Captivating Children - Through cross-curricular teaching of Art, Science and Technology

A process study report on phase two of the Baboró-BEAST! Project

DRAFT No. 1

Authors:

Ms. Patsy O'Sullivan
Dr. Lisa Moran
Dr. Cormac Forkan

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School of Political Science and Sociology,
NUI, Galway

School of Political Science and Sociology
National University of Ireland, Galway
Tel: 00 353 91 492290
Web: www.nuigalway.ie/soc

The School of Political Science and Sociology at the National University of Ireland, Galway, undertakes research on a wide range of areas such as, education, the environment, work, crime and deviance, family care and welfare and public policy.

The views expressed in this report are those of the authors, and not necessarily those of Baboró Management.

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Ms. Patsy O'Sullivan
Dr. Lisa Moran
Dr. Cormac Forkan

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Executive Summary

This is the second report in the process study that focuses on the learning from the BEAST! Project which is an educational arts and science project that has been developed and operated by Baboró since the project's conception in 2012.

Baboró International Children's Arts Festival has operated for more than seventeen years and focuses on making art accessible to children of all ages including babies, toddlers and teenagers and their families. Baboró offers direct cultural art provision to children and families and stages an Arts Festival for children in October each year. This includes new and innovative works using the art forms of puppetry, theatre, visual arts and music amongst others. The organisation has developed strong links with schools, communities and educational institutions since its inception. This outreach work is a developing aspect of Baboró's role and in 2012 the organisation established the BEAST! (Baboró: Environment, Arts, Science and Technology Project), to work with schools on achieving a higher profile for science/technology (STEM subjects)[1], by encouraging children and their teachers to explore these subjects through the arts which included film making, model making and poetry writing amongst other mediums.

Representatives from Baboró developed links engaged with the Ryan Institute, National University of Ireland, Galway (NUIG) in 2012 to create a brief that would attract the interest of scientists, technologists, engineers and other researchers and academics from across the university community to design and deliver science projects to primary school children in County Galway. The project brief invited researchers to devise a series of workshops that would explore the possibilities and realities of designing a 'low carbon' future and its impacts on biodiversity and sustainability. This was an innovative approach that planned to use expert scientists and artists to work with school children and teachers to work with children to change their attitudes towards science and the environment.

During the development phase, Baboró engaged with the School of Political Science and Sociology at NUI, Galway to carry out a process study review. Researchers from the School worked with Baboró to refine the project objectives and design the research study. They produced the first process study in 2012 entitled '*Magic can happen; A Process Study of BEAST! Project',* which informed the design of the project in 2013. This report is the second process study based on the findings from the research carried out by social researchers in 2013. The research objectives are detailed in the methodology section (Chapter Three) and include the design of qualitative and quantitative tools to collect data, observation of science/technology and art workshops, description of the project model and compilation of the process study report offering analysis and recommendations on the future development of the BEAST! model.

The expected project outcomes included impacts for the children around engagement, behavioural change and social development; impacts for the teachers in how they view the use of art to teach science and technology subjects and the documenting of the project model and project outcomes in a process study report.

Three primary schools in County Galway took part in BEAST! in 2013 and these were selected from the eight schools that participated in the project in 2012. They were located across County Galway, in the following locations; Gort, Oughterard and Newcastle, Galway City. The schools served a spread of populations that included a school serving a wide multicultural population and schools from rural and

[1] 'STEM' subjects include science, technology, engineering and mathematics

urban populations. The young participants were predominantly in the 8yrs to 11 yrs age group and numbered 66 children in total.

Baboró facilitated a briefing meeting for science, computer technology and arts practitioners to meet with Teachers in April. They discussed aspects of workshop delivery, timings and other organisational aspects. Social researchers from the School of Political Science and Sociology, NUIG were also present at the briefing in order to engage in the initial phase of the process study. The intervention comprised the delivery of workshops in the schools and these took place over the months of May to June. Each school received 7-8 hours of science, 7-8 hours of creative writing/drawing and 6 hours of computer technology workshops. This comprised 13 workshops in total in each participating school.

The research methodology for the process study included a literature review of research on science education methods in primary schools. The literature, Kelly (2012), Rose (2009) and Alexander (2012) identify the benefits of cross-curricular teaching. NCCA 2005, Ofsted 2002, Department of Education and Science 2013, point to the benefits of using arts in teaching. The long term UK study ('Creative Partnerships' 2002-2011) was a government funded educational initiative that was delivered in more than 2,700 schools and worked with more than one million young people. It examined the impact of using external, creative practitioners in the teaching of the school curriculum and demonstrated that there was a measurable improvement for the young participants in terms of improved attendance, behaviour and performance (Kendall *et al.* 2008) compared to the rest of the UK school going population. Reports on artist and teacher collaboration (AICE 2012, Department of Education and Science 2006) highlight the importance of preplanning meetings to facilitate the more effective delivery of arts workshops. Studies on the use of ICT in the delivery of education programmes by Hall and Schavarian (2011) found that *'where the children's curiosity was the engine for their learning, profound understanding of the topic evolved'* (2011454) and Passey *et al*. (2004) found that ICT had a motivating effect on children's learning.

The research methodology drew upon a mixed methods approach to capture the project outcomes. This included participant observation at workshops and field trips, focus groups, personal interviews and purpose built data collection instruments that were administered to children pre and post intervention. The benefits of tracking the outcomes for children over time are highlighted in the literature and findings from the data collection instruments are being tracked over the three years of the project. Three case studies were generated using this material (Chapter Four). Scientists, technologists, the artist, teachers and parents in addition to Baboró staff were interviewed on their perceptions of BEAST! and these findings are detailed in Chapter Five.

All stakeholders expressed positive comments about BEAST! They felt that the project had achieved its objectives for this second year of operation and they were keen to continue their relationship with Baboró and with NUI Galway. Teachers, scientists, the artist and social researchers noted a high level of engagement in the workshops by children and teachers. Children talked about changes in the ways that they perceive science since participating and showed that they had deepened their understanding of the science concepts. Teachers and social scientists noticed that the approach adopted by practitioners allowed usually less able children to 'shine' and also facilitated more able children to share their learning or experience. 'That's the beauty of it. It caters for every level' (Teacher 4). Parents noted their children demonstrated an increasingly positive attitude towards science and that their thinking about the role of science had changed. The children showed a high level of collaboration and this was noted by teachers, arts/science practitioners and observers in the three case study schools. The project objective of raising the profile of science in the participating schools was thus achieved successfully as was the objective of increasing the level of team-building and collaboration amongst the young people.

Children learned new skills such as creative writing, drawing, computer programming. They also demonstrated good recall, improved recording and critical thinking. Parents noted a more positive attitude toward science, towards the possibility of science as a career and also more awareness of their environment and 'how things work'

In addition to the widespread collaboration and team working that took place with the young people, collaboration between science and arts practitioners and teachers was also very evident. This was a strong feature of BEAST! and stakeholders identified that they felt that the project could be further improved by increasing the opportunities to network and collaborate

In relation to the teaching method adopted by the visiting practitioners, teachers were very positive about the benefits of the more open, creative and flexible approach adopted by science and arts practitioners and stated they were learning more around the positive impacts of using creativity in teaching and were adapting their own teaching styles to incorporate creativity and cross-curricular, more relaxed approaches. Science practitioners identified that they were challenging themselves to use more creativity, to be 'child-led' and to incorporate more of the children's 'lived experiences' in order to create more enthusiasm and participation by the children.

Research participants stated that practitioners were highly enthused by their subjects and this enthusiasm, coupled with the ability to engage with the young people, was seen as a key element of the effectiveness of the model. Teachers discussed that children had more 'ownership' of the work when they had significant input into decisions about the work. They felt that it was a very worthwhile and exciting project which challenged them to introduce the creative arts in science and literature teaching in the classroom. Hence, there is qualitative evidence that this model of working has created real synergy in the schools and amongst the practitioners delivering the workshops. This teaching methodology could be successfully transferred to other schools; the model is sufficiently robust to be replicated with the proviso that the key essential elements described in the findings chapter (Chapter Five) are in place.

The recommendations arise from the process study findings and are detailed below: -

- In order to facilitate good project planning, it is ideal if funding could come on stream earlier in the project timescale. This factor needs to be accommodated in project planning as it is a recurring issue which has impacts for project management, schools and arts and science practitioners.

- There is a requirement for a more formal briefing of school principals and class teachers at the early planning stage. This is in order to achieve full 'buy in' by schools and full understanding of the BEAST! project objectives which is important for achieving the full benefits of the project.

- There is an identified need for meetings between teachers and science and arts practitioners to agree practical aspects of the project and to aid good planning. This should include discussions regarding the school culture and ethos; the needs and ability levels of the class group; the roles and responsibilities of teacher and practitioner during workshops and discussion around the science curriculum which will aid decisions around content and harness more learning for the children.

- High levels of engagement were observed in the children when they were involved with more interactive elements of workshops. This has been one of the most successful outcomes of the project as it has facilitated 'deep learning' in the classroom. It is recommended that workshops

in 2014 should continue to be designed to include a wide range of opportunities for interaction and should be child-led where possible.

- Collaboration should continue to have a high priority at every level of the project and more opportunities to collaborate should be built into project implementation.

- In order to build on the learning from this process study it would be beneficial if Baboró management, teachers, arts and science practitioners and social scientists meet in order to reflect on the study findings and to engage in discussion around these. Practitioners identify that this would be very helpful in consolidating their learning from their engagement with the project and give them an opportunity to share information and learn from others. This would also support planning for BEAST! 2014.

- Dissemination of the project findings should be further considered. At present there are videos of BEAST! 2012 and a downloadable file on the Baboró website which interested parties can access. It is recommended that a copy of the report or executive summary should be sent to participating schools and practitioners in order to disseminate the findings to the wider school and university populations and wider community.

- It would be beneficial to further engage parents during the intervention possibly by including more exercises for children to do at home with parents

> Participants would like to continue and strengthen their links with Baboró and National University of Ireland, Galway. *'To be honest I'd have trust in what Baboró would come up with. Its very well run and I'm very impressed and it's a great privilege for the children and myself to be involved with it.'*(Teacher 3)

Chapter One: Introduction and Description of the BEAST! Project Model

1.1 Introduction

This chapter introduces the three year BEAST! project in greater depth; it outlines the genesis of the BEAST! model, discusses some of the principal motivations of Baboró management for adopting this approach, the roles of scientists and social researchers in NUIG and the aims and objectives of the BEAST! model. Firstly, the chapter begins by discussing the role of Baboró as an organisation who advance the creative arts among children in the West of Ireland. Secondly, the chapter discusses the aims and objectives of the BEAST! in greater depth, before moving on to outlining some of the expected outcomes of the project, such as behavioural and attitudinal change among children towards science and the arts and more general impacts on the schools who took part in the BEAST! project. It will then describe briefly the goals of the scientific, artistic, and technological strands of the project in their work with the three participating primary schools.

Over the last seventeen years, Baboró Children's Art Festival has brought a wide variety of Irish and International shows to children and their families in Galway. These have included performances, workshops, exhibitions and literature events that have showcased the art forms of poetry, percussion, dance, theatre, puppetry, mime, music and visual arts. Baboró aims to introduce new works, highlight new approaches to the arts and provide new engagement opportunities to their young audience. The festival takes place during October, and this year it is happening from 14th – 20th October 2013.

Baboró Children's Arts Festival began as one element of the Galway Arts Festival in 1994 and the organisation developed into its own dedicated festival in 1997[2]. In the seventeen years since its establishment it has focused on making art accessible to all children including babies, toddlers and teenagers. In 2009 Baboró hosted a conference 'Natural Born Artists - Arts for Early Years in Ireland' which attracted delegates, speakers and artists from the national and international artistic communities.

1.1.1 The BEAST! Project

As part of its remit, Baboró engages with families and children in schools and in the wider community. The outreach work with schools has become an important loci of the work and as part of the schedule for 2012, Baboró targeted a cohort of eight schools in County Galway with a new project entitled BEAST! 2012 (Baboró: Environment, Arts, Science and Technology Project). Baboró, engaged in an outreach partnership with the Ryan Institute, NUIG to deliver the project. NUIG has access to internationally recognised researchers in the fields of sustainability, environment and development and the Ryan Institute facilitated the recruitment of academic staff along with postgraduate and postdoctoral students to deliver the scientific elements of the project. The Ryan Institute also facilitated the scientists[3] to refine their proposed workshops to make them appropriate for young people.

Because of the success of BEAST!2012 Baboró decided to extend the project over three years and taking on board the findings of the study carried out by NUIG entitled '*Magic can Happen – A Process Study Report of the Baboró BEAST! Project'* devised a second phase of BEAST! to be delivered in schools in 2013. This report is the second process study of BEAST! and documents the processes and outcomes of the project in 2013.

1.1.2 Rationale

[2] Details on establishment of Baboró and BEAST! Project from Project Documentation/personal interviews.

[3] The term 'scientist' includes researchers and academic staff that came from biological and marine sciences, computer science and engineering disciplines.

Baboró identified the rationale behind the establishment of the BEAST! Project;

> '*Arts and creative activities are of enormous benefit for young children as they engender confidence, encourage critical reflection and creative thinking and provide a powerful base for team working, problem solving and future development.'* (Project proposal)

The original idea for the BEAST! Project was inspired by a project in the UK called 'The ARK Project' which worked with technologists, artists and children to create a life-sized ARK art installation and in the process inspired an excitement and interest in science and art in the young participants. Discussion and reflection brought Baboró to question the relationship between science, art and how best to design a project that would use art to create new ways of learning science and technology for primary school children.

> *'We wanted to give the children an eye-opening experience, where the world opens up [to them] and they get the excitement that one gets from new learning and the sense of wonder. [We wanted them] to be able to take the new knowledge and explore and create the habit of a lifetime. And we wanted to bring knowledge in a supportive way, contextualise knowledge, so that practitioners would act as facilitators… would journey [with the children], learning and exploring [together].'* (Baboró Director)

The 'Arts in Education Charter' (2013, DES) has informed the work of the BEAST! in 2013 and Baboró are involved in the consultation processes of the charter. The goals of the charter are to place the arts at the centre of the education system. The means of doing this include creating 'arts-rich schools' (ARIS), greater involvement of visiting arts practitioners in schools, reduced cost ticketing for cultural activities and visits to cultural institutions, amongst a range of actions. It can be seen that the BEAST! project aligns very well with these high level strategies and this project has much to offer in terms of the learning from the process studies.

The overall BEAST! project goal was to raise the profile of science and technology in the cohort of primary schools, encouraging the children and teachers to engage with and explore these subjects through the arts.

The learning for Baboró management from BEAST! 2012 fed into the formulation of BEAST! 2013 which led to the decision to focus more activity and attention on three schools rather than on eight schools in 2012. This had the result that the three schools received 13 workshops from a combination of visiting practitioners that included scientists, an artist and computer technologists. This would have a greater 'dose effect' and have a greater chance of impacting on the children in the participating schools.

The project aims were refined with the NUIG social scientists and are defined as the following:-

1.1.3 Project Aims

- To instil or improve levels of confidence, critical thinking, problem-solving, creative thinking and team working in primary school children
- To demonstrate in schools and to teachers the use of the Arts in teaching the school curriculum
- To create a project model that can be replicated easily and effectively and be used by others to teach and to evaluate

1.1.4 Project Objectives

- To marry Science, Technology (STEM)[4] and the Arts in exploring a 'Low Carbon Future' with primary school children though a series of workshops delivered by Scientists and Artist
- To create an artistic response using the children's understanding of the topic and to use Technology (Scratch Programming) as a method of expressing that artistic reaction
- To design and/or source quantitative and qualitative tools to collect data
- To observe workshops and document behavioural and attitudinal changes to evaluate the impact of the project.
- To write a process study report offering critical thoughts on the process and possible future developments for BEAST! Project

1.1.5 The Expected Outcomes

The expected outcomes were identified with Baboró and the NUIG social researchers at the early stage of the process study. The initial expected project outcomes included:

a) Impacts on the children relating to engagement, behavioural change and social development both in and out of school.
b) Impacts on the ways the children engage with learning
c) Impacts on how teachers view the use of art in teaching the science and technology curriculum.
d) The production of a video game/story by each of the 3 schools with a view to creating this into a video game in year three of BEAST! Project 2014
e) The continued documenting of the project model that can be replicated by other educational organisations working with children. (Process Study Report Two)
f) The continued documenting of the learning created through the delivery of the project (Process Study Report Two)

1.1.6 BEAST! 2013 Process Study

The staff and management of Baboró were conscious of the need to compile social scientific data on the various impacts that the project might have on the children, as well as the other participants who were involved in the project, such as the teachers, artists and scientists. As a result, representatives from Baboró contacted researchers at the School of Political Science and Sociology, NUI, Galway to conduct a process study of the BEAST and the social researchers have been involved in the evaluation of the project since the early planning stages in 2012. In particular, as Baboró were interested in documenting the engagement of individual children in the classroom with scientific and artistic topics and in monitoring any behavioural changes which might occur as a result of the project, the social researchers were interested in conducting a benchmark of children's sense of belonging, attitudes towards science and nature and their feelings about school. As well as this, in-depth data collected through interviews and Participant Observation (PO) enabled the researchers to reveal some complex patterns underpinning children's reactions to the different topics and their sense of engagement in the creative process.

1.2 Project Details

1.2.1 The BEAST! 2013 Project Staffing

One member of Baboró staff was dedicated to manage the project part time over the project time frame. One member of staff provided administrative support to the project on a part time basis. Two further members of management staff were involved in the project design and implementation. One

[4] 'STEM' refers to the initial goal of increasing interest in young children in Science, Technology, Engineering and Mathematics subjects.

photographer was employed to record the workshops using still camera and video camera to form a visual record of the work done with the children. One person was employed to curate the children's artistic work for the BEAST! 2013 Exploratorium interactive exhibition. In addition a further eighteen practitioners from different disciplines were involved in direct delivery or in supporting roles. This comprised: four NUIG researches; four Scientists; two Computer Scientists; one Artist and five teachers based in the 3 schools providing support to the science, art and computer science practitioners as they delivered their workshops to the children. A total of 23 people were involved in the project and all of these were involved on a part time basis.

