The Leonardo Effect

Synchronised Integration of Art and Science

A Nationwide Study Involving Schools in England, Ireland, Wales, Northern Ireland and Scotland

Abstract

This research and publication of initial results are current and timely given recent curricular developments with the promotion of flexible, integrated, skills-based learning and teaching.

The research presented here represents the initial results of The Leonardo Effect in schools across England, Ireland, Scotland, Wales and Northern Ireland.

Questionnaires were used to ascertain: the professional evaluations of the teachers who delivered the Leonardo Effect; the opinions of principals from their school management perspective and the perceptions of parents/guardians on the commitment and response of their child to the project. Furthermore, focus group interviews with children were carried out to determine their views of the Leonardo Effect.

The information collected provided a substantial amount of qualitative data. Quantitative analysis of this data involved the collation and classification of positive responses, negative responses and issues.

The collated quantitative data is organised and presented as follows:

Primary Schools:
- Teachers' Responses
- Principals' Responses
- Parents' Responses
- Pupils' Responses

Post Primary School:
- Teachers' Responses
- Parents' Responses
- Pupils' Responses

Qualitative data, in the form of quotations extracted from questionnaires and interview transcripts are included; and provide a valuable and insightful illustration and elucidation of the statistics.

Our results explicitly show that primary teachers, principals and parents are overwhelmingly supportive of the Leonardo Effect; and the legacy will continue in their schools long after the conclusion of the pilot. Teachers comment with enthusiasm about the positive effect on children's engagement in learning, creativity, inclusivity, acquisition of knowledge, literacy, skills development and the integration of art and science.

Post primary results indicate that the model can be successfully applied at this level, and indeed the teachers were particularly positive in areas such as skills development, literacy and the use of Joint Learning Outcomes. While they gave strong support to the Leonardo Effect, we recognise the contextual challenges, such as subject specificity, encountered by the post primary teachers. There is clearly a need for further investigation with a much larger sample of schools.

Presentation of Results

Primary School Pilot

Introduction

To assess the impact the Leonardo Effect was having in schools we surveyed opinions from all stake-holders. These included: teachers and principals for their evaluation from a professional standpoint; parents for insight into how the learning experience was affecting their children; and the children's views on how they found the approach in practice. In addition teachers completed diaries (many illustrated) recording their day-to-day experiences, these and the work produced by children have yet to be analysed formally. Literacy case studies were also recorded.
Each curricular region across the British Isles is represented in the results.

Questionnaires (see Appendix 1) were used for adults, and children's opinions were obtained through informal focus group interviews (questions also outlined in Appendix 1).

For initial analysis of questionnaires, each response was categorised under one of three headings:
Positive- indicating the approach had made a positive contribution.
Negative- the approach had a negative effect.
Issues- areas of the approach that might require further development.

We present a brief outline of this analysis under the headings of:

Teachers
Principals
Parents
Children

Teachers' Responses

Teachers were issued with an extensive questionnaire and asked to use their professional judgement to assess the approach under a number of headings including: Planning; Use of Joint Learning Outcomes (JLOs); Teaching; Pupil Learning; Transferable Skills; Assessment and Development of Literacy.

16 teachers (100%) from Northern Ireland primary schools (NI) responded and 10 (50%) from schools outside Northern Ireland (XNI) returned questionnaires. (Some XNI teachers felt the questionnaire only duplicated what they had already responded to in their diaries.)
There was a strong similarity in the responses to questions between both groups of teachers. The overall results of the entire questionnaire are shown in Fig 1.

Overall Response

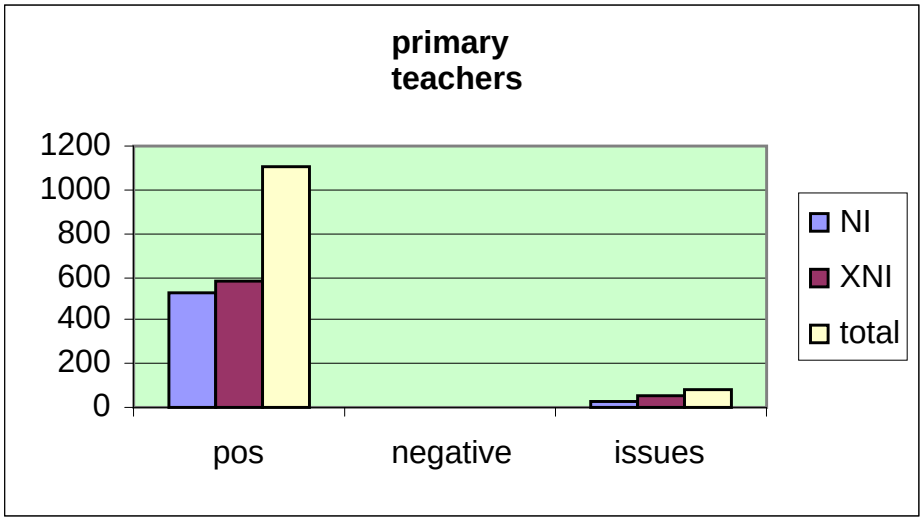

Fig.1 Overall response of teachers to questionnaires

It is very clear that teachers were extremely supportive of the effect the approach had in their classrooms. Strikingly, of 1197 comments no negative comments at all were made and relatively few issues were raised.

