This paper[1] provides information for teachers at post-primary level on how to encourage and support students to participate in science fairs[2]. Engaging with science fairs provides opportunities for students to take more control of their own learning and build skills sets necessary for the 21st century, an approach which is strongly advocated in the framework document for junior cycle reform:
*Research has also shown that the quality of students' engagement – with the school, with teachers and with learning – is central to developing the skills and competencies that are necessary for students in today's world…*A Framework for Junior Cycle, Department of Education and Skills, 2012.

This paper is divided into two sections. Section 1 deals with general questions about science fairs while Section 2 deals with the specifics of science fairs at post-primary level. Information is also provided on how teachers can organise their own class/school-based science fair.

Section 1

This general set of questions and answers sets the scene and promotes the idea of involvement in extracurricular science activities. A recent publication from the OECD finds that:

In most countries, science-related extracurricular activities at school are related to better student performance, a stronger belief by students in their abilities to handle science-related tasks, and greater enjoyment of learning science. And, in many countries, this is true even after accounting for the socio-economic background of both students and schools……. PISA IN FOCUS 2012/07 (July) – © OECD 2012

Q1 As a teacher, what opportunities are there for my students to get involved in science fairs?

You can encourage your students to enter one of the three science fairs held annually in Ireland and/or hold your own class/school-based science fair.

The three science fairs are:

The BT Young Scientist and Technology Exhibition (www.btyoungscientist.com)

SciFest – Implemented at three levels as SciFest@School, SciFest@College and SciFest National Final (www.scifest.ie)

Sentinus Young Innovators (www.sentinus.co.uk/)

Information on class/school-based science fairs is available at:
www.scifest.ie/scifestschool
http://scienceprojectideasforkids.com/2010/organizing-a-science-fair/
http://www.sciencebuddies.org/science-fair-projects/Teacher_ScienceFairGuide.pdf

[1] This paper is the result of an action plan from Intel ISEF with contributions from Pádraig Ó Murchú, Intel Ireland, Doreen McMorris, Department of Education and Skills, Sheila Porter, SciFest, Mari Cahalane, BT Young Scientist and Technology Exhibition and Gerard Hughes, Sentinus Young Innovators.

[2] A science fair/exhibition is where students, having completed a scientific investigation, present their methods and findings in the form of a report, display board and models for exhibition and evaluation. The terms 'science fair' and 'science exhibition' are used interchangeably. The term 'science fair' is used in this paper.

Q2 What is my role as a teacher in preparing students for entry to a fair?

- The teacher's role should be to make students aware of the opportunities and encourage them to consider entering a project to one of the fairs. This can be done in the course of normal science lessons, by placing promotional material on school notice-boards, by organising meetings for students interested in participating in a science fair, or by organising a class/school-based science fair.
- Teachers can also help by suggesting project ideas to students[3] who are having difficulty in coming up with their own ideas, by suggesting sources of ideas for potential projects and by advising students on their choice of project.
- Teachers should check that application forms are completed correctly and they are required to sign off on the completed form.
- While teachers have a role in supporting and guiding students as their project develops they must always be conscious that projects must be the students' own work.
- Some projects may involve visiting distant locations. Students may also seek advice or information about their project from sources beyond their school, such as parents, the internet, government organisations, universities, institutes of technology or other experts. Students should apprise their teacher of all external work being undertaken.

Q3 What are the benefits to students of participating in a science fair?

Participation provides opportunities for students to benefit from:

1. **Self-directed learning**: Students identify the subject matter to be investigated; self-directed learning promotes confidence and strong student ownership of their projects and results.
2. **Learning that is relevant to their lives:** Students can select local/global topics of relevance/interest to them, and develop their own scientific investigations and models.
3. **Skills development**: Students learn through hands-on, experimental and problem-based approaches to learning. Skills development includes research methodologies, design of experiments, data collection, evaluation and analysis, critical thinking, problem solving, communications, innovation and entrepreneurship.
4. **Collaboration**: Students often work in groups, learning to be both tutors and learners while building social and collaborative skills.
5. **Cross-curricular and integrated approach**: Projects tend to support a cross-curricular, as well as an integrated, approach to STEM[4] learning.
6. **Engaging with global challenges**: Science fairs are a great way to connect learning in the classroom to the external world and the global grand challenges of food, water, energy security, better health services and better infrastructure.