1.2.2 Funding

Baboró received funding for the BEAST! 2013 Project from the following bodies: -

- NUI Galway 'Bright Ideas Innovation Fund'
- Forum Connemara
- Science Foundation Ireland
- Galway City and County Enterprise Board
- Galway County Council

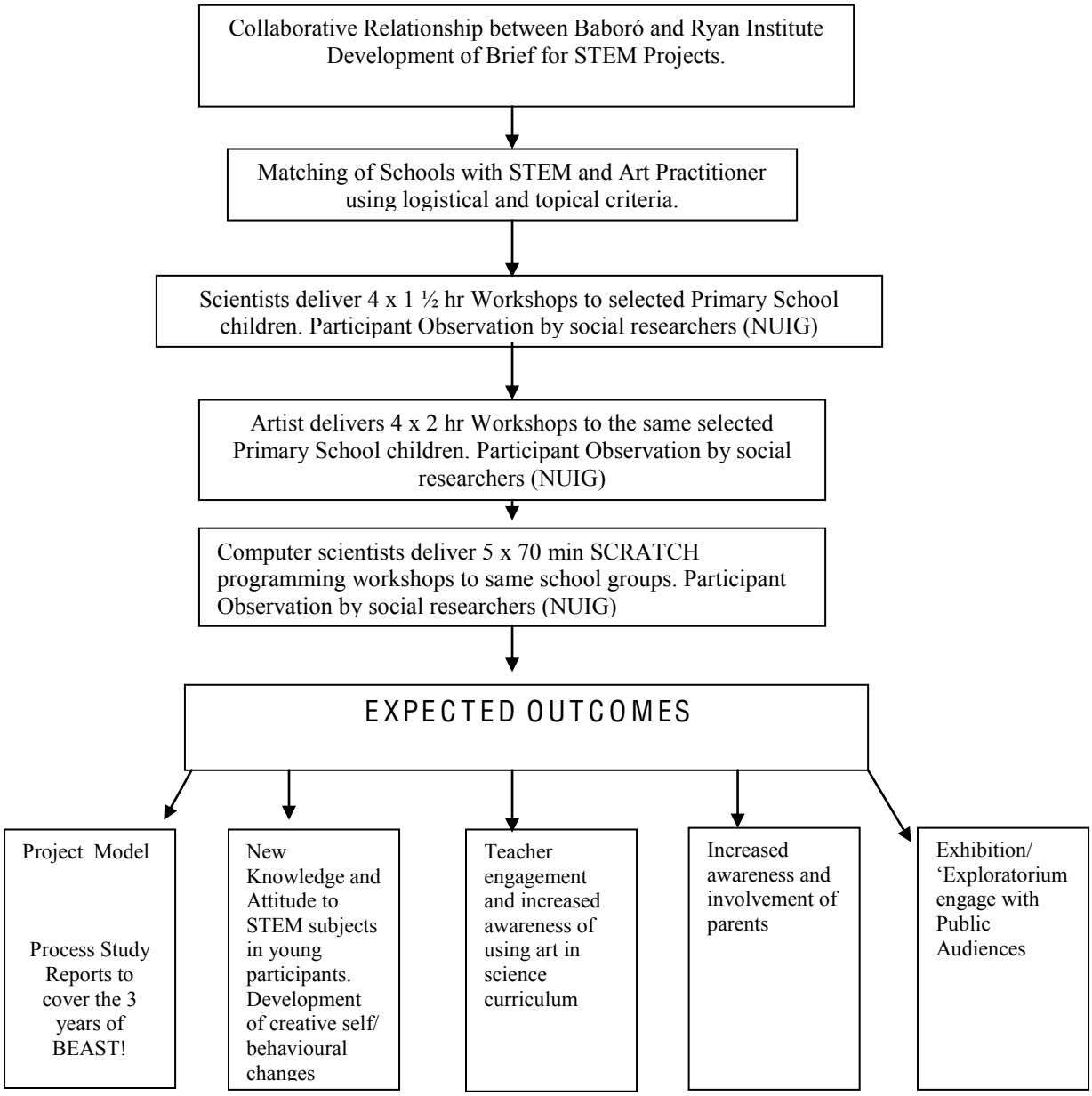
1.2.3 The School Cohort

Three primary schools participated in the project and these were selected from the eight schools that had taken part in the first phase of the project in 2012. They were situated throughout County Galway and were located in Gort, Oughterard and in Newcastle, Galway City. The schools served a range of populations with one school serving a disadvantaged population, one school serving a wide multi-cultural population with increased needs for language support and learning support and one school serving a more rural population. The total cohort of children involved with the project comprised 66. They were primarily children from 3rd ,4th or 5th Class and aged from eight years to eleven years.

1.3 The BEAST! Model

The discussion and planning for the project took place over more than a year from 2011 and involved consultation with the Ryan Institute at NUI Galway, scientists and other arts practitioners in Ireland and in the UK. After the research phase a model of delivery was designed and took the following format. This model was further refined after BEAST! 2012 and is outlined here (see Figure 1 below):

Figure 1. Baboró BEAST! Model 2013



1.3.1 The Scientific Engagement

In early 2012 Baboró approached the Ryan Institute (NUIG) to collaborate in the delivery of the project. The Ryan Institute sent out a call to all university departments which detailed the brief for proposals to run 3 science (STEM) workshops (1½ to 2 hours each) with primary schools in County Galway. There was an enthusiastic response from the academic community and the project outcomes have been detailed in '*Magic can Happen - Beast! Project Process Study Report One'.* Following on from the findings of the process study Baboró decided to focus the project on the three schools and selected 3 scientists to work with individual schools.

1.3.2 The Science Project Topics

The scientists were all researchers from NUIG and were experts in their field of research. All had prior experience or knowledge of the project from the work in 2012 and for this set of workshops the brief was broad. It was to design a series of four 1 ½ - 2 hour workshops that would teach concepts of science using as illustration their area of research in a way that was age appropriate and that would include discussions around the environment and a' low carbon future'. From experience in 2012 scientists knew that the children responded very well to hands on exercises. The Scientists took the topic of energy generation as an overall theme and created a link between the three different sets of workshops by keeping in mind the question *'What if you are stranded on the Aran Islands without electricity....what do you do?* The projects undertaken in each of the schools which took part in the BEAST! 2013 project are outlined in Figure 2 (below);

Figure 2: List of Schools and Projects Descriptions

School	Project Description
Galway Educate Together National School Newcastle, Galway.	Seaweed and Exploring Bio fuels. DNA Testing – This project explored the interconnectedness of marine life off the coast of County Galway but also inspired young people to think about international marine environments. Children were exposed to different varieties of seaweed and algae and their role in international ecosystems.
Scoíl Inse Guaire, Gort	Alternative Energy – Energy generation and personal power production. Storing and converting energy and harvesting energy from natural resources and from and people during motion
Scoíl an Cuimín agus Chatríona, Uachtar Ard, Co Galway	Smart devices for smart energy consumption Green and sustainable information technology. Carbon usage, science as 'all around us' and children's representations of sustainable futures.

1.3.3 Initial Project Briefing

Baboró brought together the scientists, artist and one teacher at an initial briefing meeting in April to provide the background to the BEAST! 2013 Project and to agree workshop scheduling and other organisational details. The social researchers from the School of Political and Social Science NUIG were also present at this briefing. This was followed by a meeting between the scientists to agree an overall theme informing the workshops that they would deliver during workshops.

1.3.4 The Artistic Engagement.

Baboró has developed relationships with arts practitioners who have experience of working with school children over many years of engagement with the arts community. For the 2013 project, Baboro selected one artist skilled in teaching creative writing to children to deliver four 120 minute workshops to each of the three selected schools. The brief for the artist was that he would work with the children's interpretation of the science topic to help them to develop a story or game using the science. The artist aimed to create an interest and enthusiasm in the children by stimulating an emotional and compelling involvement with the workshop themes that would have an lasting impact. The themes were around the science topics, environmental issues and renewable energy, concepts of story writing and drawing techniques. He began with outlining the principles of story writing described as *'the building blocks of storytelling, character development, setting and plot structure'* and followed this with a session on

drawing skills. This was to facilitate the children to develop individually and in groups, the creative output and imaginings that would be used in the third stage of the work which is to use the stories and drawings to design a computer game or animated film.

1.3.5 The Computer Technology Engagement

The third strand of the project involved two computer scientists delivering five 70 minute workshops to the selected schools. They demonstrated the basics of SCRATCH programming and facilitated the children to transfer their artwork into their computer programme. The role of the SCRATCH tutors was described as '*To help the children to use scratch as a tool to convey, in a digital format, what they have created with [the artist]'.* This constitutes a highly innovative, and interactive measure for teaching young people about the intersections between science and art and the role of creativity in STEM areas.

1.3.6 The Schools Engagement

Schools provided considerable support to the project in terms of timetabling children to be free for workshops, providing educational and other facilities and in being adaptive and flexible supports to the practitioners. One of the objectives of BEAST! is 'To demonstrate in schools and to teachers the use of the Arts in teaching the school curriculum' or in the words of the Baboró Director *'art practitioners demonstrate to teachers how art can be used to deepen the learning around science and technology'* . There was considerable interest in the project within the school communities and often there was more than one teacher present at workshops. Teachers were not there in an observational capacity but as a support to the practitioners, often contributing by making links with the children's existing learning. The teachers' insights on the teaching approaches used by the practitioners and of the possible impact on the school curriculum are detailed in the three case studies and in the discussion section of this study.

1.3.7 The Public Engagement

The culmination of the project work will be an interactive exhibition called the 'Exploratorium' in a well chosen, accessible site in Galway. There will be school and group tours and interactive elements in the exhibition with which audiences will be invited to engage. This element of the model is not included in the process study as it has not taken place during the study timescale.

1.4 Report Structure outline

The following outline summarises the layout and content of subsequent sections of this report;

Chapter Two: Literature Review: In this chapter, the literature surrounding important aspects of the BEAST model is reviewed, such as the benefits and challenges of using art as aid for teaching science, collaboration between arts and science practitioners and the impacts of using cross-curricular approaches in teaching in primary level education

Chapter Three: Research Methodology: This section outlines the methodological approach that was taken by the researchers who combined a range of qualitative and quantitative methods to gather data in the schools under study. Such methodological techniques include Participant Observation (PO), in-depth interviews, focus groups and a survey questionnaire.

Chapter Four: Three Case Studies: The three schools where the research took place are described in this chapter, Scoíl Cuimín agus Chatríona , Uachtar Árd, Galway Educate Together National School (GETNS) and Scoíl Inse Guaire, Gort, County Galway. This chapter also describes the projects that were rolled out here.

Chapter Five: Research Findings: The main findings of the project are outlined in this section. In particular, this section focuses on issues to do with engagement and attitudes towards creativity of all stakeholders in the project.

Chapter Six: Discussion and Recommendations: This part focuses on the extent that the BEAST! 2013 project model managed to achieve its aims and makes recommendations on how the project might be enhanced in the future.

Chapter Two: Literature Review

2.1 Introduction

This literature review critically examines social scientific literature on topics that relate to components of the Baboró BEAST! Model. In the first process study in 2012[5] the literature review identified that primary school science curriculums are often highly prescriptive, lack access to tactile experiences and interactive aspects, contain repetitive topic revision and therefore, facilitate 'surface learning' (Murphy and Beggs 2003). In contrast to this, Varley *et al*. (2008) advocates the importance of including opportunities for collaboration teamwork and engagement in which children are actively involved in designing classroom activities for teaching the science curriculum. Hence, more recent literature on science teaching, the curriculum and education argues for more interactive methods of student engagement which adopt a 'whole learner' approach by nurturing the 'multiple intelligences' of young people.

This literature review explores research that can further support and inform the learning from the Baboró model. It will explore research studies from the 'Creative Partnerships' scheme that operated in the UK from 2002-2011 which fostered collaboration and creativity. It will specifically examine the learning from research with teachers and arts practitioners to identify the best ways in which these practitioners can collaborate in the delivery of workshops to primary school children. Furthermore this section will explore the impacts, benefits and challenges of using cross-curricular teaching for science teaching at primary level. Using ICT in teaching at primary level is relatively new to the school curriculum and findings from studies relating to the impacts of ICT use will be discussed. Finally, involving parents in their child's education is of significant value but is also a constant challenge for teachers and the findings from studies of cases where this has been achieved successfully are considered.

2.2 Collaboration between visiting arts practitioners and class teachers

Best practice around involving arts practitioners in schools has been researched in the UK by Creative Partnerships/AICE (2011) and in Ireland by the Department of Education and Science (DES)(2006) with the Arts Council.

The Creative Partnerships scheme was comparable with the BEAST! as it brought science, the school curriculum and art together in efforts to help children engage with subject matter in deeper ways in the classroom. Creative Partnerships was advertised as the UK's 'flagship creative learning programme'[6] and the project brought people who were involved in different sectors of the creative industries into classrooms, such as architects, scientists and artists to work with teachers 'to inspire young people and help them learn'.[7] The programme was hugely successful. Overall, it worked with 2,700 schools, 90,000 teachers and over one million young people were involved in the project. The programme aimed to develop the skills necessary to help students excel academically and to prepare them for the workplace. Creativity was at the very heart of the 'Creative Partnerships' initiative. It was defined as 'the wider ability to question, make connections, innovate, problem solve and reflect critically'. Fostering creativity among young people was seen as being important for helping them to re-imagine what the world should be like and to enable them to make change happen. Hence, themes such as civic engagement, youth empowerment and participation lay at the heart of the Creative Partnerships; young people's artistic abilities and their knowledge of how science happens in the home and in the school were married together in highly inventive ways.

[5] *'Magic can happen' – A Process Study of the Baboró BEAST! Project. 2012*
[6] See http://www.creative-partnerships.com/
[7] See http://www.creative-partnerships.com

A wide range of reports and guides have been produced as an outcome of the 'Creative Partnerships' scheme. In an analysis of case study and survey data , McClellan *et al*. (2012) found that at primary level, assisting pupils to exercise their 'student voice' was vital in facilitating wellbeing and in supporting them to become personally and socially more effective. In all the participating schools the emphasis was on helping students to think *'flexibly, strategically and creatively'.* (2012:5). Such emphasis on strategic learning and critical engagement with science, the arts and society are core to the BEAST project which encourages young people to think about society-nature interdependence and how the environment inspires scientists and artists to think 'outside the box'.

AICE (2011) have developed a guide for artists and teachers from learning gained through the Creative Partnerships scheme entitled *'Artists in Creative Education: Unlocking children's creativity – A practical guide for Artists.'* Building on the learning from Creative Partnerships, AICE recommends that it is important to build a relationship between the teacher and visiting artist before the delivery of arts sessions. This is in order to identify the ethos or culture of the school, the needs of the children and to identify the aims of the work so that realistic expectations are created. AICE state it is crucial that the teacher is present during sessions so that they can share in the learning. It is ideal if artist and teacher can agree their roles. This could include the teacher taking responsibility for conflict and dealing with children with learning difficulties. Teachers can also draw links (with other learning that the children have already engaged with) as the session proceeds. The artist should give an outline of what will be covered and it is ideal if this connects with the current school curriculum. This will enable the teacher to prepare the children for the sessions and also to build on the work between sessions and later on. (I would include page numbers after these quotes Patsy)

The Department of Education and Science (DES 2006) in a report produced with the Arts Council views that Artists-Schools programmes *'enrich the school curriculum'* (2006:10). The report recommends that visiting artists and school teachers should engage in a collaboration of mutual respect and negotiate a common purpose prior to the work starting with pupils. This is central for ensuring that trust relationships are formed from the outset by key stakeholders and for agreeing on how the curriculum can be (re)-formed in the context of new disciplines being introduced. As outlined by AICE (2011) it is important that roles and responsibilities should be defined and agreed. In addition the artist should ascertain the availability of space, facilities and resources. The benefit of formal evaluation of the programme is also highlighted in the report. (2006:12-16). Overall, the (2006) report contains critical insights on practical elements that affect the development of inter-disciplinary interaction between scientists and artists and their impacts on curriculum development.

2.3 Cross-curricular teaching of science at primary level

The literature on scientific education in Ireland is sparse, although some important studies have emerged on this topic. In 2003, the Irish Primary Science Curriculum was implemented in Ireland and has served as an important impetus for the publication of reports and research articles on the theme of science education. Research in Ireland by Varley *et al.* (2008) in particular sees that children do not understand the relevance of science to their everyday lives. Science is in fact removed from the 'lifeworlds' of most children; *'In general, primary school children are not necessarily relating their school science experience to the wider world or future aspirations'* (2008:8). The NCCA (2005) noted that regardless of subject matter, children reported that the activities they view as most enjoyable and appealing, are ones that includes collaboration, authentic learning and inquiry-based learning. Strengthening the role of science on the curriculum is not a straightforward matter; ensuring that the teaching method is appropriate for children and that it caters to children's learning is extremely important. Greater emphasis is now given to the 'voice of the child' in policy arenas and research.

Given children's preference for social interaction and a more creative way of learning, is it time to move beyond adult-centred notions of the curriculum towards child-friendly modes of curriculum design and delivery?

Kelly (2012) states that cross-curricular teaching is historically associated with more constructivist methodologies in child education. She discusses that young children do not necessarily associate different activities into different subject areas and advocates that this is not the way that most children learn. Dewey (1933) also argues that there are many linkages between areas of knowledge that would militate against the teaching of single subjects only. In the UK, Ofsted (2002) recognise that successful primary schools utilise cross-curricular teaching and Rose (2009) and Alexander (2010) recommend that subject teaching combined with 'well planned' cross curricular approaches achieve high standards, thus showing that such approaches facilitate higher academic outputs for young people (Rose, 2009:2). Kelly defines cross curricular teaching in science as '*how another subject can support and enhance children's learning in science'* (2012: 3). In order to achieve more successful outcomes when using cross-curricular approaches researchers have identified the necessity of providing a clear focus for children's learning by limiting the number of subjects used for a given theme (Ofsted 2002; Jarvis 2009; Barnes 2011).

