, history and aims of the project. In Part 2 we describe briefly what happened session by session. So the flow of our narrative is not interrupted we provide documentation we think you might find useful in the Appendix. In Part 3 we each present some of what we have learned. We conclude in Part 4 with the rationale underpinning the project, evaluation, key points of learning that have emerged through the project and implications for possible future developments.

The success of our efforts to make our knowledge publically accessible can only be known over time. It will be evidenced by whether or not our account stimulates your imagination and contributes anything to your efforts to improve educational experiences and learning as you develop your own science and educational research projects. How could we improve our account? What are you doing that we could learn from? We would really love to hear from you – [coolbookings@brlsi.org](mailto:coolbookings@brlsi.org)

## **Part 1 Setting the Scene**

We begin by introducing participants and then telling you something of the history and mission of the Bath Royal Literary and Scientific Institution, Young BRLSI and the BRLSI researchers project.

### **1.1 Main Participants**

Paul Thomas, BRLSI Researcher project leader and 'Young BRLSI' Convenor: Graduate of Oxford, Bristol and Exeter Universities. Retired writer, artist and academic, Paul T has lived locally since 1968. He is passionate about research and encouraging young people to be involved in STEM. He initiated and has been responsible for the 'Young BRLSI' programme since 2012.

Paul Shepherd, BRLSI Researcher project leader: After completing a Degree in Maths (Cambridge) and a PhD in Fire Engineering (Sheffield), Paul S joined international consulting engineers Buro Happold where he developed specialist software and used it to design large complex buildings such as the Emirates and Lansdowne Road Stadiums, working with some of the world's most influential architects. Now an academic in the Department of Architecture and Civil Engineering at the University of Bath, he uses the skills and experience he gained in industry to inspire the next generation of built environment professionals, and to research new ways of using computers to improve the building design process. He is also a passionate Public Engagement advocate, and regularly presents to audiences of 1000 school pupils about the use of maths in real world applications.

Marie Huxtable. BRLSI Researcher project leader: Developed a life long interest in psychology during a degree course at Hull University. She subsequently developed a commitment to contribute to improving the educational experiences and learning of children and young people by qualifying and practicing as an educational psychologist and as she developed and led the B&NES APEX programme. She continues her passion and commitment to researching educational practice to improve it since completing her doctoral programme at University of Bath by working with learners of all ages engaged in researching their passions for learning and making a difference that contributes to the flourishing of humanity.

Muzzamil Shakil, BRLSI Young Researchers Supervisor: Previously studied Civil Engineering (University of Bath). Currently a PhD researcher in Low-carbon cementitious materials (University of Bath). Interested in engaging and inspiring the younger generation through research. Passionate about yoga and running on trails. He has been Involved with the BRLSI since October 2014.



Joe Williams, BRLSI Young Researchers Supervisor: PhD candidate at the University of Bath and former graduate with an MEng in civil and architectural engineering. STEM

**Figure 1 Joe, Oliver and Barnabas**



ambassador and keen participant of several university public engagement programs. Particularly interested in promoting engineering and sustainability amongst future generations.

Barnabas, BRS LI Young Researcher: I am studying for my GCSEs at Kingswood School in Bath. My favourite subjects are Chemistry and History.

Oliver Sani, BRS LI Young Researcher: A Ralph Allen student, who enjoys skiing and science! Has appreciated the opportunities provided by BRS LI since the age of about 10.



**Figure 2 Giovanni and James**

Lives in Bristol with his partner. Inquisitive person, he is passionate about research and loves Richard Feynman's books (e.g. "The pleasure of finding things out").

Giovanni L. Pesce, BRS LI Young Researchers Supervisor: Post-doctoral research associate at the Department of Architecture and Civil Engineering. Graduate of Genoa (Italy) and Bath (UK) Universities.

James, BRS LI Young Researcher:

Ammar, BRS LI Young Researchers Supervisor:

Mari, BRS LI Young Researcher:



**Figure 3 Ammar with Mari and Molly**

Molly, BRS LI Young Researcher:



**Figure 4 Teresa with Nicola and Kitty**

Teresa, BRS LI Young Researchers Supervisor: Teresa Chiang obtained her PhD in architecture from the University of Bath while working on the Young Researchers Project. She joined the Project to develop her learning about working with young people interested in STEM and to gain experience in public engagement.

Nicola, BRS LI Young Researcher: Aged 14 years old. Has lived in Somerset since birth. Loves research, likes to try new things, is very inquisitive about new opportunities and takes them with enthusiasm. Hopes to become a science journalist in the future.