A number of selected areas are discussed below in greater depth.

Planning

positive	negative	issues
76	0	15

A sample of typical responses is given below:

"Refreshing not to pre plan, and to listen to the pupils interests and be led by this."
"As the project proceeded I found that the planning became more self-evident and presented its own direction via the children."
"Having no fixed target or end result at the beginning of the project due to its open ended approach allowed a greater diversity of learning and I feel a much more enjoyable time for both pupil and teacher."
"Now when I think about the whole year, I feel we have actually covered more."
"I am now much more aware of the science involved in manipulating materials especially in art and design."

Issues raised centred on the difficulties of adapting to a new approach to planning. This is also commented on in the external evaluation carried out by Goldsmith's College, University of London "The scale of the transition should not be underestimated."(p. 8).
In almost every case initial difficulties were regarded as worthwhile by the end of the project. Examples of this are given in the following quotes:

"I was rather apprehensive in the beginning as I have been used to knowing exactly what I would be teaching…I was very surprised when we discussed their ideas as they were much better than mine!"

"Initially we were a little sceptical about the open-ended approach....it became clear that the children's approach to the theme was more imaginative than a formal planning structure."

There are many examples of self-generated questions posed by the children that are less likely to have arisen with more formal planning such as: *how intelligent are birds; where do birds live in London; what weight is an owl?* Teachers were challenged in their planning to accommodate this level of curiosity and in most cases travelled a journey of discovery with the children, which traditional planning may not have so naturally allowed.

Teaching

positive	negative	issues
133	0	14

A sample of typical responses is given below:

"Completely different to the way that I would normally teach."

"I felt that I was challenged to teach more creatively as the children seemed to be investigating with drawing and modelling a lot more as opposed to reading and writing."
"Constantly thinking of different ways of remembering/recording skills used and tasks that were completed –not just pen and paper!"
"I really used the ideas that the children had given me to help me teach more creatively."
"I was more like a supervisor than a dictator!"
"The children had to think for themselves and work independently of the teacher."

One question in this section asked, **"If this new approach was fully supported by curriculum bodies for the long-term, would you be willing to apply it to topics other than flight?"** Teachers generally were very positive about this. Answers included:

"Most definitely this enthuses children and brings the best out of the teaching and learning experience."
"It would be perfect for when the new curriculum comes into place."
"I certainly would utilise it as I can see first hand how much the children have learnt, how much they enjoyed the topic."
"I think many science topics benefit from being taught this way."
"…gives us the opportunity to introduce and develop those all important transferable skills at a much earlier stage in the children's lives."

The issues raised in the teaching section also centred on the need to learn to change entrenched approaches:
"I feel many of us have been conditioned into focusing too much on what the children know and not how they know it."
Or to involve the process in whole school planning:
"Each school would have to work together to produce long term plans to ensure that topics taught like this cover all of the science curriculum."

Learning

A very high proportion (29%) of the total responses given by teachers was on the topic of children's learning.

positive	negative	issues
342	0	10

This conveys the clear message that, in their professional opinions teachers are strongly supportive of the benefit of this approach to their pupils' learning. Typical comments included:

"I found that the project became a central focus to their school life, many of them watching TV programmes they may have not previously watched, using the Internet for research rather than gaming, and using 'raw' materials i.e. relatives, family friends to help and guide them."
"I found that they enjoyed the science taught during the Leonardo Effect a lot more."
"They were retaining a lot more facts and wanted to learn more about why and how certain things happen in relation to flight e.g. How does an aeroplane fly?"
"Their understanding of concepts seemed beyond what you would expect for their age."
"Working as a team on a large scale project."
"Through observation and informal assessment of the children it was obvious that the children were developing thinking skills and their ability to solve the problems they were facing."

Of particular interest were the responses to questions relating to children at different ends of the conventional skills distribution. Responses to the question, "**How did children of below average ability benefit from the project?"** were very encouraging as it was widely reported that these children benefitted greatly from the Leonardo Effect. A typical quote stated:

"One child in particular who has extensive literacy difficulties enjoyed being able to show the depth of her understanding and analysis of information, through detailed artwork."

When asked, **"What did the most able pupils gain from the teaching approach?"** teachers reported that the challenging nature of the approach was well adapted to these pupils' needs and that they thrived in such an environment. In addition the diverse nature of the work meant that:
"They had to work together rather than dominate."

Issues represented only 3% of responses and were not focussed on any particular area.