The motivational aspects of cross-curricular teaching are discussed by Muijs and Reynolds (2011) as they reason that it engages with the emotional elements of learning as children adopt more independent and self-led exploration. Curran (2008) looks at the way that emotion is inextricably linked with learning:

> *'Learning is directed and controlled by the emotional and limbic brain [....] the emotional self is centrally involved in the vast majority of the things you learn'.* (2008: 61-6)

This relates specifically with the Baboró model as practitioners and teachers in Baboró BEAST! 2012 recognized the enthusiasm with which the pupils engaged with the workshop topics and social science researchers also observed the emotive language that children used during workshops which demonstrated their levels of engagement with the topics[8].

Critics of cross-curricular teaching point to pupils not gaining necessary subject specific skills(Muijs and Reynolds, 2011), levels of learning lacking sufficient depth, (Alexander *et al.* 1992), and weak links being forged between subjects (Jarvis, 2009). That said, recent research also shows that this can be addressed by having clear learning objectives for the learning theme (Savage, 2011); limiting the number of subjects to three or four (Barnes 2011); following the National Primary Curriculum and using this to inform teaching session design. They also point out that there is a requirement to manage the school timetable flexibly in order to facilitate children to engage fully with the work.

Under the 'Arts in Education Charter' (2013) launched by the Minister for Education and Science and the Minister for Arts, Heritage and the Gaeltacht, schools are encouraged to include visits to cultural institutions such as museums and art galleries. In a similar vein, Gilbert and Priest (1997) focus on field trips to museums among primary school children, and they argue that children are more engaged in exhibits when they work in groups with friends, when they can walk around on their own and choose which exhibits to visit.

The benefits of child-led learning and the impact of using the Arts across the curriculum are demonstrated by a study within schools with arts practitioners, student teachers and primary school

[8] '*Magic can Happen' – A Process Study of the Baboró BEAST! Project. 2012*

children carried out by Barnes and Shirley (2007). They point to the '*great potential of shifting the locus of control towards children*' and also the power of the Arts as a motivating factor for learning across all curriculum subjects. (2007:162). This suggests that aspects of the Baboró model may be conducive to science learning, as it is provided ample opportunities to children to develop their own individual ideas and to work creatively and collaboratively.

2.4 Using ICT in teaching at primary level

The use of ICT in teaching is a developing methodology though it is an increasingly important one. Sociologists such as Castells (2000) discuss the 'network society' and the effects that momentous changes to technological developments have on social interactions between people of all ages. Hall and Schavarian (2001) in a six month study carried out in the US with primary level pupils found that when using ICT if the child's interest was engaged the impacts were greater as they state '*where the child's curiosity was the engine for their learning, profound understanding of the topic evolved*' (2001:454). They identified that where the learning of science and technology was focused at or near their home or community and in the child's own personal context the engagement of children was more meaningful and children's ideas *'deepened'* (ibid). Overall, this shows that connecting science learning to young people's 'lived experiences' is a critical part of young people's social development and their learning.

Passey *et al.* (2004) found a correlation between ICT use by pupils and teachers and positive motivational outcomes with increased focus on school tasks in a study carried out in a range of case study schools across the UK. They found that motivation was increased when both children and teachers engaged with the ICT in hands on approaches. The study also pointed to positive impacts on pupil behaviour when in school and some indicators of positive impacts on behaviour outside school.

Valentine (2008) found that parents, teachers and pupils reported that the use of ICT had a motivating effect and raised children's self-esteem. They also found that the use of technology enables children with special needs as well as high achievers to display their skills and can thus be beneficial for pupils with wider ranges of abilities. Goodison (2002) also identifies that some children can display a very sophisticated use of technology which implies that societal knowledge of these subjects is expansive and ever-changing.

The vast majority of primary schools in Ireland now have interactive whiteboards used for teaching purposes but as Goodison (2002) and NCCA (2010) have acknowledged, teachers need more support in order to use ICT and this should be addressed in teacher training and in-service training. Goodison (2002) also notes that the task for teachers, where there is a wealth of web-based resources, is to identify the best ICT tools for particular tasks. The National Council for Curriculum and Assessment (NCCA) (2010) produced a guide for using ICT at primary level which identifies how to support children in their use of ICT. This includes identifying for children age appropriate and language appropriate websites (such as yahooligans.com, Scoílnet.ie). The guide states that websites consulted should provide information that is current, relevant and unbiased. Teachers can use age appropriate assignments for group work to encourage social skills and the report suggests that they can invite parents or other adults into school to help pupils. This is an important finding as it suggests a model of collaboration which moves beyond the school environment into the home and suggests an interchange of knowledge between parents, teachers, artists and children which is highly beneficial for young people's learning.

2.5 Involving parents

The value of parental support is highlighted in many studies and discussed by Desforges and Abouchaar (2003) in an extensive literature review into the impacts and influence of parents on their child's education. They concluded that effective and 'good parenting' impacts the child by influencing their self concept as a learner and through setting high goals or ambitions (2003:5). Valentine (2008) in a study with twelve UK schools on the teaching through ICT shows that many parents would like to be more involved in their child's education and would like teachers to identify how they can best support their child's learning in ICT in terms of recommending appropriate websites or by establishing school-home websites. They recommend that adult literacy programmes should include modules on helping participants to support their children with their ICT for schoolwork.

Safford and O'Sullivan (2008) in a study on parent's responses to their child's involvement with Creative Partnerships in schools identified that:

> - 'A creative curriculum has a positive impact on home-school communication. Children's enthusiasm for creative projects leads them to talk at home about what they do in school, and parents develop new perspectives on their children's learning.
> - Parents feel that creative projects motivate children to be in school and support children as individual learners. Parents believe that creative projects have a significant, long-term impact on children's confidence, skills, wider learning, overall
> - A creative curriculum offers low-risk invitations to parents to become involved in school. Children's engagement also leads parents to reflect on their own school experiences and to take-up cultural and other learning opportunities for themselves'
>
> (Safford and O'Sullivan 2008:38-40)

The findings from these studies indicate a very positive demand from parents to be more involved in their child's education and shows that programmes such as Baboró BEAST! can be very effective in harnessing this interest and enthusiasm in a variety of ways to produce more positive outcomes for the education of primary school children. It also suggests that relationships between parents and teachers can be greatly enhanced and that such relationships can impact in very positive ways on children's learning.

2.6 Summary

This section reviewed literature under a number of different headings which relate to relevant factors in the BEAST! Project model. It reviewed literature on collaboration between arts and science practitioners and teachers, cross-curricular teaching of science at primary level, the use of ICT in teaching and research on studies that focused on more actively linking parents to their children's education. Previously, the authors identified that there is a sparse research available in the Irish context on the impacts of using different methodologies in teaching STEM[9] subjects and urge the production of more studies on science education and what it means to different stakeholders. In particular, the attitudes of parents and teachers towards science and emerging relationships between them can have highly beneficial effects on children's learning. Recent research emphasises that 'real learning' happens in highly interactive ways and that is contingent on social interactions between multiple stakeholders in the learning process (parents, scientists, artists, young people and teachers). This is evocative of 'the whole learner approach' which seems to be a mainstay of recent research. This emphasises the significance of fostering multiple aspects of young people's development and the need to interrelate the sciences and the arts in a spirit of creativity, knowledge-creation and mutual respect.

[9] STEM – Science, Technology, Engineering and Mathematics Subjects

There is a significant need in the Irish literature for more large-scale, quantitative work on young people's attitudes to science and the arts. This is especially appropriate given the emphasis given to discourses around the 'knowledge based economy' and the 'knowledge based society' since the Celtic Tiger era (1995-2008) and changes to the Second Level Mathematics curriculum. However, there is also a need for more qualitative work on children's feelings about science and its intersections with artistic disciplines and how they react to scientific knowledge, more generally. Such research would make significant inputs to the literature on children, knowledge and science in Ireland and internationally.

The next section of this study outlines the BEAST! process study methodology and how a mixed-method approach facilitated a deeper understanding of young people's reactions to science, the arts and their feelings about the environment and ICT.

Chapter Three: Research Methodology of the BEAST! Process Study

3.1 Designing and Implementing the Project Methodology

The researchers utilised a mixed-method approach when collecting, analysing and interpreting data for the BEAST! process study. Qualitative and quantitative methodological techniques were employed in order to access children's social worlds and to tap into the experiences of multiple stakeholders in the BEAST project (teachers, Baboró representatives, scientists, parents and artists). In this context, the combination of in-depth qualitative and quantitative data provided much detail about young people's reactions to science and art and their feelings about ICT. Mixed-methods research techniques frequently yield highly comprehensive data and this context, applying a combinatory approach generated in-depth qualitative and quantitative materials on people's discourses about creativity, science and the arts and their attitudes about the BEAST!

The objectives of the Process Study were as follows;

- To design the project methodology including to design and/or source quantitative and qualitative tools to collect data.
- To describe, and critically analyse, different aspects of the project model
- Establish the perspectives of different actors involved in the BEAST project (artists, parents, scientists, teachers and children).
- To observe workshops and document behavioural and attitudinal changes to evaluate the impact of the project.
- To write a process study report offering critical thoughts on the process and possible future developments for the BEAST! Project

3.2. Description of Schools who took part in BEAST Process Study

Representatives from Baboró chose the three schools taking part in the BEAST! process study. These schools are Scoíl Cuimín agus Chaitriona, Uachtar Árd, Scoíl Inse Guaire Gort and Galway Educate Together National School (GETNS). Baboró decided to include these schools because they wished to include urban and rurally-based schools and because of the amount of interest that was expressed by teachers and parents in these schools since the first BEAST! Project was rolled out in 2012. It was also felt that the science and art projects worked especially well in these schools in 2012 and that the children benefitted greatly from the projects in these settings.

3.2.3 Overview of Research Aims, Questions and Methods

The following table (Figure 3) provides a summation of the main aims of the BEAST process study, the research questions relating to these aims, and the methodological tools that were adopted throughout the project.

Figure 3: Summary of BEAST process study aims, research questions and methodological approaches utilised

Aim	Research questions	Methods
Describe and Analyse the Baboró BEAST! Project Model	●What does the BEAST! Project Model consist of? ●What are its aims and objectives and desired outcomes? ●Why was it established? ●What are the structures and practices of the programme? ●How many schools/young people involved? ●What is the key research evidence on using arts in the science/technology curriculum?	●Review of programme reports & other relevant documents ●Interviews with Baboró Art Director/ Project Co-ordinator Focus group with Baboró Management Staff ●Documentary review ●Literature review
Establish the perspective of participants/key stakeholders regarding the programme	●Why did stakeholders choose to engage with the programme? ●What outcomes are perceived to result from the programme for young people, teachers, practitioners, parents? ●What are the views of stakeholders regarding the programme implementation?	●Interviews and Focus Group with Baboró Director/Administrator/ BEAST Co-ordinator ●Administration of Quantitative data collection instrument to children in two participating schools ●Observation of 3 workshops in each of the case study schools and at field trip to marine laboratory. ●Interviews with 3 teachers, 3 Scientists/Technologists, 3 Artists ●Focus Group with young people in one school Interviews with parents
Document Attitudinal and Behavioural Changes towards Science and Art	● What are the opinions of key stakeholders in BEAST project towards science and art at the commencement of project? ● What can be concluded at end of project about behavioural change as a result of BEAST?	●Quantitative Survey questionnaire (Baseline study) ● Interviews and participant observation ●Quantitative survey questionnaire (Baseline study) of young people's reactions to ICT ●Quantitative survey questionnaire (repeat of baseline study conducted in Week 1) ● Quantitative survey questionnaire (repeat of baseline study of young people's reactions to ICT) ● Interviews and Participant Observation

Reach a series of conclusions regarding the BEAST! pilot project	●What is the core purpose of the project? ●What outcomes are perceived to result from the programme for children, teachers and practitioners? ●What are the views of stakeholders regarding programme implementation? ●What recommendations can be made to guide the future development of the BEAST! Project?	●Interviews with Baboró Art Director/ Project Co-ordinator ●Focus group with Baboró Management Staff ●Analysis of findings from Quantitative data collection instrument ●Review of all primary and secondary data Process study review

3.2.3 Collecting Data using Standardised Measurement Tools

In Phase I of the BEAST! study, the social researchers developed an instrument to gauge children's attitudes to the BEAST project, science and art, their feelings about school, their friends and resilience and wellbeing. This survey was repeated with children during Phase II of the BEAST! in 2013. This quantitative instrument was partly developed from research that was previously completed by the Child and Family Research Centre, NUI Galway (CFRC). This tool was tested and validated for measuring children's wellbeing, their feelings of resiliency, their social networks and social supports. In the BEAST! survey, such items were incorporated to 'measure' children's sense of 'belonging' at school and at home in order to chart attitudinal and behavioural changes (Appendix I).

Larsson *et al.* (2009) items on children's feelings of eco-affinity and eco- awareness were also incorporated into the instrument. As the scientific projects implemented in schools were focused on children's interpretations of a 'sustainable future', the instrument looked at how young people react to the environment. It was also envisaged that at the end of the project, researchers would be able to make some suggestions about children's environmental behaviours and attitudinal changes which may take place as a result of the BEAST! study.

The questionnaire was divided into five discrete sections (see Appendix I). Children were asked about their experiences in school; whether they feel like they belong in school and if they felt 'connected' to their teachers and/or other pupils. The survey also looked at how the children feel about themselves included items such as 'I feel good about myself', 'I feel worried' and 'I feel valuable'. The fourth section asked about the children's feelings towards their friends, while section five focused on their attitudes towards nature. The researchers administered the survey with the children during the first workshop with the scientist and repeated it again during the final session in order to chart any changes that might have taken place in behaviours and attitudes during the project.[10] The number of children who took part in the survey questionnaire in both schools is summarised in the table below (Fig. 4).

[10] The survey questionnaire was carried out at T1 and T2 in Scoíl Inse Guaire, Gort and Scoíl Cuimín agus Chatríona, Uachtar Árd. To date, it has been carried out only once in GETNS. This phase of the data collection is taking place however in October 2013.

Figure 4: Number of participants in Pre and Post Questionnaires (BEAST! Process Study)

	GETNS	Scoíl Inse Guaire	Scoíl Cuimín agus Chatríona
Pre-questionnaire (number of participants)	**26**	**22**	**20**
Post questionnaire (number of participants)	**---**	**16**	**20**

3.2.4 Measuring Children's Reactions to ICT and SCRATCH Programming

In this second year of the project, it was decided to deliver 5 workshops in SCRATCH programming and the researchers wanted to identify the impacts of using this approach with the children. The ICT questions were taken from a study by Passey *et al.* (2004) *The Motivational Effect of ICT on Pupils.* Lancaster University: Department of Education and Skills. The study by Passey *et al.* (2004) was carried out in 17 schools and with more than 1200 pupils. It identified that ICT had positive motivational effects on young people's learning when it was implemented with an appropriate pedagogy. More positive motivation occurred when ICT was used as a teaching and learning tool.

These questionnaires were carried out in Scoíl Inse Guaire and Scoíl Cuimín agus Chatríona at T1 and T2 to trace any behavioural or attitudinal changes to ICT which may be attributable, at least in part, to participant's exposure to the SCRATCH workshops. The data collection for SCRATCH in GETNS is to be completed in October 2013 as a number of the SCRATCH workshops were scheduled to take place during Autumn 2013 in GETNS due to difficulties surrounding timetables prior to the 2013 summer break. Figure 5 contains the number of children in both schools who took part at T1 and T2;

3.2.5 Using Focus Groups, Interviews and Ethnography to Access Children's Reactions to Science, Art and ICT

Participant Observation
Phase III of the study focused on the qualitative part of the project. The researchers completed ethnographic research (Participant Observation) at three workshops in each of the schools. The observation schedule was adapted from Ballantyne (2005[11]). This observational schedule was also used during the first BEAST! process study in 2012.

The group from GETNS also attended a walk along the shoreline of Galway Bay with two scientists affiliated with the Ryan Institute in NUIG and one of the researchers attended this trip, recording extensive field notes about children's behaviours and their learning. Participant Observation is extremely advantageous as the researchers were able to directly and ask participants about their feelings towards different parts of the BEAST! project.

Qualitative Interviews
This ethnographic research was also completed in tandem with of qualitative interviews which yielded exceptionally rich data on how people (re)-construct social meanings (see for example, Waterton and

[11] Ballantyne, R; J. Packer and M. Everett (2005) 'Measuring Environmental Education Program Impacts and Learning in the Field: Using an Action Research Cycle to Develop a Tool for Use with Young Students' *Australian Journal of Environmental Education,* vol. 21: 23-37

Wynne 1999; Macnaghten 2004). The artists, scientists and teachers in the three schools were interviewed using the interview guide and in-depth interviewing techniques. The interviews were carried out face to face and over the phone. The children from Scoíl Inse Guaire and Scoíl Cuimín agus Chatríona took part in focus groups and were very forthcoming with their individual and group reactions to the project. Additionally, parents of children in Scoíl Cuimín agus Chatríona were interviewed. The researcher in GETNS made efforts to contact parents to take part in interviews for this study, but none of the parents expressed interest in taking part. Scoíl Inse Guaire has a policy of not requesting parents to take part in surveys. The total number of stakeholders who were interviewed is given below;

Figure 5: Participants interviewed as part of BEAST! process study;

Participant's role in BEAST project	Number of participants interviewed
Artists	1
Scientists	5
Baboró representatives	4
Parents	4
Teachers	5

3.3 Qualitative and Quantitative Data Analysis

The interviews and ethnographic research was analysed using Discourse Analysis (DA). This is a highly versatile method of analysis as it can be used to analyse texts and photographs as well as talk (see Bryman 2012: 528). The researchers completed a close reading of the field notes and interview transcripts and extracted themes from these texts. Utilising Discourse Analysis (DA) was useful as it enabled the researchers to appreciate how different stakeholders in the project negotiated different understandings about science, art and creativity. Authors such as Alldred and Burman (2005) also state that the DA approach is important for researching children. They advocate an approach to research where precedence is given to the voice of the child and where they are listened to throughout the research process.