Kitty, BRS LI Young Researcher:

Georgia, BRSLI Young Researcher:

## 1.2 The Bath Royal Literary and Science Institution

Bath Royal Literary and Scientific Institution is a registered charity. It exists to promote an interest in the arts, literature and sciences in Bath [UK] and the surrounding area and provide resources for education, research and enjoyment. It acts as a cultural centre for its members and the public and provides a wide-ranging programme of lectures, discussions, science demonstrations and exhibitions. Anyone can become a member and anyone can attend its activities. (Thomas, 2014, p. 111)

The Bath Royal Literary and Scientific (BRLSI) has a well-established programme of talks and discussions on a very wide range of subjects and attracts presentations from leading thinkers in their fields for the promotion and advancement of science, literature and art. BRLSI owns premises in Bath where they hold meetings and house collections, which include internationally recognised items of geology, natural history, ethnography, and archaeology together with a library of some 2000 antiquarian books and the correspondence of many eminent 19th Century scientists.

BRLSI was founded in 1824 as the direct descendant of Bath societies going back to the 1770s. In 1992 the BRLSI was re launched and registered as an Education Charity. In 2000 BRLSI members initiated the 'Bath Taps into Science' event and since 2010 have invited research students to deliver short lectures on their research and offer supportive feedback. Paul T was the convenor for BRLSI Youth Activities and had experience of converting the research findings of international Natural History specialists into Radio and Television scripts and books. The 'hands on' workshops had uncovered a 'hunger' of science students to share their enthusiasm and knowledge of STEM in the context of public engagement, which is encouraged by the University of Bath through its 'communicating science' programmes.

## 1.3 Young BRLSI

The BRLSI Youth Activities programme began in September 2012 as part of the APEX<sup>1</sup> legacy. It was set up on the demise of that provision and the overall aims, objectives, organisational thrust and structure for delivery was devised by adapting BRLSI and APEX philosophies. Paul T used his previous experience including: involvement in the Bath Taps into Science initiative; providing 6th form Philosophy seminars which bring PhD philosophy students from the University of Bristol into contact with 6th form students from B&NES in an

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<sup>1</sup> APEX (All are Able Pupils Extending Opportunities) was an inclusive educational 'gifted and talented' project that was run by Bath and North East Somerset Council until 2012. Details in APEX Living Legacies: Stories creating futures (Henon, A. (Ed) 2012, freely accessible from <http://www.actionresearch.net/writings/apex/livinglegacies2012.pdf>

annual series of seminars supported by the Royal Institute of Philosophy; and a series of 'hands on' science related workshops for children over 8 devised and delivered as part of the APEX programme. One of these projects involved the participants undertaking a research project into energy conservation and Georgian Buildings, based on the example of the BRLSI Headquarters at 16 Queen Square. The results of the children's research were used by them to produce a 'toolkit for saving energy for use in Georgian buildings'. The children presented their findings and the 'toolkit' as part of a B&NES schools' climate change conference held at the University of Bath in 2008.

The premise of the BRLSI Youth Activities Programmes is to bring (self selected) school age children and young people from across the area together and provide them with challenging and fun learning opportunities which are not directly related to the existing school curriculum and take place in the context of 'hands on' or 'discovery' learning activities and enquiry led learning. The 'hands on' workshops concentrate on Science, Technology, Engineering and Maths (STEM<sup>2</sup>), which reflects the focus of BRLSI and the current Government's initiative to encourage the involvement of all children and young people in STEM and through them whole communities.

To deliver the BRLSI Youth Activities workshops a team of volunteers is recruited from the BRLSI membership, graduates and undergraduates from the University of Bath, Bath Spa University, Norland Childcare Training College (Bath) and STEM Ambassadors from Industry. Volunteers are urged to ask open-ended questions. The questions are intended to encourage observation and discovery, to model enquiry led learning and guide the children to create valid explanations themselves. The children are encouraged to reflect on their own learning and achievements and are provided with a 'Research Portfolio' (a loose leaf file see Appendix 1) in which to store records of their research, learning, questions and speculations. The aim is that through participation in the children retain a sense of curiosity, a passion for enquiry, the confidence to develop and test the validity of their own explanations and share the knowledge they create, work with others and present what they have learned.