Transferable Skills

positive	Negative	issues
185	0	5

Teachers were asked to comment on the opportunities provided for children to develop transferable skills such as thinking skills, communication skills, ICT and

interpersonal skills. Again, the response was very positive with only five comments concerning issues. Typical quotes include:
"The project develops children's confidence in communicating with others as many had the oral confidence that comes with truly understanding and owning the material you are presenting to others."
"Throughout the whole project children were challenged to question their own learning and other ideas based on what they already knew and what they were finding out."
"The project is based in using higher order skills e.g. The process of designing and making their own camouflage kite, flying it and then evaluating it."
"The children were constantly communicating visually and orally to each other."
"Photo-stories, digital photography, animation, digital blue microscope, wordprocessing, graphics package, internet, email and digital blue recorder."
"Children in my class have previously struggled working on the same table as others, however, during this project children seemed to genuinely want to help others and work together to produce their best work."
"Working with others was a huge part of the creation process. Some groups managed this better than others."

One teacher commented on the exemplification of skills in practice:
"I feel one of the biggest ideas to come out of the project for me was the emphasis on skills rather than very specific objectives."

Literacy

positive	Negative	Issues
203	0	9

Comments from teachers followed the usual pattern, with only 4% of 212 responses relating to issues. In the teachers' responses opportunities for higher order literacy skills and children's motivation to communicate verbally and in written form, featured highly.
Teachers' quotes include:

"Children were motivated in approaching literacy type activities during the project compared to their usual commitment during literacy."
"They wanted to answer their own questions so they wanted to read."
"Sometimes the quality of the discussion was truly amazing."
"Children's spellings improved because they were continuously using flight vocabulary. Reading improved during the gathering information period due to children's engagement. Speaking and listening also improved due to children's increased confidence in their work."
"A vast improvement was seen in creative writing content with new vocabulary being used."
"Children began to read more books related to the subject, both novels and reference books."
"The children were much more at ease with text."
"The children loved reading the books and researching on the internet."
"From the very beginning right through to the end of this project I have been very aware that the children's language development has been greatly enhanced. They are

also able to use scientific and subject related vocabulary in the correct context and they understand the meaning."
"I found that because children were so motivated by the project that they became motivated to read and write."
"I found that during discussions and talking and listening activities, the children were very keen to talk about the project, share their ideas and opinions and talk about their work."
"The motivation varied according to the normal day –to – day attitudes to literacy based activities."

Assessment

positive	Negative	Issues
172	0	8

Here teachers were asked how the Leonardo Effect was suited to assessment and how evidence of pupils' art and science knowledge could be observed. Of 180 responses 172 (96%) were positive. Typical comments included:

"You can see where children are using their scientific knowledge through a piece of art, e.g. printing of the primary feathers."
"Children applied their knowledge to their design."
"My class in some ways saw the application of acquired knowledge being justified in their creatures."
"We were able to assess art and science jointly. You can see where the children are using their scientific knowledge through a piece of art."
"The completed drawings show awareness of colour, shape, tone as well as being scientifically correct."
"Each group had a very clear idea of why the creature looked the way it did."
"Drawings were far more detailed and realistic."
"I feel that I could assess pupils' knowledge of art and science by observing the processes and the products from the synchronised art and science lessons."

Conclusion
This brief digest of the responses of teachers to the Leonardo Effect shows unambiguously that, in their professional opinions, primary teachers find the approach to be extremely successful with their pupils.
It is clear that teaching was found to be more creative and enjoyable. This in turn, developed an environment in which pupils' skills were enhanced without loss of conceptual knowledge. Similarly, pupils of below average ability were supported in their learning but the nature of the project did not hamper development of high achievers. Literacy appears to flourish.
Teachers acknowledge that, in some cases there were difficulties in adapting their approaches to lesson planning to this more creative style. In most cases this problem resolved itself as the project developed. Further support through training is likely to assist any problems in this area.

Principals' Responses

Principals were issued with questionnaires that were similar to those given to teachers and asked to assess the approach from their school management perspective. In addition to the topics of Planning; Use of Joint Learning Outcomes; Teaching; Pupil

Learning; Transferable Skills. Principals were also asked about the legacy of the project in their school and whether they would support the national implementation of such an approach.

Overall Response
Five (63%) of the NI principals responded and nine (90%) of the XNI group.
As found in the teachers' response no principal made any negative comment and only a few issues were raised. Results are shown in Fig.2.