The quantitative surveys were analysed using the statistical package SPSS which is widely used in the social sciences.

3.4 Ethical Issues

Ethical issues were also given the highest primacy during the project. A literature search on ethical issues that impact on research with children was conducted during BEAST! Phase I and Phase II and the researchers adopted a 'child-centred' approach to the process of data collection. A consent document was prepared which the children signed before taking part in the interviews and this contained pictures which the children could relate to. Representatives from Baboró and the schools contacted parents to ask permission for their child's involvement in the study prior to its commencement. Both of the researchers were vetted by Gardaí before completing the study.

3.5 Conclusion

This chapter outlined the mixed-method approach that was utilised during this study. Mixed-methods enabled the researchers to create a much fuller picture of the reactions of children and other stakeholders (teachers, scientists and artists) towards the project. The qualitative and ethnographic research strategies yielded in-depth data on reactions to the project and the children's behaviours.

However, the quantitative survey questionnaire enabled the researchers to tap into children's feelings of resilience, wellbeing, social support and their reactions to nature.

Mixed-methods could be advantageous for other evaluations of the BEAST! project that might be completed in the future. However, there are some limitations. The fact that the BEAST! was completed over such a short time-scale means that the data is limited in the extent that it can capture behavioural changes in children. That said, the utilisation of qualitative and quantitative methods in this context facilitated a rich dataset of children's reactions to ICT, science, the environment and the arts. The next chapter of this report outlines the main findings from the three case-study schools.

Chapter Four: Three Case Studies of Participating Schools

4.1 Introduction

In this chapter, background details on the three participating schools are provided. This section presents critical data on how the BEAST! project was operationalised in each of the schools. This includes details on the content of the individual workshops that were delivered by the scientists, artist and computer technologists; what they wanted to achieve throughout the project and the learning of the participants who took part in the project. This included the views of children, teachers, scientists and the artist.

The first case study which is outlined here relates to Scoíl Cuimín agus Caitríona, Uachtar Árd which is situated in a predominantly rural area north of Galway City, near the shores of Lough Corrib. The second case study documents the BEAST! model as it was implemented in Scoíl Inse Guaire, Gort and the third case study focuses on the implementation of the project in Galway Educate Together National School (GETNS), Newcastle, Galway City.

Case Study 1. Scoíl Cuimín agus Chaitríona , Uachtar Árd: Discovering Children's ideas about 'Smart Devices', Carbon Usage and 'Sustainable Futures'

Background

Scoíl Cuimín agus Caitríona is located in the town of Uachtar Árd County Galway. It is a mixed school with boys and girls, ranging in age from four to twelve years. This is the second year that BEAST has operated the project in the school and practitioners worked with the same group of children. This year, twenty children took part in the project and they had graduated to third class and were now aged between nine and ten years. The teachers, artist and scientist observed that the children were very enthusiastic and engaged with the project and showed good interest in each of the different workshops. The children reviewed their learning from last year's BEAST project work and demonstrated that they had absorbed and applied a great deal of the workshop information during the intervening period. The science project, in this second stage, focused on energy and carbon usage and children learned how to calculate the energy usage of common household appliances.

What the Scientist wanted to achieve

The scientist, in continuing to engage with the same group of children wanted to develop further their exposure to the concept of science; to deepen their understanding of the scientific process, and to make science accessible to the children involved. He wanted the children to develop their ideas around science being valuable and 'being everywhere in life.' He talked about inspiring children in primary schools to become the *'scientists of the future'*(Scientist 1) and he did not want the children to feel that they were 'removed' from science.

The scientist delivered three workshops of 90 minutes each. He discussed his work as a computer scientist and his link with NUIG and with DERI (Digital Enterprise Research Institute). He further developed the concept of electricity creation and used videos to showcase how energy is generated and delivered through the national grid. Outdoor activity of 'jumping jacks' for a short time period showed in a concrete way how long would have to engage in this activity to create 1 watt of energy. They saw how long they would have to jump in order to produce enough watts to power common appliances for one hour. They were shown cartoon videos of 'Ed's World' which demonstrated the consequences for the world of excessive energy consumption in an amusing way and the children displayed a thorough understanding of the films messages. The children brought tasks home to work on with their families and were able to calculate the approximate energy usage of their household and identify where energy could be saved. Parents engaged with children in the exercise and learned more

about energy conservation and also more about the project. This implies that the BEAST project had significant learning outcomes for children and adults.

The children also visited the Technology and Science Museum based in DERI at NUI Galway. They were very engaged with the exhibits that chart the development of communications and information technology from early times. They were particularly interested in the old school classroom exhibit and in the early versions of computer games and computer technology saying *'I'm a hacker!'* They asked many questions on older versions of technology developed before they were born such as *'how did the first laptop develop?'*

When talking about the scientist the children said *'I liked that he didn't shout – even though someone interrupted him he didn't get annoyed', 'He did things the fun way, joker, he was bold!'*
In relation to science as a subject the children said *'It's really fun because something could explode like a volcano and I like the way science is fun because you don't know the ending' 'You get your hands messy and I love doing that. It's really relaxing'*

What the Artist wanted to achieve
The artist delivered four 90-120 minute workshops to the group. The artists brief was to extrapolate the children's responses to the content that was delivered by the scientist. And how they conceptualised a 'low carbon future' as expressed by the question ***'What will you do if you are living on the Aran Islands and there is no electricity? How will you survive?*** This probed children to think outside of their own 'lifeworlds', to think about children and adult's lives in other places and the impacts of science on all our lives.

The artist's aim was that the children would also use this question to motivate them to gain the skill of story writing. He planned to do this through creating enthusiasm and engagement so that they would be 'personally involved in the process in an emotional, creative and compelling way'. (Artist 1) He hoped that the impact on the children would be lasting and that during the workshops he could stimulate curiosity and interest to help them through the early blocks that children new to writing often display. The artists brief was that he should find out from the children what they had absorbed of the science workshops and work with them to develop a story line with characters and plot based on their science workshops. The children had a lot of questions about the environment and how it related to them at a personal level. They were very responsive and actively engaged in developing characters, problems and associated storylines based on the brief. They were very keen to share their character descriptions and outlines and asked '*is it where you were born or where you were before you were born*?' The artist also showed the children how to draw characters that could be adapted for computer games. They produced some very original drawings that the artist then simplified so that they would be able to adapt them for the next stage of the project which was to learn SCRATCH programming in order to design a computer game based on the original storyline.

When asked about the art workshops, the children appreciated the difference between the scientist's and artist's presentation styles and they enjoyed the jokes. They preferred the sessions where they were engaged in writing the storyline and drawing characters. They appreciated where they learned about the importance of planning for better stories and for better drawings. The early stages where the artist discussed and described the process of story writing were enjoyed less by some of the children, one of whom said that it was *'like going to church'* . They also said they preferred it when the artist *'lets us do the work instead of doing it all himself'.* Such findings seem to corroborate the findings from the literature discussed previously in this report which states that children learn in highly interactive ways and that didactic modes of teaching and information transfer often stifle young people's engagement in creative processes.

What the computer technologist wanted to achieve.
Two computer technologists delivered five 70 minute SCRATCH programming workshops to the group that adapted the original storyline developed with the scientist and the artist. The class teacher and another teacher supported the less able children as they followed the technologist's directions. Initially the children were shown how to operate the programme and they picked up the process very quickly. The children were very keen and exclaimed that it was *'cool'* many times. They worked on laptops in groups of two/three taking turns to operate the keys and were excellent at following directions. They were interested in who had invented SCRATCH (Massachusetts Institute of Technology) and who owned it (Open Access). The children used the digital drawing tools to draw the characters they had developed with the artist and then they designed backdrop and actions for the characters. Some of the children included elements from the story line such as the energy source that was malfunctioning on the Aran Islands. The children enjoyed experimenting with the paint pad and drawing elements of the SCRATCH programme.

When asked about the workshops they said *'I like that we got to do something instead of [scientist] doing all the work.' 'You have to pay attention to learn what to do ... really pay attention.. it was hard and challenging.' 'We liked that we had cool computers to work on and it was just like working and playing.' 'It's a bit confusing;* ***you*** *were the home-made computer game yourself.' 'you got time – loads of time.. the others [workshops] were rushing you. The hour felt short and it was great fun.'*
Overall, such findings imply that the children enjoyed being stimulated by the interactive elements of the BEAST process and that the process stimulated their creativity as well as their learning.

Benefits to the children of participation in the BEAST II Project
Engagement and increased attention span

The teachers felt that the children were very engaged in all elements of the workshops *'The children were very engaged throughout and very excited'* (Teacher 3)
'The class had a significant proportion of children with language difficulties or learning difficulties where they have experience a lot of failure and [these children] were able to engage in the SCRATCH programming and in art on an equal basis to the others in the class. That's the beauty of it.. it caters for every level' (Teacher 4) '*It gives the less academic children a chance to shine'* (Teacher 3). Children described the workshops as *'fun', 'exiting and amazing', 'funky and cool',* and showed their interest throughout the majority of sessions.
The teachers discussed that the children were still talking about the workshops on their return to school in autumn 2013 and on how they had used SCRATCH at home over the summer.

Development of New Skills
Teachers appreciated the skill levels of practitioners. *'It's great to have such different experts in their field'* (Teacher 3). They also identified that the children gained good writing skills and that they too as teachers had '*picked up loads from [the artist] and from the SCRATCH workshops'*. Teachers identified that children displayed good recall, improved critical thinking and recording skills. The computer technologists engaged very well with the class '*they were fantastic with demonstrating the computer skills and the children responded well and the teamwork developed good social skills in the children'* (Teacher 4). Instilling such a wide range of skills in young people is important for improving academic outputs. However, these are also life skills which will be developed and nurtured throughout the life course.

This year the art workshops included creative writing and drawing skills. The teachers felt that the children really enjoyed acquiring these skills and could see the impact on the improved writing style and drawing ability of many of the children.

Changes in attitude towards science
The teachers identified that the children had continued to talk of the BEAST project since they participated in workshops in BEAST I of last year. Some children had talked of their enjoyment of the science workshops, the enjoyable style of delivery used by the scientist and of a career in science. This corroborates the findings of last year's report which showed that knowledge and attitudes towards science were significantly enhanced through the BEAST! process.

Teaching method - Cross curricular approaches
One teacher felt that the children were very active throughout the workshops. The subjects covered linked well with each other and also linked with the children's own lives. They saw a great deal of integration across subject areas. One teacher felt that the workshops showed them that art can be used in more subjects than just English and felt that they learned a lot from the workshops and *'that there is scope to use my own creativity and this has shown me how. It has improved my teaching style to be [more] creative and relaxed and in getting the children to express more'* (Teacher 4). This teacher also identified the challenges of using a cross-curricular approach to teaching as there is increased need for planning. She saw opportunities here for cross-school teacher partnering in relation to using creativity to deliver the primary school curriculum.

Collaboration
One teacher felt that project management and coordination was generally good. They identified a need in the BEAST! project to engage more with workshop practitioners to help them plan workshops which will support the school curriculum and to agree more fully on the role that the teacher will play in supporting the visiting practitioner. Another teacher would have liked more engagement with the artist on what they planned to do so that they could prepare the children. There was an identified need for a discussion/planning meeting with individual practitioners and teachers.

Learning from the project experience
The learning from the experience of those involved in this school is the following: -

- The young people deepened their engagement with science and showed a better understanding and retention of key science concepts and a positive attitude towards science.

- Children developed skills in science concepts (inventing their own experiments), in critical thinking, creative writing, drawing and in SCRATCH programming.

- Children were very engaged and enthused during workshops and enjoyed the relaxed teaching style and environment during workshops.

- Teachers saw real benefits in this teaching methodology and are incorporating elements of creativity and cross curricular approaches into their own teaching styles.

- Scientists challenged themselves around incorporating creativity into their workshop design and delivery.

- Parents were involved through homework tasks and would like more involvement.

- Teachers would have liked more information regarding the arts workshops and more collaboration with science and art practitioners before the workshops started. Teachers felt that possibly there was a need for longer art workshops as they were a bit rushed at the end.

- The children also mentioned being rushed in some of the workshops and that they appreciated having sufficient time to complete tasks.

- The children, in discussing their ideas on future work with the project, said that *'We would like more work with computers' ' I would like to have art everyday ' 'I wouldn't do it the way that the artist did it at the start'* They preferred the interactive sessions where they were doing most of the work rather than the early sessions where the arts practitioner was doing a lot of talking.

Case Study 2. Scoíl Inse Guaire, Gort National School : 'Alternative energy Sources and harvesting energy from people'.

Background

Scoíl Inse Guaire is a small three teacher school, located on the outskirts of Gort. The pupils are all male and the culture of the school is one where sport is very important and there are many opportunities to engage in sporting activities. The school population includes a significant proportion of pupils from newcomer families and there are language challenges for new pupils and for their teachers. The participating class included 20 boys who were in 3rd and 4th Class and aged between eight and ten years.

What the Scientist wanted to achieve

The scientist delivered three 90 minute workshops to the class. She had worked with the same group of children in the first phase of BEAST and had the aim of further developing the children's knowledge of science, in particular, their understanding of renewable energy and energy harvesting devices. She hoped to further develop the idea that science is easy and encourage them '*not to be afraid of questioning things about science'* and *'that maths they apply [*in the workshops*] is interesting and easy' (Scientist 2)* The scientist also regularly reminded the participants about the posed problem of how they would survive without electricity on an island and what this would mean at a personal level. The aim of this exercise was to encourage young people to think again about energy consumption and sustainability.

What the Artist wanted to achieve

The artist delivered four 90-120 minute workshops to the group. The brief was to extrapolate the children's responses to the content that was delivered by the scientist. And to find out how they conceptualised a 'low carbon future' as expressed by the question ***'What will you do if you are living on the Aran Islands and there is no electricity? How will you survive?*** The artist's aim was that the children would use this question to motivate them to gain the skill of story writing. He planned to do this through creating enthusiasm and engagement so that they would be *'personally involved in the process in an emotional, creative and compelling way'.* (Artist 1) He hoped that the impact on the children would be lasting and that during the workshops he could stimulate curiosity and interest to help them through the early blocks that children new to writing often display. The artists brief was that he should find out from the children what they had absorbed of the science workshops and work with them to develop a story line with characters and plot based on their science workshops.

Benefits to the children of participation in BEAST II project

Engagement, extended attention span

Good levels of pupil engagement were observed by the teacher, scientist, social scientist and technologists during the science workshops and during the SCRATCH programme workshops. During the early creative writing workshops, the children's level of engagement tended to drop off as the opportunity to engage was less and the workshops lasted two hours. When a break was included the engagement improved and where the children had the opportunity to practice their own creative writing and drawing tasks engagement was much improved. The children said that the scientist *'made work more interesting' .* They preferred much more interactive styles of teaching where they could link the points made by the artist to their own experiences. '*They shouldn't just show us [pictures] we want to <u>see</u> stuff not just hear about it or [see it] on video'.* The artist found that the class as a group were very lively with shorter attention span than the other two groups he was working with and at times this interfered with the learning possibilities. This highlights how peer dynamics and the versatility of young people's learning styles impact on the effectiveness of programme delivery.

Skill development
Some of the young participants were very happy to have learned how to write stories and talked about learning about the 'three Ps' of story development. They enjoyed learning to draw and said that the artist '*made it easy'*. They had retained a lot of the science regarding renewable energy and renewable energy devices from their workshops in 2013 such as photovoltaic cells or solar panels and how energy is made and stored. They were particularly enthusiastic about the SCRATCH workshops and felt they had learned a lot and wanted to do much more work with computers in future.

The teacher noted that the children were pleased that they had gained narrative skills and drawing skills and observed that they were impressed and proud of their stories when they read them to the class. She also observed good improvements in the children's vocabulary and writing skills after the arts workshops. The teacher also discussed that she had gained new skills in writing concerning preparation for developing the story line, character development, the use of brainstorming and SCRATCH programming.

Changes in attitude towards science
The scientist noted that the children mentioned that they had applied the knowledge they had acquired in the workshops at home. For instance removing the magnet from broken electrical appliances and experimenting and taking apart their remote controlled devices. The children said that science was *'wacky'* and also noted that there were possible career options for themselves as either engineers/scientists or as artists and it was possible to earn a living at these occupations. (Field observation notes June 2013) The children said that they enjoyed the SCRATCH programming workshops the best. *'SCRATCH was the best by far followed by drawing'.* They would like ICT as a subject as *'it's funnier and more interesting and enjoyable'* (Focus group 2)

Teaching method and Cross –Curricular approaches
The teacher identified that the workshops linked well together and created continuity in the learning. She built on the content of the workshops by working with the children in the intervals between workshops by using the creative writing approach to finish their individual stories and also to work on their drawings. The teacher extended the learning by incorporating science concepts in geography and across the curriculum.

Collaboration
The scientist was *'pretty happy'* with the level of collaboration with Baboró project co-ordination but would have liked more pre-planning and collaboration with the teacher from the start and throughout the workshop delivery timeframe. In addition the scientist felt that more feedback and contact with the artist would have been helpful. This was also reiterated by the teacher. The artist said that more collaboration with the teacher would have been helpful but that he deliberately did not collaborate with the scientist as he wanted the children to conceptualise the learning in the science workshops and use this to inform their artistic responses to the science.

Learning from the project experience

- The teachers, arts and science practitioners and children were all very happy to have been involved with the BEAST II project and would like to see that involvement continue.