Volunteers also learn core skills such as effective communication, sensitivity to the process of individual learning, the ability to reflect on participants learning and their own learning, and how to support educational enquiry. In the case of volunteers without a STEM background they also learn, side by side with the children, about the scientific content of the STEM activities. Additional skills are acquired through active participation, which include social, personal and those of the 'expert'.

Volunteers contributed in February 2013 to clarifying the purposes of the programme which provide the basis for development, implementation and evaluation:

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<sup>2</sup> STEM – Science, Technology, Engineering and Mathematics

- To enable children and young people to experience passionate learning and serious fun in a relaxing academic environment
- To foster a love of science in young people
- To foster a love of enquiry
- To provide opportunities for children beyond those restricted by school curricula and their teachers knowledge and experience as research scientists
- To increase the knowledge and experience of children, young people and adults as researchers. There are two aspects to this - research and enquiry to acquire knowledge and research and enquiry to create knowledge
- To bring young people and adults (family members such as parents and grandparents) into BRLSI
- To enhance the contribution BRLSI makes to the academic quality of knowledge for local people
- To contribute to BRLSI realising its' mission as an educational charity concerned with the promotion and advancement of science, literature and art.

Many of the workshops use selected activities from the library of over 350 'hands on STEM experiments', which have been developed by Paul T and his team for this purpose. Many can be downloaded from <http://www.brlyouthgallery.org/>. Each activity has to offer intellectual challenge as well as being fun and provide opportunities for the participant to learn how to ask questions, form and test hypotheses, and deal positively with and learn from uncertainty, difficulty, 'failure' and 'success'. All the activities involve collaborative, active learning, problem solving and use the analytic, creative thinking and planning skills that the 'expert' uses. Most activities involve a 'product' of which participants can feel proud and include suggestions which aim to encourage participants to extend their thinking and learning and explore additional possibilities.

A standard pattern for workshops has evolved. Children are usually in teams of four with a team leader. It is very important that children are encouraged to work together and to share their discoveries, knowledge and skills. Activity leaders (i.e. subject specialists) support the team leaders to enable each child to attain their highest level of understanding. Children move from activity to activity (usually five) with their team leader making notes; they return to their team table to assimilate the information and to prepare for an end of workshop three-minute team presentation, which is aimed at explaining what they have learned and what they enjoyed.

The workshops provided an opportunity for children over 8 years of age to learn with student volunteers over 17 years of age, postgraduate researchers, BRLSI members and STEM Ambassadors. The workshop format was not so well suited for children under 8 or for children over 12. BRLSI wished to retain the interest

of young people, 12 – 17 years of age, so an additional programme had to be developed. Towards the end of summer term 2014 two participants of BRLSI Children’s Workshops, approached Paul T separately, suggesting that the Institution should devise a specific programme for young people aged 13 plus.

Early in the Autumn of 2014 Paul T was invited to a “sand pit” by the Public Engagement Unit of the University of Bath. The aim of the day was to form groups to brainstorm projects, which would link members of the university with the local community, and to submit bids to get the projects funded. Paul S, a member of the Architecture and Civil Engineering Department and Paul T convenor for BRLSI Youth Activities got together and formed one such group. Paul S had a cohort of young enthusiastic researchers to offer, and Paul T needed help running research-focused workshops for young people.

Paul S attended the meeting in his role as the recent winner of the University Vice-Chancellor’s Staff Award for Public Engagement with Research. He had been rewarded for his many sustained personal efforts in engaging the public with his research, and was now looking to “pass on the baton” and inspire a new generation of researchers in his department to get involved in public engagement. Partly from an altruistic belief that engaging with people outside academia it was a rewarding activity which developed useful skills that all early career researchers should have, and partly from a selfish desire to share the ever-growing demands on his time to attend public engagement activities more widely.

It was agreed that Paul S would invite PhD students from his department to join the proposed programme. The doctoral and postdoctoral students would act as mentors and share their research. This would provide teenagers with an insight into what it was to be researcher, give them experience of research mentored by people involved in research and provide PhD students with an opportunity to improve their supervisory/mentoring skills, communicate their research to a new audience and to reflect on their own learning. It was suggested that in addition to an oral presentation by participants of their research and learning there would be two other end products: A self guided family trail around the centre of Bath making use of the varying building materials used in some of Bath’s notable buildings and a published research/report paper outlining the BRLSI Researchers findings. Paul S worked all this up into a formal bid, which the University of Bath accepted and offered funding, and so the programme was born to:

- enable 13+ [years old] young people to learn from and with doctoral students what it is like to be a researcher by completing a meaningful research project which might contribute to a post graduate research thesis.