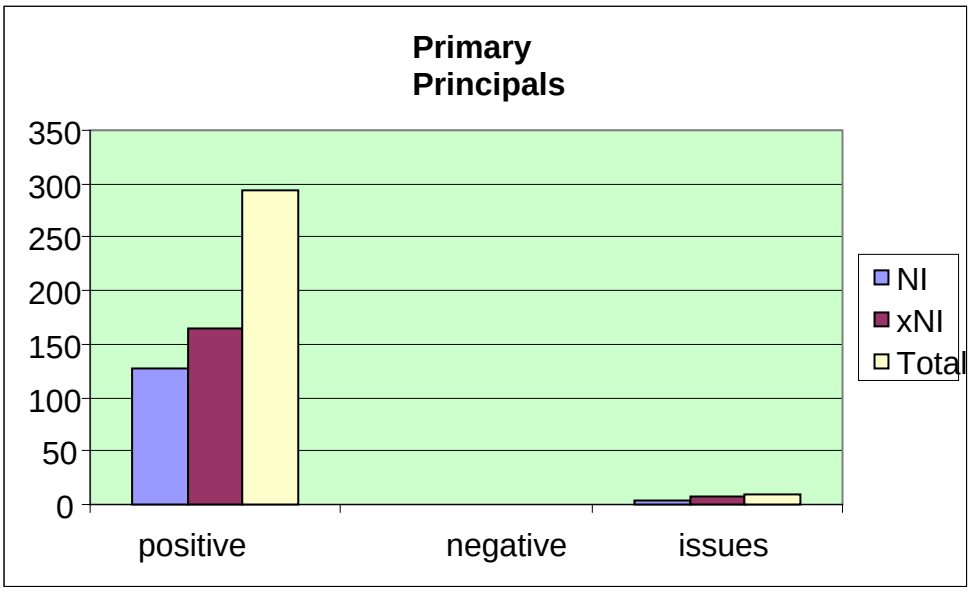

Fig.2. Overall response of principals to questionnaires

Six of the 10 issues were raised under the topic of Planning The following statements were typical:
"Teachers found this challenging as they are used to planning in a more structured way."
"Teachers who prefer to work within a well planned and thought out framework would feel quite overwhelmed by the spontaneity required."

However, principals also recognised the importance of training for teachers in this new approach.

Three questions will be looked at specifically:

(i) **Is there a lasting legacy of the project in your school?**

positive	negative	Issues
17	0	0

Principals were strongly supportive of the approach in relation to the legacy for their schools. Of 17 responses all were positive. Comments included:

"We feel working like this is a way forward for us as a school."
"We have changed our whole school planning."
"Other classes are asking when is it their turn."
"We have totally rethought our curriculum planning"

"We plan to extend the methodology throughout the school."
"Other staff have been very interested and this will have a long term effect across the school."
"The experience of this project has been key in informing our work."
"The staff involved will have a head start for delivering the revised curriculum."

(ii) **"If the Leonardo Effect approach was to be adopted nationally, how would you feel about this?"**

positive	negative	issues
17	0	0

They were unanimously supportive of the national adoption of the approach. Typical comments included:

"We have already thrown caution to the wind by applying the new approach to all areas of the curriculum. We feel confident that we should be teaching children NOT teaching subjects at primary level."
"Maintains the integrity of disciplines whilst working across the curriculum."
"Yes. Art and science are great bed partners & this synchronised integration will be used for other topics i.e. water, growing things etc."
"Absolutely. If rigour is maintained this is the way to enthuse pupils and provide a broad, relevant curriculum."
"It is a mechanism of learning that supports all. Giving lesser able children the confidence to have a go."
"Class teachers and I, as line manager, were completely delighted at the level of learning achieved by all pupils from most to least able."
"Parents were amazed by the factual learning as well as the creativity. Children were enthused and parents were delighted."
"It was not noted that any pupil failed to be engaged. It is a mechanism of learning that supports all."

They were subsequently asked what problems might arise for schools if the approach was adopted. Their responses centred on planning as noted above, resources, workload and need for training.

"The St. Mary's lead and resource support made a critical difference."
"Training would be needed."

(iii) **The project required a more flexible and creative approach to planning. What do you see as the advantages/disadvantages of this?**

Typical responses included:
"It gave the opportunity for children to explore an area in depth. As a result of this, children attained levels in Maths and Science that were much higher than expected for Year 4."
"Both teachers and children find it easier to make connections in their learning. This led to much more involvement and enjoyment from the children."
"Pupils were actively involved in planning for their own learning experiences."
"The project created much excitement, new knowledge and presented science in a creative approach."

"The children felt total ownership of the project and fully believed that all decisions about what would happen lay in their hands. They responded very positively to this and the results were quite amazing."
"…teachers have more autonomy and can plan to meet the needs and interests of pupils more effectively."

They also raised some issues:
"This needs careful staff development."
"Younger teachers trained within the constraints of 5-14 with its rigid adherence to time balance etc. may find it hard to adjust to the creative, flexible nature of planning required."
"Teachers found this challenging as they are used to planning in a structured way."

Conclusion
The principals have resoundingly endorsed the Leonardo Effect, and it is clear that the legacy of the approach will continue in those schools long after the conclusion of the pilot. The pattern of their responses, closely parallels that of their teachers, however, they give more weight to the positive effects across the whole school. They have concerns in areas such as resources and particularly in training/staff development. However, these are capable of being surmounted.

Parents' Responses

Parents of children in each class involved in the project were asked to complete a questionnaire. This was much shorter than those completed by teachers and principals, and focussed on their perceptions of the commitment and response of their child to the project; whether they supported the synchronisation of art and science and the effect on their family.