[3] http://www.scifest.ie/sites/default/files/Project%20Ideas_2.pdf

http://www.sciencebuddies.org/science-fair-projects/project_ideas.shtml

http://www.sciencefairadventure.com/

[4] STEM- Science, Technology, Engineering and Maths

Q4 What other benefits accrue when schools promote participation in science fairs to their students?

When schools promote science fairs, students actively look for interaction/engagement within the local environment. Such interactions build connections between:

- Schools and local resources, parents and the community
- Local organisations and businesses including the farming sector, third level colleges, enterprises and science outreach centres

This creates opportunities to identify local needs, solve local problems and create and grow local business opportunities.

Where opportunities exist for students to work cooperatively with peers in diverse geographical regions on areas of local as well as global scientific and engineering interest such as climate change, sanitation, soil fertility, animal husbandry, fishery science, access to healthcare, education and ICT, such collaborations enrich the learning experience and build global perspectives.

Science fairs extend education from the classroom into the external environment.

Participation in science fairs also raises the profile and reputation of the school in the community and in the region while supporting improved educational experiences for students.

Participation in science fairs supports schools in ensuring that their delivery of science syllabuses meets the stated requirement of being inquiry-based.

Q5 What are the benefits to me as a teacher of science?

Teachers see real, long-term benefits from getting involved. Students learn better when they engage with others, are active participants in their learning and are learning by doing. Students are more motivated, resulting in improved learning outcomes as noted in the earlier reference to a recent PISA report.

Participation in science fairs also provides teachers with an opportunity to meet other science teachers in the region and exchange ideas. SciFest fairs are held in institutes of technology and thus they afford teachers an opportunity to visit the local third level college, meet staff working in the STEM area and learn about the STEM-related courses available in the college. There are also online support and resource materials on the fair websites to help teachers implement inquiry-based strategies and support project work.

Q6 How can participation in one of the fairs assist students studying Junior Certificate science?

In its discussion document – *Innovation and Identity: Ideas for a new Junior Cycle 2010* – the NCCA advocates an inquiry-based and problem-solving approach to learning and to science:
Across the developed and the developing world schooling finds itself at the centre of a set of global concerns about the future of the planet, about food and water security, and about the movement of peoples in the face of climate disasters. The global economic crisis adds to these concerns and increasingly, schools are being asked not simply to teach students about these issues but to shape the next generation of creative problem solvers who can quite literally, 'save the world'. To us this

may seem like a tall order. To our students it is an imperative. They will outlive us; they will have to be the generation of problem solvers.

By engaging in science fairs students are active problem solvers, addressing issues that have local as well as global impact. Furthermore students engaging in project-based work for science fairs develop skills which are directly relevant to at least eight of the twenty-four statements of learning outlined in the framework for the new junior cycle; these are:

1. Communicates effectively using a variety of means in a range of contexts
2. Recognises the potential uses of mathematical knowledge, skills, and understanding in all areas of learning
3. Uses mathematical knowledge, reasoning and skills in devising strategies for investigating and solving problems
4. Improves their observation, enquiry, and critical-thinking skills
5. Develops an understanding of the natural world
6. Takes initiative, is innovative and develops entrepreneurial skills
7. Uses appropriate technologies in meeting a design challenge
8. Applies practical skills as they develop models and products using a variety of materials and technologies

Section 2 – Post-primary Science Fairs

Q6 What are the main differences/similarities between *BT Young Scientist & Technology Exhibition*, *SciFest and Sentinus Young Innovators*?

	BT Young Scientist and Technology Exhibition	**SciFest**	**Sentinus Young Innovators**
Inquiry based	✓	✓	✓
Individuals	✓	✓	✓
Groups (max 3 people)	✓	✓	✓
Age Categories	Post-primary students Junior 12-13 yrs Intermediate 14-15 yrs Senior 16-19 yrs	Post-primary students Junior 11-14 yrs Intermediate 15-16 yrs Senior 17-19 yrs	Secondary 11-19 yrs Junior 11-14 yrs Intermediate 15-16 yrs Senior 17-19 yrs
Discipline Category	**1.** Chemical, Physical & Mathematical Sciences **2**. Technology **3.** Biological and Ecological Sciences **4.** Social and Behavioural Sciences	**1.** Physical Sciences **2.** Technology **3.** Life Sciences (includes Biological, Ecological and Social & Behavioural Sciences	1. Life Sciences 2. Physical, Chemical , Mathematical Sciences 3. ICT, Social and Behavioural Sciences 4. Engineering/Technology