- The scientist found that the children were very capable. She learned that the children needed sufficient time to explore and play with the devices and that it is important in the early stages to keep concepts simple.

- Teachers and scientist identified that the diverse approaches in the workshops allowed the

Usually less involved or less able children to show other abilities for example in the drawing exercises and in using computers.

- As a result of the teaching styles adopted by the practitioners the children were able to contextualise learning to their own lives and experiences, which made it more realistic for them.

- There was a need for earlier and more detailed planning and collaboration between teachers, scientists and artist so that all practitioners were fully informed and could effectively support the project processes. This should be balanced with the opportunity to engage and experiment with the creative project processes.

- As the age range in the class extended from 8-10 yrs the workshop content, particularly in writing tasks was challenging for younger children and those with language or learning difficulties. There is possibly a requirement for more teacher support for weaker pupils or for more interactive components to be adopted. This group responded very well to more interactive styles of teaching coupled with concrete examples of how concepts relate to their daily practices. They also needed plenty of time to explore and experiment with the science equipment, thus showing the highly tactile and visual elements to children's science learning

Case Study 3: Human-Environment Relations and Interconnectedness: Exploring the Importance of Seaweed and Marine Life in Sustainable Development and the Creation of Green Technologies

Background

Galway Educate Together National School (GETNS) is a multidenominational mixed-school situated in Newcastle, a suburb of Galway City. The children are aged from four to twelve years and the children who participated in the BEAST were aged been ten and twelve years approximately. The principles of inclusiveness and parental participation lie at the heart of the school's ethos which is summed up in the phrase 'learn together and live together'. This year's BEAST project as it was rolled out on the school focused on the interconnectedness of marine life off the coast of Co. Galway. However, it also emphasised the interdependent webs that exist among marine species internationally and what this means for sustainable development and children's lives in the West of Ireland.

What the Scientist wanted to achieve

The scientist wanted to deepen children's appreciation of science and their knowledge of marine life around the Galway coast. The resounding message from the workshops was that all life is interrelated and that the 'natural' and human worlds are intrinsically interconnected. This inspired the children to think critically about the world around them and about their place in it. This also reflects some of the main things which the scientists wanted to achieve with the project. Moreover, during the workshops, the scientist continually challenged the children to think about the 'naturalness' of the Galway coast, showing pictures of mussel farms in interactive slide shows. In essence, she showed that the seascape around Galway cannot be conceptualised as 'natural' as traces of human interference with the physical world are everywhere. The children displayed a high conceptual knowledge about the world around them and their science education up to that point clearly helped them to digest the concepts in a much fuller way.

The children demonstrated high levels of engagement throughout the workshops and they were exceptionally enthusiastic about the sessions. As one child said; '*I really love these sessions. They are so cool'*, while others said *'wicked'* and *'awesome'* when asked their feelings about the project. The children also seemed to make connections between the scientific concepts and how they related to their lived experiences. For instance, when talking about seaweed in one session, one child talked about their experiences on beaches with friends gathering seaweed, while another mentioned how a family relative had once classified every seaweed type washed up in Galway Bay. They made these connections because the scientist continually asked them what they thought about the pictures and the marine life that she was exposing them to.

The children also visited a pier near Galway which overlooks the Burren in Co. Clare. Here they met with the scientists who asked them to think about the surrounding environment and the types of seaweed which were all around them. The children were encouraged to think about the sea as a type of life giver and as a creative force with its own natural rhythms but that people are continually harnessing the world's oceans for their own purposes. Children were given the opportunities to touch and hold the rocks, to look at the seaweed and algae around them, to touch the seaweed and talk about it. They were very engaged at all times at this visit and after a time, the scientists asked them to identify seaweed on their own which they had discussed previously. The children correctly identified the seaweeds and displayed some knowledge of how that particular seaweed evolved in that area and how it links to seaweed varieties that are found internationally. The children were also impressed by the approach of the scientist. As one child said *'It's so interesting and so nice to be back here and making all these things and getting the chance to play".*

What the Artist wanted to achieve

As in the other case-studies, the artists brief was to look at how the children responded to facilitate the children to give artistic expression to what they learned in the science workshops. The concepts of story writing and storytelling were at the heart of what the artist spoke about with the class and he viewed the practice of storytelling as an important mode of scientific communication and learning (Artist 1). Throughout these workshops, the children were encouraged to use story writing as a conceptual 'frame' to think about scientific practices and their interrelationships with the world around them.

During these workshops, the artist interacted personally with the children, asking questions of the class about TV programmes that they watch and movies that they may have seen. This enabled the children to see that storytelling is all around them and that their lives are comprised of narratives. The artist also produced drawings of cartoon characters for the class. Week by week, the artist worked through the different stages of writing a story and the critical elements that are involved in story writing and storytelling such as the significance of characters and events and how these typically proceed in children's novels. Moreover, the artist had a high degree of knowledge about books which the children are reading and the characters and this fostered a high degree of engagement in the process for the children.

At the same time however, it should be said that the children's levels of engagement seemed to wane at particular times during these sessions. This was particularly evident when the artist spoke for longer periods of time with little or no interaction from the children. They enjoyed the sessions and they learned a lot from them with one boy saying that he would like to be a writer when he grows up. However, in situations where the level of creativity and interaction was low, young people seemed to 'zone out' for periods of time from the sessions.

What the computer technologist wanted to achieve.

Computer scientists from DERI NUI Galway delivered SCRATCH programming workshops to the group. One computer scientist said that he wanted to inspire the young people to think about how technology affects their lives. According to this scientist, the importance of programmes like SCRATCH is that it facilitates children's learning about technology and its impacts on society. Students at GETNS did not receive all of the SCRATCH training before the 2013 summer break and some of these sessions were carried over to September 2013. The GETNS teacher who was interviewed stated that it is now very difficult for the children to recall the sessions with the artist and apply them to SCRATCH. The issue of timing around the delivery of workshops is a critical issue and should be addressed by the BEAST! administrators during the planning stage of future projects.

Benefits to the children of participation in the BEAST II Project

Engagement and increased attention span

The teacher felt that the children were engaged in the science and artistic workshops *'Definitely I felt they were engaged. They were excited by it'* (Teacher 5). He also felt that the creativity element of the project was an excellent way of engaging children's interest in the sciences and that it is sometimes 'very difficult to engender creative approaches in the classroom' (Teacher 5).

Development of New Skills

The GETNS teacher also commented on the knowledge and skills that the young people had learned from their BEAST! experiences and he felt that much of this was due to the approach taken by the scientists during the study. At the same time however, he also commented that knowledge and ability levels of the majority of children in GETNS is high and many children in the school are very

accomplished and engaged in the creative arts and the sciences. However, such life skills are important for children's personal development.

The teacher also felt that the children's engagement with the artist and with the computer scientist was high and that this interactive approach facilitated 'deep learning' in the classroom.

Changes in attitude towards science
The teacher identified that the children talked about the project in the classroom since the conclusion of the project and that they enjoyed the BEAST! However, he also said that many of the children have a high level of scientific knowledge themselves which is fostered in the school and at home and that they are enthusiastic about the discipline.

Teaching method - Cross curricular approaches
The GETNS teacher felt that creativity and the bringing together of science and art is an important teaching tool for young people. The children were also very relaxed about the subject matter and much of this was due to the approach taken by the artist and the scientists who were involved. The teacher also stated that he would recommend that the BEAST! project is rolled out in the school again because of the importance of cross-curricular approaches to student learning.

Collaboration
Overall, the GETNS teacher felt that the project coordination was good and that the project was well organised. He talked about the interactive lessons with the scientist in particular and the efforts made by the artist to attend the sessions in Galway. He stated that there could have been more collaboration at times but from his perspective, the system worked perfectly well and he favoured the approach taken by the artist, where the children are exploring their own ideas on their own terms, without adult interference.
He did say however that more co-ordination is needed with the planning and implementation of the SCRATCH workshops next year as it is difficult for the children to recall their learning from before the summer. This impedes upon their creativity.

Learning from the project experience
The learning from the experience of those involved in this school is the following: -

The young people were engaged with the concepts and ideas in the science and artistic workshops and exposure to these sessions enhanced their appreciation of the arts and sciences and what they mean together

The interactive style adopted by the scientist greatly enhanced the children's learning and their enjoyment of the subject. The approach of the artist also meant that the children were relaxed when learning about stories and saw themselves as storytellers of the future.

The GETNS teacher commented that the teaching methodology is useful as it marries different types of creativity (artistic and scientific) together

Chapter Five: Research Findings

5.1 Introduction

This section presents the results of the qualitative, quantitative and ethnographic data which was collected by the researchers in the schools in Uachtar Árd, Gort, and Galway City. It includes the interviews that took place with children, teachers, artists, scientists, computer technologists, parents and members of Baboró staff. The research produced findings on issues such as the children's level of engagement and their changing views about science. It also produced findings relating to the key issues that were being investigated and some of the core themes which were revealed through ethnographic and qualitative research. The interview questions (see appendices) contained questions about the BEAST! model, the teaching method and participant's views on collaboration and creativity that emerged during the study. This section goes into some detail regarding the findings which will also be considered in the discussion and recommendations sections of Chapter six.

5.2 Views of Teachers, Science and Arts practitioners regarding BEAST! Teaching Method

As in the first year of the project, there was widespread support among teachers for the BEAST! teaching method. The five teachers interviewed were very positive about the engagement of the children and the positive impacts on the children's lives. They commented that the teaching approach allowed children to learn and display a wide variety of abilities. One teacher said that it allowed usually less academically able children to shine. For example in drawing or using SCRATCH programming and this resulted in increased self-esteem. The project also allowed more able children with previous knowledge to share their expertise with others. *'That's the beauty of it ..it caters for every level'* (Teacher 4)

5.2.1 Benefits to Teachers in terms of learning and skill development.

Participating teachers spoke of the benefits they had received from project involvement. One teacher spoke of the how the project was impacting on her teaching style:

> *'The project has shown me how creativity can be linked into every subject and as a result I realise that I must become more creative as a teacher. My teaching style has become more creative and more relaxed and [the artist] showed me to get the children to express [their views] more. As a teacher you are constantly looking at the clock whereas the children's views matter. The artist also showed me the importance of planning in terms of writing stories when he described how he went about writing.'*(Teacher 3).

Another teacher who was interviewed said that he is very aware of creativity in the classroom and how it facilitates children's learning but that the BEAST! had heightened his interest in how creativity can be used as an instructional method when teaching science (Teacher 5).

Teachers talked about how they built the learning from the workshops into other subject areas and made links for the children between sessions to extend the learning and one teacher made a habit of reviewing the learning with the children at the end of each workshop. Teachers also spoke of how using creativity across subject areas adds a lot to the curriculum but it takes planning and time. As one teacher commented; "*getting the balance right with creativity takes a lot of time"* (Teacher 5).

One parent identified the impacts of cross curricular teaching on her child.

> *'It's amazing how having an interest in something leaves them open to accepting more and learning more. It's easier then to teach other subjects because invariably the subjects are linked. Having the exposure to something outside the curriculum was a huge benefit[...]and there is more awareness and thinking outside of themselves in a gentle and subtle way and he*

has more awareness of what's going on around him and more understanding of how things work' (Parent 3)

5.2.2 Using creativity in science workshop design.

The project was viewed by one practitioner as *'Enjoyable and challenging in the best sense of the word'.* (Scientist 3). This echoed the responses of other participants in the BEAST! (artists, scientists, teachers alike).

In this second year of the project scientists challenged themselves more around how they went about the process of design. One scientist stated that he was aware of the potential for using creativity across the curriculum. He said that he consciously tried to be child-led in his design and used the feedback in the first session to develop content for the rest of the workshops (Scientist 4). Other scientists who were involved also commented on the heightened engagement of the young people in the workshops and that creativity and interaction was the reason for this; *"I was amazed at what they know and they are so engaged".*

Across the three schools there was a wide range of workshop activities. Each scientist delivered a different set of workshops in their assigned school, and activities included producing bio fuel from seaweed, showing children how to carry out an inventory of their home energy consumption (with the help of a parent) and using energy harvesting devices amongst a wide variety of activities. One scientist said that *'[the children] reminded me how much I enjoyed this stuff. I enjoyed the translation of science into workshops as long as I had a clear goal and the children understood what they were going to do'* (Scientist 3).

5.3 Perceptions of stakeholders about children's participation in BEAST!

Participant children were very enthusiastic about their involvement with the project and described it as:

'*Fun and amazing'*
'Exciting and interesting'
Funky and cool'
'Brilliant and awesome'
'They were very nice to bring us into the digital [DERI]'
(Field observation notes. June 2013)

Teachers in two schools identified that children had developed their critical thinking skills, their recording skills and their computer skills. Teachers and social scientists noted that during workshops the children displayed longer attention spans than they observed usually. Teachers all also noted that after the project children were still remembering and talking about their engagement positively and teachers were continuing to draw out the learning from the workshops.

5.3.1 Changes in the Children's attitudes towards Science

Pupils applied the learning from the workshops to explore in their home contexts. They discussed dismantling broken appliances to explore the workings and look for magnets to experiment with. They talked of how they had used the learning in the intervening period between BEAST! 2012 and BEAST! 2013. Children said that science was *'Wacky'* and *'fun'*. They recognised that there were possible career options for them in science/technology or art and that it was possible to earn a living in either of these occupations (Field observation notes. June 2013). This is a highly important observation and implies that the BEAST! achieved its aims. The children were very capable and asked thoughtful questions. They liked it best when they got to do experiments, examine devices and work in groups together. They had good retention of the concepts that were covered such as 'renewable energy' 'windmills' 'solar panels' 'the coil' and photovoltaic cells' They saw the personal benefits of science *'..It makes you smarter'* (Focus group 2).

Children liked that they could be more informal and when the practitioners joked and had fun with them. '[science] *is really fun because something could explode like a volcano!' ' It's fun because you don't know the ending' 'You get your hands messy and I really love doing that and it's really relaxing'* (Focus Group 1).

One teacher talked about how this teaching method made children more aware of possible career choices for them.

> *'The scientist put thoughts into the children's heads. They never link maths and learning with what they can do in later life. Our school is very disadvantaged. It put thoughts into the children's heads they would never get from anyone else.. about being an engineer. They talked a lot about it and last year we visited the college in Engineering Week and it bought it to life for them. They saw that an artist could make a living and it made them think maybe I could be an artist'* (Teacher 1)

5.3.2 Perceptions regarding children's participation in arts workshops

Some children in two schools were initially surprised that the artist was a writer as they expected to be engaging with art forms they had learned in BEAST! 2012 such as visual arts or model making. (Field observation notes June 2013). At the early stages the artist spent time explaining story construction to the classes and also demonstrated the use of planning both for story writing and drawing. The children really appreciated that they had learned skills which they could apply. *[artist] helped me to write a story' 'He taught us to draw and sketch better..and to draw monsters and he made it easy]*' (Focus group 2). In general the children preferred the later workshops where they '*got to do the work'* such as the character development, writing the storyline and drawing cartoons. There were high levels of child engagement in the story drawing workshops across all three schools. The social scientists observed that children raised their hands regularly, shouting the answers at the artist and that they applied the main ideas from the workshops to their own unique social contexts. They linked the learning from the workshops to the things that they learned at school and in the home.

They most enjoyed drawing and writing stories and reading their own stories to the class. Children appreciated that the artist could joke with them as well as being serious and they enjoyed his *'acting'.* One parent said that workshop content was very good and that 'My *child adored [artist]. He thinks the sun shines out of him'* (Parent 1). The artist was seen as '*inspirational'* by one teacher (Teacher 3). She admired the way that he engaged with the children in teaching creative writing, which many children find difficult, and said that the children enjoyed these workshops. Teachers also commented that the artist was friendly, articulate and engaging with the children and that he adopted an appropriate teaching style which facilitated interaction but which was also highly structured.

For some children who were not interested in reading or who found writing difficult, the creative writing aspects of the workshops were not so enjoyable. Comments included: -

> *'I hate books'* (Field observation notes June 2013)
> *'I didn't like when he did all the work at the start'* (Focus group 1)
> *'[artist] talked a lot – I wanted to go to sleep it was boring, like church'* (Focus group 2)

These comments indicate that, for this group, there is a need for more interactive/practical approaches.

The children identified that they would like more use of computers and for their homework to be done on computers. They would also like the inclusion of more art [such as drawing/painting/modelling]

The same group identified that their own behaviour could have been better *'Our attitude could be better ...give honour get honour'* (Focus group 2). The artist was very pleased to be involved with the project and felt that overall it worked very well; he observed that the children were all very enthusiastically involved and he felt he received good support from Baboró management. He was working across the three schools, all with different ethos, culture and abilities and found that after consultation with the teachers he included more breaks and adapted his teaching approach to suit some children's attention levels. The artist also commented that the creativity of the project and the interlinkages between science and art were a unique selling point of the BEAST! and that it enables children to see the arts in new ways.

5.3.3 Perceptions children's participation in SCRATCH workshops

All children without exception were very positive and enthusiastic about the SCRATCH workshops.

> ' *I liked that we had cool computers*' *' It was like working and playing at the same time'*
> (Focus group 2)

They found learning computer programming challenging at the start. One child said *'We got to do something instead of [computer technologist] doing all the work. You have to pay attention, really pay attention to see what to do'* (Focus group 2). The children appreciated that they were able to use the computer to draw the characters they had developed in the arts sessions. It was interesting and confusing for them as they were engaging with something totally new and they tried to find ways to describe this. *'It's a bit confusing. You were the home-made computer game yourself'* (Focus group 1)
They liked the way that the computer technologists gave them plenty of time to explore. *'The way he had [of explaining] was simpler, giving you time ..loads of time.'* (Focus group 1). Children saw the future benefits of learning computer technology *'computers help you in the future'* (Focus group 2)
In interviews with Baboró, management observed that they were surprised to see that SCRATCH programming contained elements of creativity and is an art form in itself that is able to blend well with other art forms such as storytelling and drawing.