A surprisingly high number of responses, 247 were received. The overall response is given in Fig. 3.

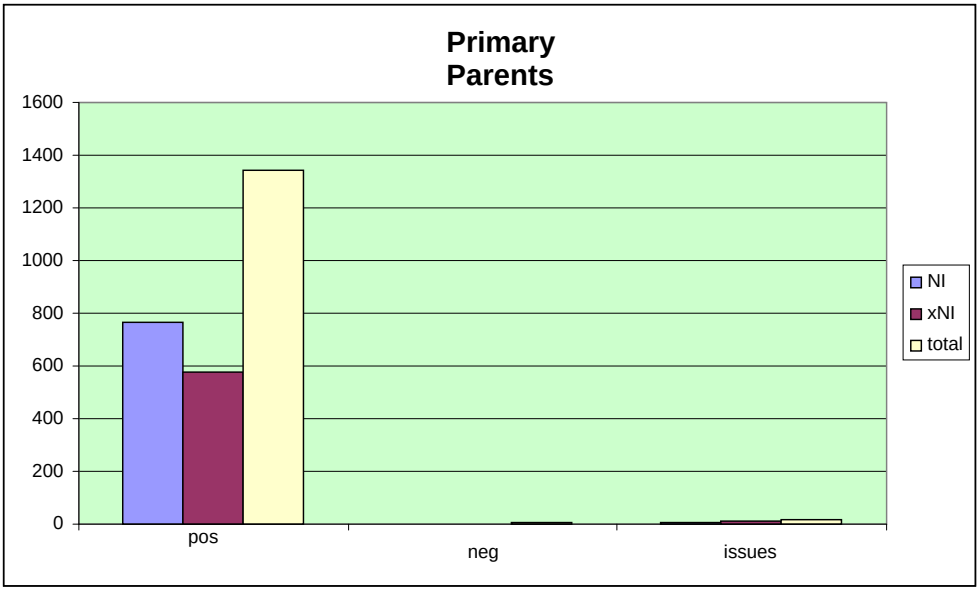

Fig. 3. Overall responses of parents to questionnaires

Of the 1361 responses only 5 were negative and 16 raised issues.

The only question to induce some negativity was, **"Pupils worked like Leonardo da Vinci – with first hand experiences, following their interests, working independently, developing ideas and creating. Would you be supportive of this approach being implemented in children's education?"**

The results for this question are shown in the table below.

positive	Negative	issues
216	5	10

All negative responses are recorded below:

"Yes in some lessons like art and science and history but not in maths and English."
"There should be a structure in place to make sure all pupils attain basic skills."
"No"
"Yes- encourages creativity but would not necessarily suit all."
"I would support working independently and learning through creativity if it were a small part of the school day, however, I do feel that structured lessons are essential in the classroom."

This reflects the concern of a small number of the 247 parents that traditionally structured teaching would be replaced, and that this would be detrimental to children's learning in literacy and numeracy especially.

A small number of comments related to issues e.g.:
"I agree with this more independent style although I imagine it is more difficult for the teachers to control and monitor."
"I am very positive with this approach. It is very practical but I would like to see basic maths and English as a backbone to everything."

Typical responses from the 216 positive comments included:

"Certainly. The children are learning and retaining facts without realising. It makes the whole learning experience fun and interesting."
"I think it is very important for children to be able to work solo and to use their own initiative. I fully support this approach."
"Yes, X learnt while having fun. I believe he will remember all the things he learned much better than if the same facts had been presented in a different format."
"Yes, I think it would be very good indeed. It would keep the children's minds more active having more interesting topics instead of just English and Maths."
"I would be supportive of this being implemented in children's education as it gets them thinking of their own ideas and how they can work on their own leaving them feeling a sense of achievement."
"Yes, I think so. Obviously I'm viewing what went on at some distance but it would appear that this approach succeeded in stimulating the children to think about what they were studying, to explore the themes and have fun being educated."

One other important question asked; **"Did the project impact on you as a family?"**

positive	negative	issues
177	0	2

Not all parents responded, but several meaningful comments were made including**:**

"Yes as a family we learnt a lot about the work of Leonardo from our daughter whilst she was learning about him."
"Yes, he came home from school asking to take him to book shops to buy him books on the subject."
"It helped us all become more involved in learning and discussing different topics."
"We all found it extremely interesting. It's nice to spend time to-gether."
"X got us all involved in discussing all the issues and themes she had been exploring in school."
"We as a family feel that as a result of the wonderful investigative and creative activities prepared by staff, our children have become more independent learners. They happily use the internet to research Leonardo's work. They are extremely keen to discuss their findings. Many people have commented on their recall of facts."

Conclusion
Despite reservations on the part of a few parents regarding the delivery of literacy and numeracy, the vast majority of parents responded positively to the approach, recognising it as having a positive impact on their children's learning. We note that parents are acknowledging the importance of independent learning, enjoyment of learning and creativity. We would have expected a much higher degree of reservation by parents about the Leonardo Effect, and more concern that literacy was being taught effectively, bearing in mind that communication to parents about the Leonardo Effect varied considerably from school to school.