Public Fair	✓	✓	✓
Pre-screening	Yes. Based on abstracts received- top 550 will be invited to exhibit	All entries accepted subject to capacity of venue	All entries accepted (provided they meet certain H&S regulations) subject to the capacity of the venue
Numbers engaging	4500	Varies by venue	
Numbers exhibiting	1500	5300+	2500
Duration	4 days	1 day at each venue	1 day
Location	Dublin	Various – all Institutes of Technology and University of Ulster – Magee Campus, Derry and an increasing number of schools	Belfast
Progression	Yes/winners proceed to EU Young Scientist and Intel award winners to Intel ISEF	Yes/regional winners proceed to national fair/winners proceed to Intel ISEF	Yes/winners proceed to Intel ISEF/category winners proceed to Big Bang UK and ISWEEEP

Q7 What age group should students be in when they decide to enter a fair?

BT Young Scientist and Technology Exhibition caters for all 12-19 year olds.

SciFest also caters for all post-primary students. On average to date some 65% of projects have been entered in the junior category (11-14 yrs), with 29% in the Intermediate category (15-16 yrs) and 6% in the senior category (17-19 yrs).

Sentinus Young Innovators has a large primary representation as well as post-primary. Consequently, the age range that can be represented at the event can vary from 8 to 19 years of age.

Q8 Is it better for students to work individually or in groups?

Historically, about 70% of entries come from groups in the BT Young Scientist and Technology Exhibition.

For SciFest the majority of entries, 83% to date, are group projects.

For Sentinus Young Innovators, the majority of the 200 post-primary projects are individual.

The advantages to students and the skills developed are broadly the same irrespective of the type of project they present – inquiry-based learning, design of experiments, data collection, analysis and evaluation, critical thinking, communications and problem solving. Participation in a group project further promotes the key skills of working with others, encouraging collaboration, and sharing of expertise and tasks. For those presenting individual projects, participation promotes the key skills of personal effectiveness, self-confidence, time management, target setting and a greater level of dedication and commitment.

Q9 What role, if any, do parents/others have when students decide to work on a project?

As in all aspects of their children's educational journey parents have an important role in supporting and encouraging students as they take their project from initial idea to final preparation for exhibition at a science fair. However, parents must be careful to draw the line between support and direct involvement. Students must always specifically acknowledge all sources of information and assistance in their report book.

Students are encouraged to seek advice/ information about their project from sources beyond their school, for example, the internet, from government organisations, universities, and institutes of technology or other experts. Students should apprise their teachers of external work undertaken irrespective of whether it is under the guidance of parents, guardians or others.

Q10 Can a student enter the same project in all fairs?

BT Young Scientist and Technology Exhibition
Projects that have been entered in other competitions can be accepted as entries to the BT Young Scientist & Technology Exhibition provided that this information is stated in the relevant area on the entry form.

SciFest
Students may enter a project in SciFest@College that they have previously entered in another fair except in the case where they have been awarded a category prize or one of the major prizes in the same year's BTYS&TE. Projects entered in previous fairs are expected to have undergone subsequent development work; such work should be clearly identified in the report book. They can also enter a project that they have exhibited at SciFest@School; it is recommended that this should also include additional work.

Sentinus Young Innovators
Students are welcome to enter a project at Sentinus Young Innovators that has previously been entered for other competitions in Ireland or the UK. As a consequence of their entry to other competitions judges would expect extra development work to have been carried out as a result of feedback received. Previously submitted research must be identified in the Report Book.

Q11 Can a student who enters a project in one year enter it again the following year?

Yes, provided there is evidence of significant developmental work having been undertaken in the interim or a new line of inquiry undertaken. Previously submitted work must be clearly identified in the display and report book.

Q12 What does participation in each of the fairs cost?

There is an entry fee for the BT Young Scientist and Technology Exhibition of €20 per student.

There is no entry fee for SciFest.

There is no entry fee for Sentinus Young Innovators.

Q13 How are projects selected for inclusion in the fairs?

For BT Young Scientist and Technology Exhibition all submitted abstracts are screened by a panel of judges; 550 of the submitted abstracts are invited to exhibit at the event. Also the 30 top students from the intermediate and senior categories are invited to participate in a residential business development programme called the BT Young Scientist & Technology Business Bootcamp. These students are short-listed from those that qualify and attend the RDS.