5.3.4 New skills development

Teachers identified that the children gained good writing skills and drawing skills. They demonstrated good recall, recording skills and critical thinking. Some children extended their learning to the home environment and designed their own experiments. The teamwork developed good social skills in the children and improved their ability to collaborate. The teachers also discussed how they learned from observing the way that the artist interacted with the children and were incorporating his approach into their teaching styles. One teacher commented that the children are highly articulate in the school that he teaches in already and that they are excellent critical thinkers. However, involvement in a project such as the BEAST! would help to advance this.

5.4. Parental perception of their children's participation in the project

All parents interviewed found that their children were very engaged and enthused by their participation in the project. *'It's an eye opener for them and shows them what they are capable of'* (Parent 4). One parent noted that their child's story writing had improved in terms of the way they constructed their stories. (Parent 3) All parents interviewed had noticed that their children were much more interested in computers, used then more competently and had used SCRATCH programming after the project ended. One parent found her child was bored over the summer and set her a project to do on the computer which the child enjoyed and carried out competently. *'Definitely improved computer use, using it more often and more confidently and as a tool for homework'* (Parent 2)

One parent identified how the project was changing her child's attitude towards what he could aim for as a career. *'He did enjoy the project and loved heading into the institute (DERI) and felt that it wasn't out of bounds. And it encourages them that there are areas out there that they can work in that are interesting.'*(Parent 3)
Parents enjoyed the homework activities that children brought home and carried out with them. They appreciated their involvement and gained a better understanding of the project.

5.5 Views on collaboration between teachers and arts/science practitioners

Stakeholders also stated that collaboration between practitioners during the BEAST! was good in most instances. Individuals had comments around collaboration that included that scientists would like the opportunity to engage with the artist. They feel that this would help with their understanding and planning for workshops. They would also like to hear more about the later stages and outcomes of the work with the children in a final feedback session. Teachers identified that initial meetings with science and art practitioners to discuss in broad details what would be covered in workshops and other aspects around role and responsibilities would be very useful. There is therefore an identified need for more collaboration and more structured discussions between practitioners.
Baboró discussed the value of the three way collaboration between NUIG Ryan Institute, Baboró and science practitioners. This collaboration had worked well in year one and continued to operate well in this second year of the project.

5.6 Achievement of BEAST! objectives

All teachers, arts and science practitioners questioned regarding the achievement of project objectives perceived that BEAST! had achieved its objectives. The goals were viewed as developmental, far reaching and ambitious.

> *'It has achieved them. Yes I am quite happy to say that it has'* (Scientist 3).

> *'To be honest I'd have trust in what Baboró would come up with. Its very well run and I'm very impressed and it's a great privilege for the children and myself to be involved with it.'(Teacher 3).*

> *'I think it did achieve the aims that it set out to in general, although the timing of SCRATCH needs to be looked at again' (Teacher 5).*

5.7 Learning from BEAST! 2013 for the project model

Practitioners identified that one strength of the BEAST! Model is the flexibility of the programme. Scientists receive a very broad brief and develop their workshops in response to the children and in this way are able to tap into the children's interests and lived experience so that they become more enthused and involved. For some children with learning difficulties or shorter attention spans, the incorporation of more teacher support or more 'hands on' activities is beneficial. Some classes may need more time to explore science concepts and these are important considerations for practitioners for their workshop design and could be discussed with teachers in the planning stage.

The need for sufficient time for the pre-project planning phase was highlighted in this year of the project. Because funding for the project was delayed it meant that scheduling happened at short notice and this was difficult for project management and for teachers and practitioners own planning processes. This also had the impact that some practitioners and teachers felt that the project was a

little unfinished at the end of the year and needed another stage *'in which to tie up loose ends'*(Teacher 2). However, there is significant learning for all stakeholders in the BEAST! based on this.

Practitioners including artists and scientists must be enthused by their own subject and the ability to inspire the children in order for this teaching methodology to be successful. Practitioners identified that the enthusiasm of the individual practitioners and their ability to engage with the children is key to the successful impacts of the project. Teachers have seen that it is a benefit to the project that Baboró have been able to access expert research scientists from NUIG through the relationship that they have developed with the Ryan Institute.

One of the impacts of the model observed by the social researchers and teachers is that the longer timescale of the project (over a three year time scale) has allowed for the project learning to infuse throughout the individual schools teacher cohort, as different teachers become involved and as discussions take place amongst the teacher cohort regarding the project impacts. This extends the impacts of the model to a wider teacher population.

In the interviews with Baboró, management identify that with this form of creative project, it is essential that a co-ordinator is employed to track the developing processes; to ensure that operational issues are addressed speedily; to time table schools and practitioners for the delivery of a large number of workshops over a short time period and establish good lines of communication and good working relationships. This is essential to the successful planning and implementation of the BEAST! model now and in the future.

Baboró management state that in operating a creative project like BEAST! they have learned the importance of school principal and class teacher 'buy-in'. They see the added significance of ensuring that for each phase of the project, teachers are fully briefed by Baboró about the aims and objectives of the study and how the project shall proceed during that stage. In addition the study has identified a requirement for an agreement between teachers and science and arts practitioners on their specific roles within the workshop sessions.

In order to facilitate good project planning it is ideal if funding could come on stream earlier in the project timescale. Funding bodies can be slow to sign off on an agreement which delays the start of project work. This factor needs to be accommodated in project planning as it is a recurring issue.

5.8 Findings from the Standardised Tools Administered to the Children

One of the core tasks of the research team in this study was to assess any attitudinal and behavioural changes towards science, art and the environment for the young people participating in the BEAST! As noted in Chapter 3, data were collected from children at two time points, using questions from a set of pre-designed and tested standardised measures. This section presents the key findings elative to these data collection tools.

5.8.1 Sample Characteristics

As shown in Figure 5.1, of the 43 children who took part in the data collection at Time 1, nearly three quarters of them were male (74.4%, n =32) while females accounted for the remaining one quarter (25.6%, n = 11). The breakdown by school is shown in Figure 5.2

Figure 5.1

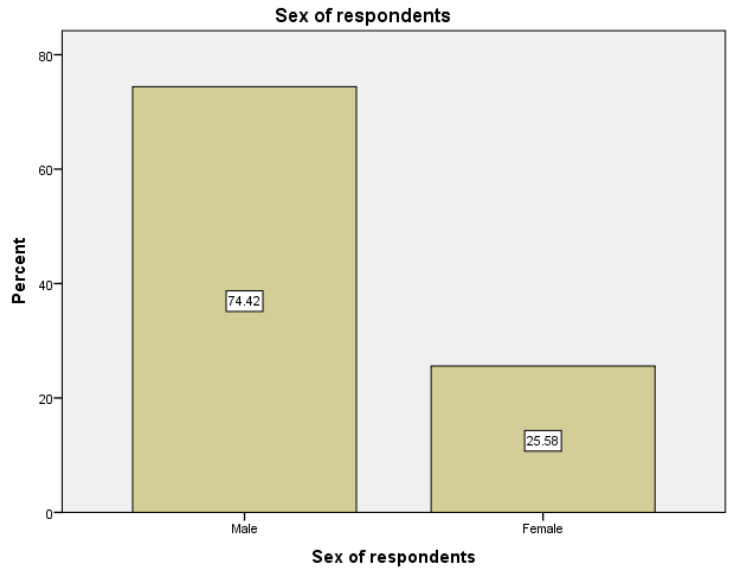
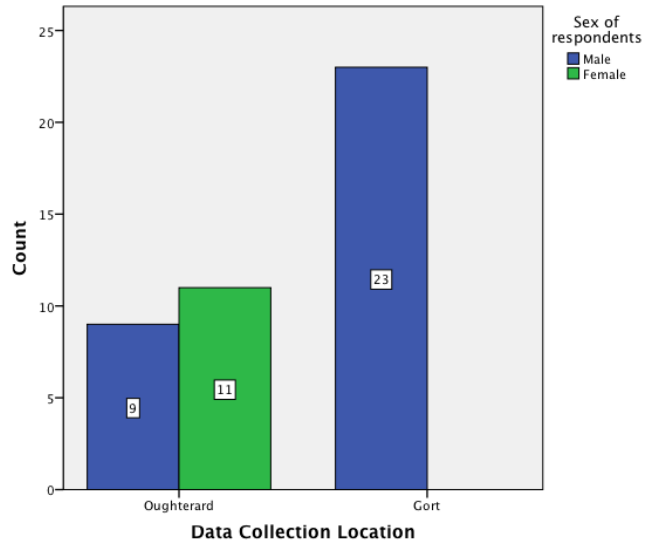


Figure 5.2 – Sex of Children in participating schools in Oughterard and Gort



5.8.2 Key Quantitative Findings

To make sense of the data emanating from the various standardised measures, the research team used one question to focus the work - *What gains were made by children participating in the BEAST! between Time 1 (T1) and Time 2 (T2). Where possible, p*aired samples t-tests were used, which allowed the research team to then report that any gains found to be statistically significant were unlikely to have been caused by chance.

What gains were made by children participating in the BEAST Programme Between Time 1 and Time 2?

Results from each of the six standardised measures are now presented below.

Tool 1: A Measure of Belonging in Youth Development Programs (BYDP)[12]

In 2002 Anderson-Butcher, & Conroy developed a *Measure of Belonging in youth development programs (BYDP).* The five items contained in the tools all tap a common sense of belonging in youth development programs along the domains of support, acceptance, comfort, being part of and being committed to the programme.

As collecting data using this tool at Time 1 was not possible given the nature of the questions, the data were collected at Time 2 instead. A total of 36[13] children participated at Time 2, the results of which are shown in Table 5.1 and Figure 5.3. The mean score was 3.14 and standard deviation was 0.735. Given that the maximum mean score possible on this scale is 4, the vast majority of the children scored extremely well, with 77% of them obtaining a mean score between 3 and 4. This would indicate that this group of children felt comfortable, part of committed, supported and accepted when part of the BEAST! Project.

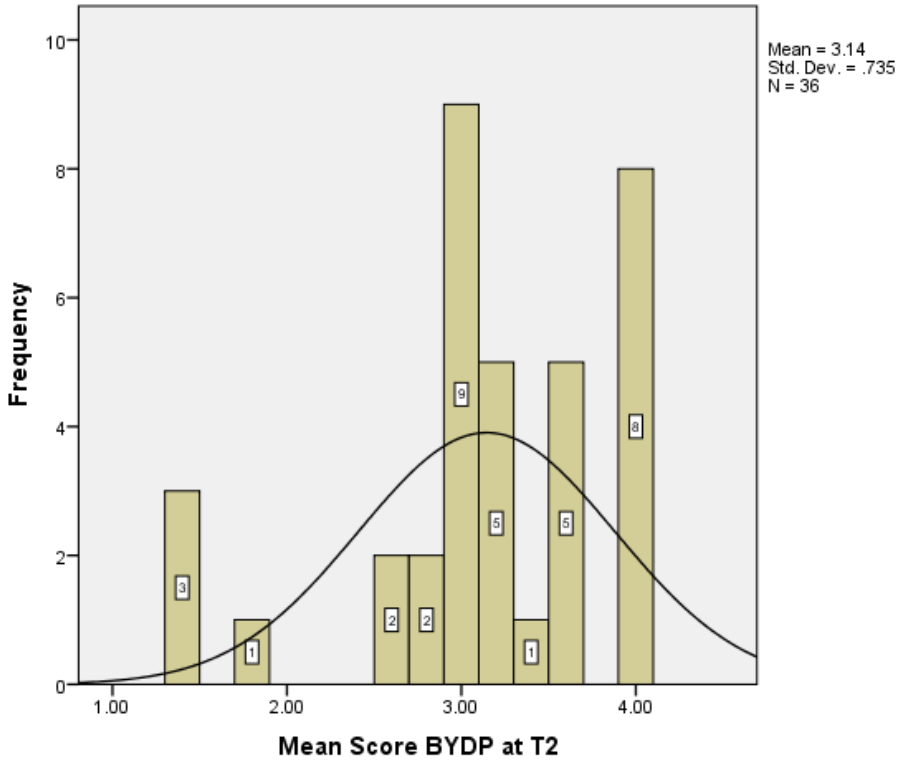
Table 5.1 –Scores for a Measure of belonging in youth development programmes at T2 for participating children

Scores	Frequency	Valid Percent	Cumulative Percent
1.40	3	8.3	8.3
1.80	1	2.8	11.1
2.60	2	5.6	16.7
2.80	2	5.6	22.2
3.00	9	25.0	47.2
3.20	5	13.9	61.1
3.40	1	2.8	63.9
3.60	5	13.9	77.8
4.00	8	22.2	100.0
Total	36	100.0	

[12] Questions 1 to 5 on the BEAST questionnaire, p.1

[13] The remaining 7 children involved a T1 did not participate in data collection at T2.

Figure 5.3 - Scores for a Measure of belonging in youth development programmes at T2 for participating children



Tool 2: A Measure of Child Belonging in School (CBS)[14]

Stroud, Asher and McDonald (2009) developed the standardised *measure of child belonging in school (CBS)*. This tool has been developed to specifically measure the level of felt belonging of children towards school.

To investigate the change in the sense of belonging felt by the BEAST! children towards school between T1 and T2, a paired-samples t-test was conducted. The findings showed a slight decrease in scores from T1 (M = 3.89, SD = .941) to T2 (M = 3.68, SD = 1.04) and these scores were found not to be statistically significant (p = .113).

The maximum mean score possible for a participant on this measure is 6. When the range of scores at Time 2 was taken from Table 5.2 and categorised into score bands, it reveals that 5.6% of the children scored in the lowest band (1-1.99). A further 44.7% scored achieved scores in the mid range band (2-3.99) while 50.2% achieved a score in the highest band (4-6).

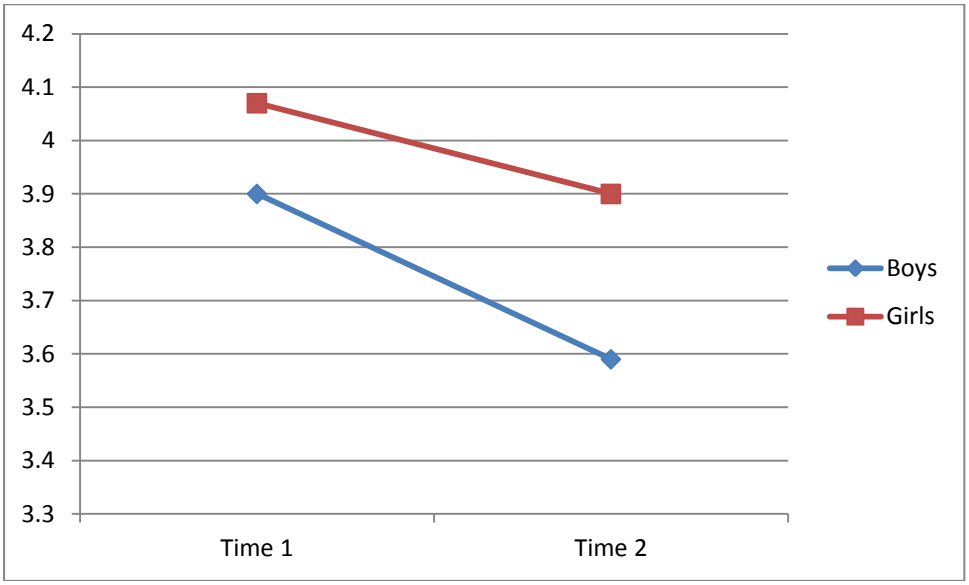
[14] Questions 6 to 11 on the BEAST questionnaire, p.1

Table 5.2 – Range of Overall Mean Scores for the CBS at T2 for the participating Children

	Frequency	Valid Percent	Cumulative Percent
1.33	1	2.8	2.8
1.50	1	2.8	5.6
2.00	1	2.8	8.3
2.17	1	2.8	11.1
2.33	2	5.6	16.7
2.67	1	2.8	19.4
3.00	2	5.6	25.0
3.17	2	5.6	30.6
3.33	1	2.8	33.3
3.50	2	5.6	38.9
3.67	3	8.3	47.2
3.83	1	2.8	50.0
4.00	6	16.7	66.7
4.17	1	2.8	69.4
4.33	1	2.8	72.2
4.50	2	5.6	77.8
4.67	1	2.8	80.6
4.83	1	2.8	83.3
5.00	6	16.7	100.0
Total	36	100.0	

Figure 5.4 shows the relative mean scores at T1 and T2 for boys and girls and illustrates the overall decrease from 3.9 to 3.5 for boys (-0.4) and 4 to 3.9 for girls (-0.1). While both groups decreased, the extent of this change is minimal. Therefore, it is fair to suggest that while participation in the BEAST cannot be said to have caused this fall, being involved in the programme for children was associated with this change. The key point here is of course that change as minimal as this is an indication of BEAST being associated with the maintenance of good experiences for children in school.

Figure 5.4 – Changes in a measure of child belonging in school (CBS) for boys and girls participating in the BEAST! between Time 1 and Time 2



Tool 3: Perceived Social Competence Scale (PSCS)[15]

The third standardised tool administered to the children was developed by Anderson-Butcher, Lachini & Amorose (2007) and is called the *Perceived Social Competence Scale* (PSCS). This measures social competence among children, particularly those involved in settings emphasising prevention, early intervention and youth development. Competence is defined as *"...the degree to which children and youth engage in prosocial behaviours and are able to successfully create and maintain positive social interactions with others*" (ibid: 47). Social competence is linked with resilience in children and youth and the development of this attribute is viewed as a protective factor for children.

To investigate any change in the perceived social competence levels for the BEAST! children between T1 and T2, a paired-samples t-test was conducted. The scores showed a slight increase from T1 (M = 3.67, SD = .749) to T2 (M = 3.82, SD = .824), but the results were found not to be statistically significant (p = .257).