Children's Responses

Questionnaires would have been an inappropriate way to gather this form of information from children, so in this case we carried out focus group interviews in every school in N. Ireland, and asked teachers elsewhere in the British Isles, to carry out focus group interviews in their schools. Children were very happy to discuss their views of the Leonardo Effect and a great deal of information was gained. The number of questions was greatly reduced to allow plenty of interaction. A sample of these are included to give an impression of the learning experience the pupils obtained working through the Leonardo Effect.

There was almost unanimous support for the project from pupils and typical responses are given below.

What did you like about the project?
Of 235 comments we have selected the following:

"I like the fact that we can find things out for ourselves."
"Very exciting, excellent."
"Really, really fun and interesting; you learn more."
"Everyone's art got better cos we don't normally do it. that is important"
"Made science more interesting – big time!"
"Loved doing the science."
"More thinking."
"Brilliant, exciting, amazing, class, great."
"It was a whole different world."
"It was so fun and active."
"Doing art and science at the same time, great fun."
"Don't normally like school."

"More freedom."
"We learned more and it was more interesting."
"We remembered it and we didn't have to write it down."
"My favourite part was learning about Leonardo da Vinci. he was an artist- really interesting - not boring."
"Made all this creative stuff – did art- loads more art."
"It just didn't feel like work!"
"School work is boring. we don't normally do things like that, no".
"Fun, educational, interesting, can do all different stuff and you learn more."

Was there anything you didn't like about the Leonardo Effect?
20 issues were raised and the following responses are typical.

"Yes, I did not like that we had to finish the project."
"It was good when we started, now we're not doing it it's not good."
"Felt sick on the buses."
"Some people took credit for things they hadn't done."
"I fell when we went to the park."
"The one thing I didn't like was when we had to bring our sketch pads with us when we were watching the DVD and Mr. X would sometimes ask us questions to see if we were paying attention. So you had to listen very carefully but it wasn't too bad 'cos' the stuff was interesting."
"..Couldn't get toy, my teacher gave me money and I had to give her back £1."

Can you think of other subjects you would like to learn about in the Leonardo way?

48 different topics were suggested, with animals of all kinds being the most popular.

"Spiders n all 'cos I want to learn about them."
"Hedgehogs – nocturnal things – I don't know what they really do in the night."
"I would like it to be about Computers, because I haven't learnt what is inside them and how to build them and how to start a document and games."
"Human Body – get to learn what's inside you."
"Art and Maths together"
"Dogs - there's many types of species and dogs are my favourite thing."
"Zebras, Dinosaurs, Planets. Mammals, War, Underwater, Jungle, Nature – plants, trees."
"Making remote control cars."
"How to make sweets."
"Animals – zoo, farm, pets, fish, go fishing."

Conclusion
We envisaged that given the opportunity for children to identify elements of the Leonardo Effect which they did not like, literacy would be mentioned and frequently. On the contrary, literacy was not mentioned once.

When children were asked for suggestions of topics they would be interested in learning about in the Leonardo way, their innate curiosity for how things work becomes very apparent, e.g. *"hedgehogs – nocturnal things – I don't know what they really do in the night."* This corroborates the methodology for the Leonardo Effect, which advocates capitalising on children's innate curiosity, feeding it with gathering information from first hand experience as Leonardo da Vinci did his own, then ideas and learning flow. As one child put it, the Leonardo Effect is *"very educationey."* Not a single child indicated that they would prefer to return to their usual style of learning experience.

Results of Post-Primary Mini Pilot

Introduction

The second and smaller part of the Leonardo Effect research was to carry out an initial exploration of how this approach could be applied with pupils in a Key Stage III environment. One school was approached and kindly agreed to take part. We had access to their entire cohort of 11 – 12 yr old (year 8) pupils.

In addition to what was carried out in primary schools, co-teaching between art and science staff was required. Only the Heads of Department for art and science with the principal were able to attend the training days prior to the start of the project. For the research team this was a matter of concern. The Heads of Department therefore led their respective staff in the delivery of the approach. For managerial reasons the project was geographically based and delivered in the art rooms.

Evaluation of the Leonardo Effect was carried out through the use of questionnaires for the principal, teachers and parents. Focus group interviews were conducted with pupils.

Teachers' Responses

The post-primary teachers' questionnaires differed somewhat from those used in the primary phase. The major topics covered were, Planning, Use of Joint Learning Outcomes, Teaching, Team Teaching, Learning, Transferable skills, Assessment and Literacy. The questionnaire is given in Appendix 1.

Teachers' comments were again classed as positive, negative or issues, and the overall pattern of responses is given in Fig. 4.