Participation in a school fair, SciFest@School, is at the discretion of the teacher(s) concerned. All project entries to the regional SciFest fairs, SciFest@College, are accepted subject to available capacity at the chosen venue. Participation in the national SciFest fair is confined to the top project award winners from each of the regional SciFest@College fairs.

In principle, every attempt is made to facilitate all projects submitted for entry to Sentinus Young Innovators. However, all projects are screened to ensure that they comply with health and safety regulations relating to safe practice in schools, including the use of live organisms for biological testing or dissection.

Many of the projects that are entered for Sentinus Young Innovators are generated as a consequence of work that Sentinus has already carried out in schools across Northern Ireland and the Republic of Ireland. Sentinus engages with more than 60,000 primary and secondary students each year through its comprehensive range of STEM programmes. All of the STEM programmes work on the basis of inquiry-based learning and problem-solving teamwork and range from one day interactive workshops to more long-term comprehensive initiatives linking schools with industry. The range of STEM initiatives that schools can participate in can be viewed on www.sentinus.co.uk and are available to schools throughout Ireland.

School-based science fairs are at the discretion of the teacher(s) organising the event.

Q14 What sort of prizes or awards can students get?

For the BT Young Scientist and Technology Exhibition, there are over 120 awards for students including travel awards. In addition there are four teacher travel awards. The prize fund is in the region of €25k per annum.

As well as the top awards, the student awards include:

1st, 2nd and 3rd prize in each category, group and individual in each category

+25 Special Awards which can be category specific, e.g. best invention, etc.

Highly commended awards in each category

Display awards in each category

For SciFest@School, each student participating receives a participation certificate. A number of small awards are presented depending on the number participating in the event. One SciFest@School Best Science Communicator Prize is awarded at each event.

For SciFest@College, there is a range of awards:

- Nine special student awards per venue (15 venues)
    - SFI/DSE Best Project Award (Trophy + €60 group/€20 individual gift vouchers)

  - Intel Award (Trophy + €60 group/€20 individual gift vouchers)
  - Runner-up Best Project Award (Trophy + €60 group/€20 individual gift vouchers)
  - Communicator Award (Trophy + €60 group/€20 individual gift vouchers)
  - Chemistry Award (Trophy + €60 group/€20 individual gift vouchers)
  - Sustainable Energy Award (Trophy + €60 group/€20 individual gift vouchers)
  - Discover Space Award (Trophy) + Discover Space Teacher Award
  - Maths in Science Award (Trophy)
  - Teacher of Chemistry Award (Crystal Plaque)
- Category Awards
- Best School Award (some venues)
- Special Awards (some venues)

Sentinus Young Innovators has a comprehensive award system for the primary and secondary sectors. A broad outline of the award structure is as follows:

Secondary Sector:

There are two main strands to the Sentinus Young Innovators Event, namely:

Northern Ireland Young Scientists (NIYS)

Northern Ireland Young Engineers (NIYE)

In each of the above strands there are Winners (£100 plus Trophy) and Runners-up Awards (£75 plus Trophy) for each of the 3 Classes (Junior, Intermediate and Senior) in each strand

Across the above two strands (NIYS & NIYE) there are 21 Special Awards (£100 plus Trophy)

Q15 What are the top awards?

BT Young Scientist and Technology Exhibition

- BT Young Scientist(s) of the Year Trophy (perpetual), cheque for €5,000 / £4,500*, the chance to represent Ireland at the European Union Contest for Young Scientists
- Best Individual/Group BT Trophy (perpetual), cheque for €2,400 / £2,160*
- Runner-up Individual and Group BT Trophy (perpetual), cheque for €1,200 / £1,080*
- Best in Chemical Mathematical and Physical Science Award – Intel travel award to the US (also includes teacher)
- Best in Technology – Analog Devices travel award to the US (also includes teacher)
- Best in Biological & Ecological Category – prize fund sponsored by Elan

  **Exchange rate dependent*

SciFest

- Each of the Best Project Award winners from the regional SciFest@College fairs receives an Excellence in Science plaque at the national SciFest fair which is held in October/November
- The overall winner/s receive/s a trophy and an Intel travel award to represent Ireland at the Intel International Science and Engineering Fair (ISEF) in the US (also includes teacher)

Sentinus Young Innovators

- The overall Grand Award winner/s receive/s a trophy and a fully funded Intel travel award to represent Ireland at the Intel International Science and Engineering Fair (ISEF) in the US (also includes teacher)
- The Runner-Up Grand Award is a fully funded trip to the USA to compete at ISWEEEP in Houston, Texas (also includes teacher)
- There are twelve Premier Awards which are nominations to attend the Big Bang Competition in the UK (each of the schools will receive a Bursary for travel and accommodation to the event)

Q16 Whose approval is necessary before my students can enter a fair?