The maximum mean score possible for a participant on this measure is 4. When the range of scores at Time 2 was taken from Table 5.3 categorised into score bands, it reveals that 14% of the children scored in the lowest band (2-2.99). A further 27.8% achieved scores in the mid range band (3-3.99) while the majority of 58.3% achieved a score in the highest band (4-5).

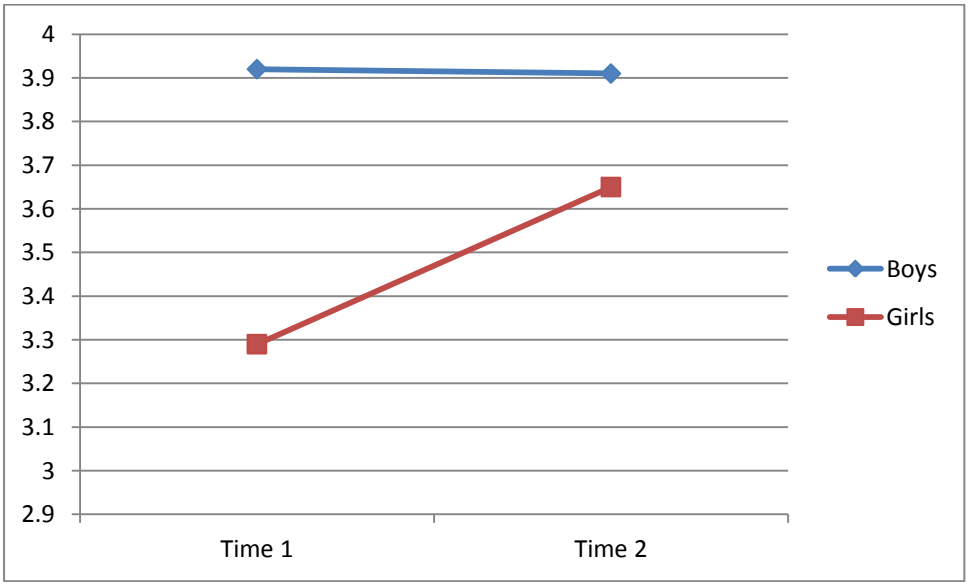
[15] Questions 1 to 4 on the BEAST questionnaire, p.2

Table 5.3 – Range of Overall Mean Scores for the PSCS at T2 for the participating Children

	Frequency	Valid Percent	Cumulative Percent
2.00	1	2.8	2.8
2.25	1	2.8	5.6
2.50	1	2.8	8.3
2.75	2	5.6	13.9
3.00	4	11.1	25.0
3.25	1	2.8	27.8
3.50	4	11.1	38.9
3.75	1	2.8	41.7
4.00	7	19.4	61.1
4.25	2	5.6	66.7
4.50	4	11.1	77.8
4.75	7	19.4	97.2
5.00	1	2.8	100.0
Total	36	100.0	

Figure 5.5 shows the relative mean scores at T1 and T2 for boys and girls. It illustrates the unchanged scores for boys (3.92 to 3.91), while the scores for girls increased from 3.2 to 3.65 (+0.45). These results suggest that being involved in the BEAST is associated with these changes for this group of children.

Figure 5.5 – Changes in Perceived Social Competence (PSCS) for boys and girls participating in the BEAST! between Time 1 and Time 2



Tool 4: Children's Environmental Perceptions Scale (CEPS)[16]

The fourth standardised measure was developed by Larson, Green and Castleberry (2010) for use with 6-13 year old children. The tool consists of two sub-scales, the first one measuring *eco-affinity*, which … '*reflects personal interest in nature and intentions to engage in pro-environmental behaviour'*. The second subscale measures *eco-awareness* which *'…reflects a cognitive grasp of environmental issues related to the general importance and sustainability of natural ecosystems*' (ibid : 83).

To investigate any change in the levels of eco-affinity for the BEAST! children between T1 and T2, a paired-samples t-test was conducted. The scores showed a decrease from T1 (M = 3.54, SD = 1.00) to T2 (M = 2.81, SD = 1.54). The results were found to be statistically significant (p = .009).

In terms of the eco-affinity, the maximum mean score possible was 5. When this mean score was calculated using the range of scores at Time 2 in Table 5.4 it was found to be 3.36. Analysis shows that 50% of the children achieved scores under this mean score, while 41.7% achieved scores in the 3-3.99 mean score range and 27% scored in the 4-5 range of marks.

Table 5.4 – Range of Overall Mean Scores for the Eco-Affinity at T2 for the participating Children

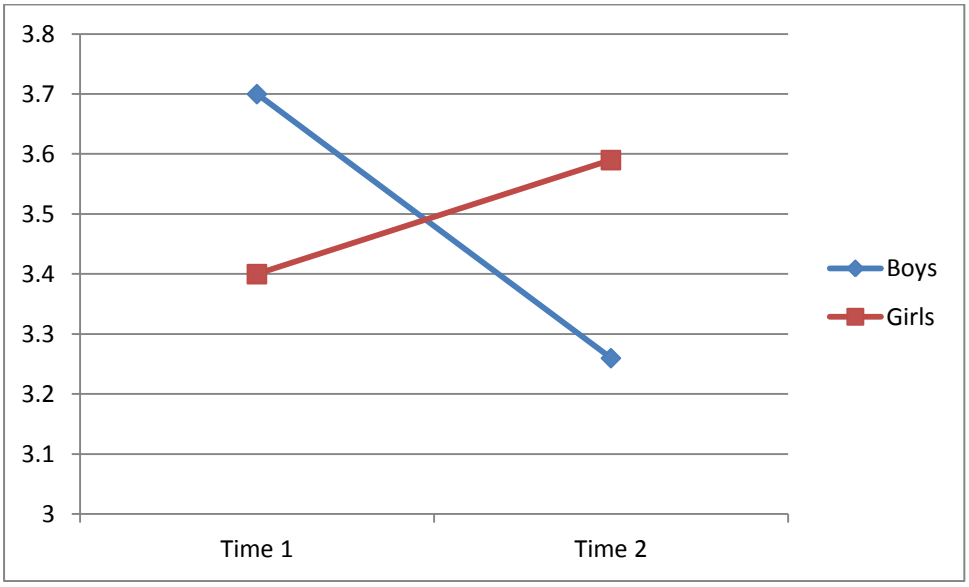
	Frequency	Valid Percent	Cumulative Percent
1.00	2	5.6	5.6
2.13	1	2.8	8.3
2.25	2	5.6	13.9
2.50	1	2.8	16.7
2.63	1	2.8	19.4
2.75	1	2.8	22.2
2.88	3	8.3	30.6
3.00	2	5.6	36.1
3.13	3	8.3	44.4
3.25	2	5.6	50.0
3.38	3	8.3	58.3
3.63	3	8.3	66.7
3.75	1	2.8	69.4
3.88	1	2.8	72.2
4.00	2	5.6	77.8
4.13	1	2.8	80.6
4.38	1	2.8	83.3
4.50	1	2.8	86.1
4.63	1	2.8	88.9
4.88	1	2.8	91.7
5.00	3	8.3	100.0
Total	36	100.0	

Figure 5.6 shows the relative mean scores at T1 and T2 for boys and girls for eco-affinity. It illustrates the fall in scores for boys from 3.70 to 3.26 (-0.44), while the scores for the girls increased from 3.4 to

[16] Questions 5 to 20 on the BEAST questionnaire, p. 4

3.59 (+0.19). These results suggest that being involved in the BEAST is associated with these changes for this group of children.

Figure 5.6 – Changes in levels of Eco-Affinity for boys and girls participating in the BEAST! between Time 1 and Time 2



In terms of the eco-awareness, the maximum mean score possible was 5. When the mean score was calculated using the range of scores at Time 2 in Table 5.5 it was found to be 3.9. Analysis shows that 50% of the children achieved up to 4, while the remaining 50% scored between 4 and 5.

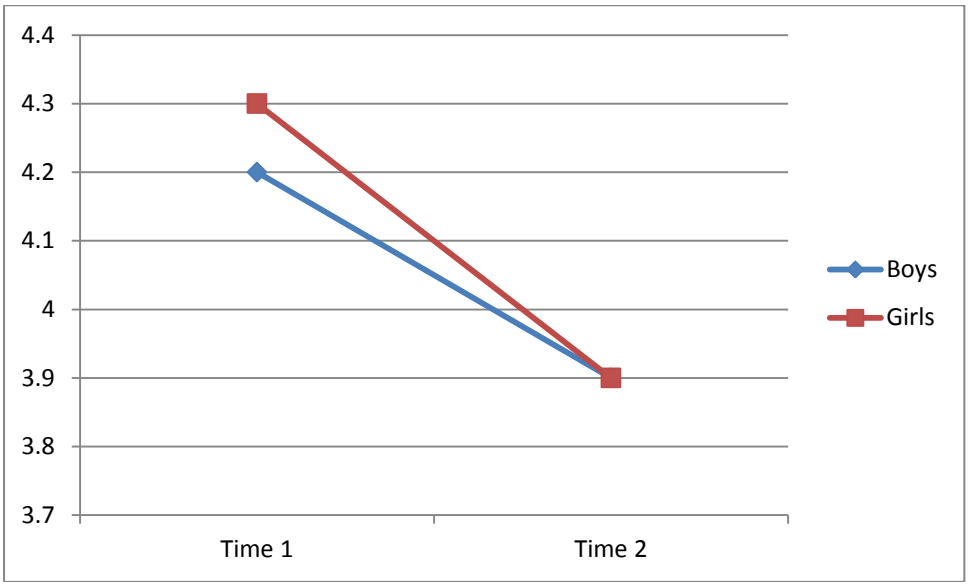
Table 5.5 – Range of Overall Mean Scores for the Eco-Awareness at T2 for the participating Children

	Frequency	Valid Percent	Cumulative Percent
1.00	1	2.8	2.8
2.38	1	2.8	5.6
2.50	1	2.8	8.3
2.63	1	2.8	11.1
3.00	2	5.6	16.7
3.25	2	5.6	22.2
3.38	2	5.6	27.8
3.50	1	2.8	30.6
3.63	2	5.6	36.1
3.88	3	8.3	44.4
4.00	2	5.6	50.0
4.13	2	5.6	55.6
4.25	3	8.3	63.9
4.38	3	8.3	72.2
4.50	1	2.8	75.0

	4.75	2	5.6	80.6
	4.88	1	2.8	83.3
	5.00	6	16.7	100.0
	Total	36	100.0	

Figure 5.7 shows the relative mean scores at T1 and T2 for boys and girls for eco-awareness. It illustrates the fall in scores for both boys and girls, with boys falling from a mean score of 4.20 to 3.91 (-0.29), while the scores for girls fell from 4.3 to 3.93 (-0.46). These results suggest that being involved in the BEAST is associated with these changes for this group of children.

Figure 5.7 – Changes in levels of Eco-Awareness for boys and girls participating in the BEAST! between Time 1 and Time 2



Tool 5: Measuring the Motivational Effect of ICT on Pupils

The final tool used with the children participating in BEAST was one developed by Passey et al (2004) which combined eight different measures designed to investigate the impacts of information and communication technologies (ICT) on pupil motivation. The aim was to quantify impacts where possible, and to relate impacts to aspects such as learning outcomes, behaviour, school attendance, truancy, wider issues such as crime and anti-social behaviour, and uses of digital content.

Table 5.6 illustrates the definitions for each of the eight motivational measures. At the time of writing this report, due to logistical issues, the research team have been unable to collect Time 2 data for the children in one of the three participating schools. Given this, they have decided not to do an analysis of this data until the missing data becomes available.

Motivational measure	Definition	'Ideal positive' learning profile
learning goal	the reason for engaging in the activity using ICT is the furtherance of personal understanding and competence	high level is desirable
academic efficacy	the degree to which an individual believes they have the capacity to design and execute the courses of action necessary to achieve a particular goal using ICT	high level is desirable
identified regulation	beginning to recognise and share the values that might have been assumed to drive the inducements offered by others to engage in the task using ICT	high level is desirable
intrinsic motivation	the degree to which ICT directly engages the pupil and holds their interest	high level is desirable
performance approach goal	the reason for engaging in the activity using ICT is the pursuit of opportunities to gain positive feedback about one's competence	low level is desirable
performance avoidance goal	the aim of engaging in the activity using ICT is to avoid feedback suggestive of a lack of competence, often achieved by finding ways of not engaging in the task	low level is desirable
external regulation	a willingness to engage in work with ICT because one feels obliged to do so by someone else, probably an authority figure such as a teacher	low level is desirable
amotivation	a lack of understanding of any particular reason for engaging with ICT supported work	low level is desirable

5.9 Summary

This section detailed some of the key findings of the BEAST! project and primarily focused on the views of stakeholders such as children, teachers, scientists, the artist and Baboró management toward the learning for the project in its second year of operation. Some of the key findings include that there continues to be widespread support for the project from all stakeholders and there are considerable benefits of the model for teaching and learning. All stakeholders identified that they, as well as the children were learning through involvement with the BEAST! project. Practitioners including scientists and teachers identified greater awareness around their own use of creativity in teaching across the curriculum and this is impacting positively for them and their pupils. The children are learning a great deal and gaining skills through their engagement with practitioners and are improving social skills through increased team work and collaboration.

The findings indicate a need for a longer lead in time to facilitate planning processes for Baboró management and other stakeholders. The planning stage is critical to the success of any project and this is an issue that needs to be addressed. There is also a need for more formalised briefing for schools by Baboró and more collaboration between teachers and practitioners at each stage of the project. This is essential for the BEAST! project moving forward and for ensuring that the lessons of the past can be built upon for the future. Furthermore, Baboró must also look at how they can involve parents in the project in a deeper way and ensure that all of the workshops are child-led. For the most part, the second of these objectives is being met, although the participation of children could also be enhanced in some ways.

In terms of the quantitative data collected using the standardised measures, given the relatively short time frame between Time 1 and Time 2, it is only possible to see emergent trends in the direction and shape of the data. What is more important that focusing on this level of detail is for BABORO to consider how best outcomes tracking such as this, can be built into the next year's planning for the BEAST! III project. This in turn will enable them to engage in real evidence-based planning and programme implementation.

The next section contains the main discussion and recommendations of the report and such issues are addressed in more depth here.

Chapter Six Discussion and Recommendations

6.1 Baboró BEAST! Process Study: Core Purpose

The core purpose of this process study is to describe the project model, its modus of operation and the views of stakeholder groups about its impact. Previous chapters have identified the views of the individual stakeholder groups involved and have been presented in order to provide clarity on the sources of differing perspectives. In this chapter these views are collated in order to answer the initial research questions and to arrive at the conclusions and recommendations.

The following analysis is based on the interviews, focus groups, observation studies and quantitative survey with stakeholders in the three schools that participated in the research. There is thus a caveat that although a significant amount of data has been generated, it is still a relatively small and readers should bear this in mind.
The research questions to be addressed in this chapter are the following;

- What is the core purpose of the Baboró BEAST! Project?
- What outcomes are ascribed to the project as perceived by the young people, teachers, parents, science and art practitioners and Baboró management staff?
- What are the perspectives of stakeholders regarding project delivery including its strengths, challenges and areas for improvement?
- Is the project model sufficiently robust that it can be replicated in other primary schools for teaching STEM subjects?

The BEAST! Project is a three year pilot project developed by Baboró to raise the profile of science and technology in the cohort of primary schools. Its main goal was to encourage the children and teachers to engage with STEM subjects and explore these subjects through the arts.

6.1.2 BEAST project aims and objectives

The BEAST! Project aims and objectives were as follows: -

Project Aims

- To instil or improve levels of confidence, critical thinking, problem-solving, creative thinking and team working in primary school children
- To demonstrate in schools and to teachers the use of the Arts in teaching the school curriculum
- To create a project model that can be replicated easily and effectively and be used by others to teach and to evaluate

BEAST! Project Objectives

- To marry Science, Technology and the Arts in exploring a 'Low Carbon Future' with primary school children though a series of workshops delivered by Scientists and Artists
- To create an artistic response using the children's understanding of the topic
- To design and/or source quantitative and qualitative tools to collect data
- To observe workshops and document behavioural and attitudinal changes to evaluate the impact of the project.

- To write a process study report offering critical thoughts on the process and possible future developments for BEAST! Project

These aims and objectives will be the reviewed in this chapter under the research questions already highlighted at the start of this section.

6.2 Outcomes ascribed to BEAST! By Stakeholders

6.2.1 Outcomes for the children: Behavioural Changes, Attitudes towards Science and Creativity

One of the main objectives of the study was to make suggestions on whether or not there were any behavioural changes for the children, such as their sense of belonging at home or at school, their resilience and their attitudes towards the environment. While the qualitative part of the study has shown that there is good evidence for changes in attitudes of the children towards science and increased creativity, it is extremely difficult to gauge if and to what extent that children's attitudes towards STEM subjects have improved and if there are any changes to young people's resilience. The time-scale of the project is an issue here; given that the project ran over a matter of weeks, it is difficult (if not impossible) to predict significant differences in children's resilience and social support and whether this is (in)-directly attributable to the project.

6.2.2 Teaching method. Using Creativity Across the Curriculum.

As in the findings of the BEAST! 2012 process study, respondents continued to report strong support for the model and for the teaching methodology. Teachers and science practitioners discussed how the project has impacted on the way they teach in terms of changing their style of teaching. Teachers have started to use creativity across the curriculum, adopted a more relaxed style and have also become more interactive with their pupils. Practitioners, teachers and children observed that there were benefits to the more 'open' and 'flexible' approach to teaching and learning that enabled the children to learn and retain information and to collaborate well together. Children enjoyed the more informal form of delivery used by practitioners and maintained their enthusiasm and interest and their attention level was observed to be extended during workshops. Teachers and children became very engaged with the workshops and teachers facilitated and supported the scientists. Teachers identified the benefits of inviting outside practitioners into the classroom who were expert in their subject area and passionate about their subject and appreciated that scientists were able to translate ideas and concepts to make them accessible to the children. Teachers noted that the workshops enabled children who were usually less able or less involved '*to shine'* and state that this approach is successful in engaging children who may usually feel left out of activities. *'That's the beauty of it ...it caters for every level'* (Teacher 4).