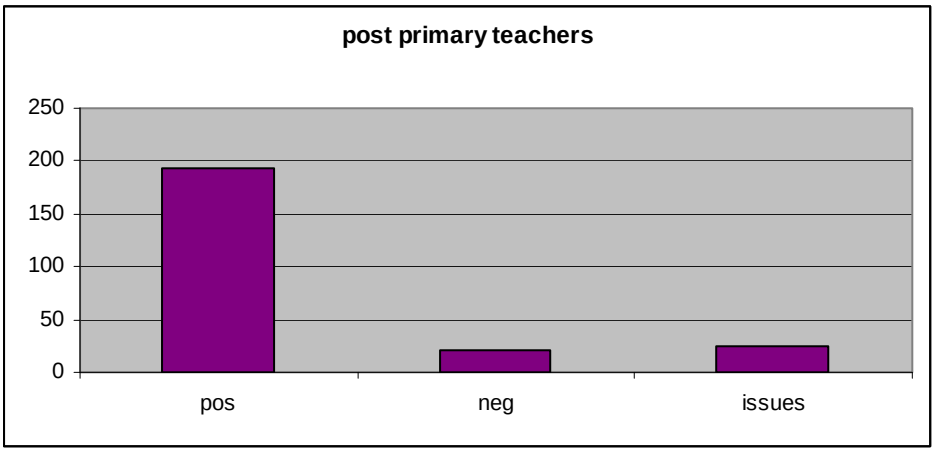

Fig. 4. Responses of post-primary teachers to questionnaire. Number of respondents =7 (88%).

The pattern of responses differs from those obtained from primary teachers. Even allowing for the smaller sample size it is clear that, although there are again a very

high number of positive responses, this group of teachers have found more problems and issues in implementing the programme.

To seek an explanation for the differences certain individual areas of the questionnaire will be looked at in detail.

Planning

positive	negative	issues
15	3	5

Teachers were totally positive in regards to how children's interests influenced the focus of the project; but gave a variety of responses when asked to comment on the open-ended approach to planning. Comments are given below.

Pos. "I *liked the open ended approach to planning."*
Pos. "*It provided the means by which imagination and creativity could be supported."*
Neg. *"I personally do NOT like anything that is deemed to be 'open ended'….the two phrases of 'open ended' and 'planning' are at two different poles."*
Issue. *"I think it would help art but it is more challenging if you wanted certain science concepts covered in time."*
Issue. *"Time restraints meant that eventually more direction and guidance was needed."*

Interestingly one teacher stated that it was *"A completely new aspect for me and the pupils I teach."*

There were several examples, as in primary, of teachers taking time to adapt to this approach e.g. *"At first I found it difficult to find out what my role was, later I got more involved and enjoyed it."*

In general, planning aspects of the Leonardo Effect were well received. Some of the difficulties encountered mirror those experienced in the primary schools, but others relate to the curricular demands of the two subjects, and time available for consulting with colleagues.

Joint Learning Outcomes

positive	negative	issues
9	1	1

Several teachers were positive about the application of these within the post –primary environment, but it was clear that commonalities between subjects, was something which had not been considered before eg. *"I had never thought of these before."* Comments regarding JLOs included:

Pos. "*Quite feasible*."
Pos. *"Experimentation, gathering information etc are common to art and science and many other areas of the curriculum."*
Pos. *"To a large extent."*
Neg. *"I was not involved in the preparation of the joint learning outcomes."*

Issue. *"Within Science, these JLOs are not well used. There is too much pressure on time and the need to get pupils to learn science."*

Teaching

positive	negative	issues
17	2	10

This section raised a large number of varied comments, and reflects the fact that teachers faced many challenges. Comments in response to the question, **"How were you challenged to teach more creatively?"** are particularly interesting:

Issue. *"You are so conditioned to following a very prescriptive scheme of work."*
Issue. *"We find it hard when our Year 11s and 12s diversify into personal projects – simply to get around them all in a class."*
Issue. *"It was difficult because the work being carried out was so wide and varied."*
Pos. *"The direction of the work was more influenced by the student."*
Pos. *"I had to take a step back, offer suggestions rather than be prescriptive – sometimes it worked, sometimes it didn't."*

Responses to the question **"How did the delivery of the project affect your teaching methods?"** seems to **i**ndicate that the Leonardo Effect model utilises different teaching strategies from those in place in post-primary.

Pos. *"From very structured science lessons I see the value of group discussion and individual work."*
Pos. *"I found that I was using totally different methods than I use in science."*
Pos. *"Open ended approach."*
Pos. *"More one to one discussion than normally possible."*
Pos. *"You were not restricted to constraints of syllabus."*
Neg. "*Honestly I don't think it really did."*

Other responses indicate that teachers found the Leonardo Effect thought provoking. As one science teacher reported, *"The project was so different in its day to day operation compared to normal science lessons and homework. Because pupils were able to follow their own interests, they did."*
"I still prefer teaching my own subject and find it more enjoyable."
"This type of 'discovery' learning can be too open ended and unless the targets were set nationally a lot of pupils would miss out on certain skills and knowledge and concepts."