	BT Young Scientist and Technology Exhibition	**SciFest**	**Sentinus Young Innovators**
Principal's signature	✓	✓	
Teacher's signature	✓	✓	✓
Parent's/guardian's signature	✓Student/Group Leader	✓ All students	
Student's signature	✓Student/Group Leader		

Q17 Do all the science teachers in my school need to become involved if some of my students decide to enter a fair?

BT Young Scientist & Technology Exhibition: No

SciFest: There is no requirement for all of the science teachers to become involved, though for SciFest@School and school-based science fairs it is desirable that teachers collaborate and support each other.

Sentinus Young Innovators: No

Q18 Where can I, as a teacher, get advice to guide me in entering students for the first time?

www.btyoungscientist.com

www.scifest.ie

www.sentinus.co.uk

www.sciencebuddies.org/

Q19 What are the key dates in relation to the science fairs?

BT Young Scientist and Technology Exhibition

1. October closing date for entries.
2. Early January fair at the RDS – it is important to check website for exact details: www.btyoungscientist.com.

SciFest

1. SciFest@School fairs can take place at any time of the year that is convenient for the teachers concerned. The SciFest organisation should be notified in good time to allow for the selection of judges, the preparation of certificates and the provision of promotional materials; registration forms are available on the website: www.scifest.ie.
2. The closing date for entries to the regional SciFest fairs (SciFest@College) is generally in early March. SciFest@College fairs take place on various dates in March/April/May/June (check website for exact details: www.scifest.ie).
3. The national final of SciFest takes place in October/November. The overall winners from each of the SciFest@College fairs are notified of the details about six weeks in advance.

Sentinus Young Innovators

The competition takes place in the Odyssey Arena, Belfast in the middle of June of each year. The deadline for close of entries is usually at end of the third week in May (check website for exact details: www.sentinus.co.uk/).

The dates for school-based science fairs are at the discretion of the organising teachers.

Q20 My school is not near Dublin, does that matter?

BT Young Scientist and Technology Exhibition

No, schools that are more than 70 km outside Dublin can apply for assistance towards accommodation costs incurred if they have to stay overnight in Dublin. Schools eligible for a grant may be awarded either €150/£135 for an individual entry or €300/£270 for a group entry, subject to a maximum grant of €1,500/ £1350 per school and other applicable terms.

SciFest

As SciFest fairs are for 1 day and are locally or regionally based this is not an issue.

Sentinus Young Innovators

Sentinus does not provide support for students to travel to Young Innovators. However, we are fortunate that students travel from all parts of Ireland and from Scotland to attend our event.

Q21 What are the first steps I should take as a teacher interested in promoting fairs to my students?

BT Young Scientist and Technology Exhibition

Log on to www.btyoungscientist.com.

Talk to some teachers who have participated.

Visit the BT Young Scientist and Technology Exhibition at the RDS in January on one of the public days.

SciFest

Visit the SciFest website (www.scifest.ie).

Send your email address to the SciFest CEO (sheila.porter@scifest.ie) to be included on the mailing list.

Talk to some teachers who have participated in previous SciFest fairs.

Sentinus Young Innovators

Visit the Sentinus website (www.sentinus.co.uk/). You can download the Sentinus Young Innovators Entry Form and find out about other STEM initiatives that your school might like to get involved in.

School Based Science Fairs

Check the following websites:

www.scifest.ie/scifestschool

www.sciencebuddies.org/science-fair-projects/Teacher_ScienceFairGuide.pdf

http://scienceprojectideasforkids.com/2010/organizing-a-science-fair/

Q22 Where can I get further details around all fairs?

www.btyoungscientist.com

www.scifest.ie

www.sentinus.co.uk/

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2 September 2013