Scientists talked of how, through involvement with the project, they had become aware of the possibilities of using creativity to teach science concepts. They challenged themselves to apply more creativity to workshop content that would have more application and relevance to the children's lived experience so that they would become more engaged. '*The children reminded me of how much I enjoyed this stuff. I enjoyed the translation of science into workshops as long as I had a clear goal'* (Scientist 3) This point is relates to findings of Varley (2008) discussed in the literature review (Chapter Two)

The artist worked across the three participating schools and the workshops concentrated on creative writing, story construction and drawing. The teaching approach he adopted was appropriate for children with a range of abilities and there was good engagement and good skills acquisition by the majority of children. In discussing future workshop design with respondents there was an identified need for more collaboration between teachers and artists in the planning phase in order to more closely align the

workshop content to the needs of specific groups of children and in order to agree the roles and responsibilities during workshop delivery of teacher and visiting practitioner.

The SCRATCH programming workshops were very enthusiastically received by children, teachers and parents. The children focused well *'You have to pay attention, really pay attention to see what to do'* (Focus group 2). The computer technologists pitched the rate and content of teaching very appropriately and the children appreciated this. '*The way he had of explaining was simpler, giving you time; loads of time'.* (Focus group 1) Children, teachers and parents saw the real benefits of learning computer skills and the learning was extended and applied in home and school contexts after the project phase ended.

The widespread support for this teaching method demonstrates that it can be a very effective approach for the teaching of STEM subjects in primary schools and that marrying science and art together in highly creative and interactive ways can be highly beneficial for children's learning

6.2.3 Change in attitude towards science and technology

It appears that this teaching approach has real benefits in that it was able to achieve the main project goal of changing children's perception of science/technology subjects and creating an interest and enthusiasm for the learning. It is '*an eye opener for them and shows them what they are capable of.'* (Parent 4). Children applied the learning in their home contexts carrying out simple experiments and explaining concepts to their parents/families. Teachers also engaged with the science and extended the learning across curriculum subjects between workshops and after the project phase was over.
Scientists endeavoured to design the content so that it had relevance to the children's lived experience and children felt that their opinions had worth and this contributed towards their levels of engagement and ownership. The process of children seeing scientists within their work environment created a deeper understanding of the scientist's role and prompted some of the children to express an interest in science as a career. Children felt valued when their questions and opinions were welcomed by the practitioners on their visit to the DERI institute and they expressed that they would like to study in NUIG. Some children saw that science was a part of everyday life and a creative activity just as much as art and also had real value. It *'makes you smarter.'* (Focus group 2). These findings indicate that the objective of raising the profile of science subjects with the children was very successfully achieved and also had the impact of changing the way that children engage with science.

6.2.4 New Skills Acquisition

In all three case study schools the children learned real skills that included designing their own experiments, creative writing skills, drawing skills and computer programming. Teachers and parents noted that children demonstrated improved recall, critical thinking and recording skills. The teamwork and collaboration incorporated into workshops have developed the children's social skills. Teachers and scientists discussed how they were constantly learning through observing other practitioners and through their own reflection on the project processes and were incorporating that learning into their teaching styles.

6.2.5 Maintaining and Strengthening Existing Links with Baboró and NUI Galway

Teachers expressed enthusiasm for engaging in the project again with Baboró and were appreciative of the schools involvement. *To be honest I'd have trust in what Baboró would come up with. Its very well run and I'm very impressed and it's a great privilege for the children and myself to be involved with it.'*(Teacher 3) .

'I'd like to become involved again. I would support this, yes' (Teacher 5).

Those teachers that went on field trips to NUIG felt this to be a very worthwhile aspect of the project and would like to repeat this experience and extend their relationship with social and environmental researchers in NUIG.

6.3 Key Perspectives of Stakeholders regarding project delivery

There was general widespread support for the project throughout the stakeholder group. Overall, the project worked well and created an excitement and enthusiasm for the science/technology topics with children and teachers alike. All teachers, arts and science practitioners felt that Baboró has achieved its ongoing project aims and objectives in 2013 as detailed at the start of this chapter. This process study has identified some key elements of project delivery and the following section highlights these.

6.3. Collaboration and Team working

There was strong evidence for the impact of collaboration with this project. There was collaboration at every level; between Baboró and NUIG at the project design phase; between teachers and the science, technology and arts practitioners, and free flowing collaboration and team working with the children in the classrooms. Parents were involved with the project through homework tasks with the children. This evidence for collaboration would highlight the findings of studies on the 'Creative Partnerships' programme which identified one of the key characteristics of creative people to be the ability to collaborate with others. Increasing children's ability to work in teams was also one of the BEAST! objectives and it was successfully demonstrated at each of the case study schools.

Even though there were many opportunities for collaboration, none the less, all teachers and arts science practitioners identified that they would welcome more opportunities to collaborate. Participants identified that there is a real need for a longer lead in time to enable fuller briefing and consultation between the teachers and arts and science practitioners. The is an identified need for more active consultation regarding the ability levels of each class group, how the teacher and practitioner will operate together during workshop delivery, how the science curriculum will be addressed through workshops and other matters that may relate to the ethos and culture of the individual school. Additionally a meeting of all participants at the end of the implementation phase to present the process study findings and discuss learning would enhance the project benefits. Another important task for the future is to have more clarity around the participation of parents in the study and to provide information sessions to parents on what the project involves and what the main findings of the project are for children's learning. This is exceptionally important for the development of the project.

The issues regarding the collaboration of visiting arts practitioners with primary school teachers are also discussed in the literature review (Chapter Two) which outlines the findings of two studies; AICE (2011) and Department of Education and Science (2006). These indicate the importance of building a relationship between practitioners and teachers before the work starts so that realistic expectations are created. They should 'negotiate' their roles in the process and the practitioner should provide an outline of what will be covered and it is ideal if this connects with the school curriculum. The studies identify that it is vital that teachers are present during workshops in order to learn themselves and to draw out the learning for the pupils and build on the work between sessions and after they finish.

6.4 Is the Project Model sufficiently robust that it can be replicated for teaching purposes?

One strength of the BEAST! Model is that it is very flexible and worked well in operation. Baboró provided the inspiration for the project and the driving force to move the project forward and to source the funding. Baboró provided sufficient flexibility to support arts and science practitioners and schools

to work with their own schedules around the programming of workshops. They also had a project manager who co-ordinated the challenging logistical and timing elements of the project and the many other issues associated in delivering a project of this complexity. This was extremely important for the success of the study.
The experience of BEAST! 2012 for schools and science practitioners was inspiring and they expressed the wish to continue their engagement with the project in 2013 and would like to continue on to 2014. Overall respondents felt that the implementation of the model worked well.

6.4.1 Learning from BEAST! 2013 for the Project Model

Lessons from the process study for the model are identified below: -

- Baboró has a history of linking with schools and the community in various projects and through the Baboró International Arts Festival operated in October each year. It also has good links to arts practitioners experienced in working with children. Additionally Baboró has developed a relationship with Ryan Institute NUIG and is able to access scientists that are expert researchers in their field and that are able to translate science concepts for primary school children. These are key strengths of the BEAST! model and will support the project as it moves forward to the final phase in 2014.

- The teaching method is viewed as very effective by all practitioners and is impacting positively on teachers and practitioners styles of teaching and on the learning and engagement of the participating children.

- The quality of learning experienced by the children is in large part dependent on the enthusiasm and expertise in their subject areas of the science and arts practitioners and this is a key element of the model and a key requirement of practitioners that become involved with workshop delivery.

- There is a positive and supportive attitude towards collaboration and knowledge sharing at all levels of the project with opportunities for practitioners to meet together to share ideas and learning. This study has identified a need for more consultation between teachers and arts/science practitioners regarding children's needs, school culture and ethos, the role of teacher and practitioner during workshop delivery and other aspects detailed in Chapter Five. In addition there is an identified need by scientists of more collaboration with artists that will support them in their workshop design and understanding of the project.

- The longer timescale of the project (over 3 years) is enabling the impacts and learning to diffuse over a wider teacher population as different teachers in the case study schools become involved with project processes. This extends the learning to a wider teacher cohort.

- It is important in a creative project like BEAST! which is spread over a number of schools, that a co-ordinator is employed to track the developing processes; to ensure that operational issues are addressed speedily; to time table schools and practitioners for the delivery of a large number of workshops over a short time period and establish good lines of communication and good working relationships.

- In this form of project it will always be a challenge to ensure that practitioners are not just supported with good information, adequate resources and opportunities to collaborate with others but are also supported through the initial stage which can feel 'messy' but which is often

a vital part of the creative process. Baboró are experienced in working with this form of creative process and are well placed to provide the appropriate support.

- There should be good briefing details at the initial stages of the project

There is evidence that the model is robust if the above requirements are fulfilled. Baboró has achieved the project goal and most of the project objectives and are in a good position to move forward to the final phase of the project in 2014.

6.4.2 What does the Quantitative Data Tell us?

As already alluded to in previous chapters, the single most important reason for introducing a set of standardised measures for use with the children was to illustrate the usefulness of outcome tracking in studies of this kind. Of the four tools reported on in Chapter 5, the general finding was that the BEAST! children achieved the mean score and often surpassed it and achieved even higher scores. The analysis of each tool also showed variations in scores for the boys and girls which is interesting and shows that despite the limitations with the data, programme design for the future must take gender differences into account. As suggested earlier, it is important for BABORO to consider how best outcomes tracking such as this, can be built into the next year's planning for the BEAST! III Project. This in turn will enable them to engage in real evidence-based planning and programme implementation.

6.5 Project Recommendations

The recommendations arise from the process study findings and from the previous analysis and are detailed below: -

- In order to facilitate good project planning it is ideal if funding could come on stream earlier in the project timescale. This factor needs to be accommodated in project planning as it is a recurring issue which has impacts for project management, schools and arts and science practitioners.

- There is a requirement for a more formal briefing of school principals and class teachers at the early planning stage. This is in order to achieve full 'buy in' by schools and full understanding of the BEAST! project objectives which is important for achieving the full benefits of the project.

- There is an identified need for meetings between teachers and science and arts practitioners to agree practical aspects of the project and to aid good planning. This should include discussions regarding the school culture and ethos; the needs and ability levels of the class group; the roles and responsibilities of teacher and practitioner during workshops and discussion around the science curriculum which will aid decisions around content and harness more learning for the children.

- High levels of engagement were observed in the children when they were involved with more interactive elements of workshops. This has been one of the most successful outcomes of the project as it has facilitated 'deep learning' in the classroom. It is recommended that in year three of the project, workshops should continue to be designed

to include a wide range of opportunities for interaction and should be child-led where possible.

- Collaboration should continue to have a high priority at every level of the project and more opportunities to collaborate and participate should be built into project implementation.

- In order to harness and build on the learning from this process study it would be beneficial if Baboró management, teachers, arts and science practitioners and social scientists meet in order to reflect on the study findings and to engage in discussion around these. Practitioners identify that this would be very helpful in consolidating their learning from their engagement with the project and give them an opportunity to share information and learn from others. This would also facilitate planning for BEAST! 2014.

- Dissemination of the project findings should be further considered. At present there are videos of BEAST 2012 and a downloadable file on the Baboró website which interested parties can access but it is recommended that a copy of the report or executive summary should be sent to participating schools and practitioners in order to disseminate the findings to the wider school and university populations.

- A strong recommendation is that BABORO work with the social researchers to build upon the system of outcomes tracking already initiated and so that evidenced-based programme planning and delivery can be used for BEAST III.

- It would be beneficial to further engage parents during the intervention possibly including more exercises for children to do at home.

- Participants would like to continue and strengthen their links with Baboró and National University of Ireland, Galway.

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Appendix 1
THE BEAST Project
Index for Children

ID Number of Child / Name _____	T2
Date 2013 M/F	

My Involvement in these Activities

I want you to think about the activities that you have been involved with in the workshops. I will read out five statements and there are four ways you can answer about what you think about being involved.

Items	Options			
1. I feel comfortable at the programme/activity	1. NO!	2. no	3. yes	4. YES!
2. I am a part of the programme/activity	1. NO!	2. no	3. yes	4. YES!
3. I am committed to the programme/activity	1. NO!	2. no	3. yes	4. YES!
4. I am supported at the programme/activity	1. NO!	2. no	3. yes	4. YES!
5. I am accepted at the programme/activity	1. NO!	2. no	3. yes	4. YES!

My Experiences in School

I would now like you to think about this school. I am going to ask you some questions about school and the friends you have here. For the next six statements, you can tell me how much you agree or disagree with things about your school.

6.I feel like I belong at this school	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree
7. This school fits me well	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree
8. I feel connected to this school	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree
9. I feel welcome at this school	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree
10. This school makes me feel like I belong	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree
11. This is definitely my school	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree

How I feel about myself in School

Read the statements and **tick the one** that is true for you. 

Remember, this is how you feel about yourself when you are <u>in school.</u>

		Not often	Sometimes	Often
(1)	I feel good about myself	☐	☐	☐
(2)	I feel healthy	☐	☐	☐
(3)	I feel I am doing well	☐	☐	☐
(4)	I feel miserable	☐	☐	☐
(5)	I feel I have lots of energy	☐	☐	☐
(6)	I feel cared for	☐	☐	☐
(7)	I feel valuable	☐	☐	☐
(8)	I feel worried	☐	☐	☐
(9)	I feel I can deal with problems	☐	☐	☐
(10)	I feel bored	☐	☐	☐

Read the statements and **tick the one** that is true for you 

Remember, this is how you feel about yourself when you are **in school.**

		Not often	Sometimes	Often
(11)	I feel noticed	☐	☐	☐
(12)	I feel people are friendly	☐	☐	☐
(13)	I feel there is lots to look forward to	☐	☐	☐
(14)	I feel safe	☐	☐	☐
(15)	I feel confident	☐	☐	☐
(16)	I feel a lot of things are a real effort	☐	☐	☐
(17)	I feel I enjoy things	☐	☐	☐
(18)	I feel lonely	☐	☐	☐
(19)	I feel excited by lots of things	☐	☐	☐
(20)	I feel happy	☐	☐	☐
(21)	I feel I'm treated fairly	☐	☐	☐

My Friends

Can you think about the friends you have and probably see most days? How would you say you get on with them? .

1. I am good at making friends	1. Not at all	2. A little	3. Some	4. A lot	5. Very much
2. I help other people	1. Not at all	2. A little	3. Some	4. A lot	5. Very much
3. I ask others if I can be of help	1. Not at all	2. A little	3. Some	4. A lot	5. Very much
4. I get along well with others	1. Not at all	2. A little	3. Some	4. A lot	5. Very much

How I feel about Nature?

The next set of questions ask you how you think and feel about nature and the world around you.

5 I like to learn about nature.	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree
6 I like to read about plants and animals.	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree
7. I would spend time after school working to fix problems in nature.	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree
8. I like to learn about plants and animals.	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree
9. I am interested in learning new ways to help protect plants and animals.	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree
10 I would give some of my own money to help save wild plants and animals.	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree
11. I like to spend time in places that have plants and animals.	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree
12. I would help to clean up green areas in my neighbourhood.	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree
13. My life would change if there were no plants and animals.	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree
14. My life would change if there were no trees.	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree
15. Plants and animals are important to people.	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree
16. It makes me sad to see homes built where plants and animals used to be.	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree
17. People need plants to live.	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree
18. Nature is easily harmed or hurt by people.	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree
19. Plants and animals are easily harmed or hurt by people.	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree
20. We need to take better care of plants and animals.	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree

My Experiences with ICT in School

I would like you to think about using ICT (Computers) in school. I am going to ask you some questions about ICT. For the next statements, you can tell me how much you agree or disagree with things about ICT in school.

1.School work with ICT is more interesting	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree
2. School Work is more fun without ICT	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree
3. I pay more attention when lessons involve the use of ICT	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree
4. I find all my school work interesting	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree
5. Using ICT helps me choose the best place to start a piece of work	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree
6. ICT lets me work whenever I want to	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree

7. Work without ICT grasps my attention better	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree
8. I get more involved with my work when I don't have to think about new ICT skills	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree
9. ICT helps me to understand things better because I see pictures and videos	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree
10. ICT helps me to understand things better because I can listen to examples that are given in sound	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree
11. Using ICT makes me keen to go to every lesson	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree
12. I mess around more in class when I use ICT	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree

13. Using ICT makes me keen to go to school every day	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree
14. Using ICT now will be better for my future career	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree
15. ICT helps me to finish a piece of work that sometimes would be difficult to finish without it	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree
16. ICT makes me want to work more by helping me to make my work look better	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree
17. I work better with ICT because I can change things I have already written without making my work look a mess	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree
18. ICT helps me to work with other people	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree

19. I work better with ICT because it helps me put my ideas together	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree
20. I work better with ICT because it helps me to see things more easily	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree
21Using ICT helps me get better marks	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree
22. I work harder with ICT because it helps with my writing	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree
23.I work harder with ICT because it helps me work better with other people	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree
24. I like working with ICT because it helps me work better with other people	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree

25. Working with other people when using ICT helps me to learn better	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree
26. I like being able to show other people how to do things when I am using ICT	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree
27I can work longer without losing my concentration when using ICT	1. Strongly disagree	2.Disagree	3. Neither agree nor disagree	4. Agree	5. Strongly agree

28. If you can work longer with ICT, tell us how much longer in minutes you can work _____ Minutes

29. What do you mainly use the computer for in school?

_____

30. Would you like to make any comments about any of the workshops that you have taken part in? If so please write on the lines below.

Thank you very much for completing this questionnaire.

The Research Team at NUI, Galway