Teachers were very positive in their support for team teaching and its benefits for pupil learning. As one art teacher reported *"It was extremely beneficial to have the 'scientific' explanations for various questions that were asked."* This fits with the conclusions of several current publications in the field.

Learning

positive	negative	issues
37	4	5

Teachers were very positive in this area, particularly to the question**, "How did the processes that pupils were involved in enhance learning?** Here all answers were

positive. In reply to the question "**Did pupils' responses to the Leonardo Effect project differ from their usual response to the learning of art/science?"** there was a mixed response:
Pos. *"They seemed to be more enthusiastic about this project."*
Pos. *"Many of the pupils needed little encouragement to do independent research. They did not perceive it as doing homework."*
Issue. *"Hard to say since year 8 pupils are usually always enthusiastic anyway."*
Neg. *"No in my experience as an art teacher."*

In response to the question**, "How did children of below average ability benefit from the project?"** opinions were again divided, although most found that these children benefited from the approach. Care however should be taken with interpretation due to the small sample size, as this may simply reflect differences between classes in this small sample.
Pos. *"They learned to put across their ideas better."*
Pos. *"They gained a sense of achievement, increased confidence and a pride in their work."*
Pos. *"They were not disadvantaged the way they may be in other subjects."*
Neg. *"I don't think generally speaking that they benefited at all."*

Transferable Skills

positive	negative	issues
33	0	2

In this area teachers were almost unanimous in the opinion that The Leonardo Effect aided the development of transferable skills. This was particularly marked in the area of interpersonal skills, which would reflect the increased group work.

Sample comments are grouped by skill sets.

Intellectual Skills
Pos. *Intellectual Skills "Some excellent ideas and problem solving."*
Issue. *Intellectual Skills "Within group work – some successful, some not so successful."*

Communication Skills
Pos. *"All of these skills were developed and could be used in other areas."*
Pos. *"Enthusiastic discussions."*

ICT
Pos. *"The children mainly used the computer for individual research at home. This could be useful for all other subjects."*
Pos. *"Digital cameras gave quick feedback on events like the bird visit."*
Issue. *"Word processing by pupils. No others – but it would have been possible with more time – pupils could do this."*

Interpersonal Skills
Pos. *"Great opportunities compared to normal."*

Pos. *"I feel this is the skill that the children developed the most. This will be useful for all subjects. It will help with coursework in later years."*
Pos. *"Working as a team to build the creation, delegation within the group, perseverance – all very valuable skills for practical work in science."*

Literacy

positive	negative	issues
10	0	1

Even though art and science teachers do not have primary responsibility for literacy development, they acknowledge benefits for pupils' literacy development through the Leonardo Effect, albeit to a lesser extent than in primary. Representative quotes included:

Pos. *"Yes, a lot more reading took place, a lot more research and finding out took place and certainly a lot more writing took place."*
Pos. *"They enjoyed reading through the reference books, improving literacy skills."*
Issues. *"In terms of research - yes - but this could have been developed further."*

Reflection
Here teachers were asked to identify what were their greatest challenges during the project. Responses included:

"Being required to be a lot more creative."
"Working with the lower ability children who couldn't seem to do anything themselves or think in the right direction."
"Learning my role in the art room."
"Providing enough ideas."

Would you be confident to apply this approach to other topics?

Positive	Negative	Issues
6	1	4

This received a very mixed response from teachers.

Pos*. "The approach is sound and I think it could be applied to other topics."*
Pos. *"I think other topics could be examined- eg the way in which living organisms are adapted to a particular environment/ feeding relationships/ camouflage etc."*
Neg. *"I feel that it would work better within the primary sector, where true integration with a range of subjects could take place."*
Issue. *"An adequate period of time given to planning and execution of the project."*

Conclusion
In several areas e.g. skills, development, literacy and use of JLOs, teachers gave strong support to the Leonardo Effect approach. They were more divided on planning and teaching. From their comments we can infer that they face some challenges in adapting to teaching across both subjects. This is hardy surprising considering their background of subject specialism. However, it is also abundantly clear that they recognise substantive benefits for children taught in this way. One comment typifies

this situation, *"A very interesting new approach linking two subjects that I didn't think would be possible."*

We acknowledge that the training given to this group of teachers was not as extensive as that given to primary teachers due to the fact that only departmental heads were able to attend full training. This is a difficulty for term-time training in large schools. Teachers also felt that they needed longer preparation time. Despite these caveats, we are heartened by the teachers general responses

"We are so used to expecting science knowledge to be a churning out of facts. This was a refreshing new approach for me."
"A very interesting new approach linking two subjects that I didn't think would be possible."
"Very challenging in terms of organisation but very motivating for the students."
"It was a good idea to try this out at secondary level with all the constraints of timetables, current subject specific specifications, availability of teaching staff, different ability levels etc etc."

The teachers' opinions from this small scale pilot test indicate that the Leonardo Effect could make a positive contribution to children's learning at Key Stage III; clearly a much larger in-depth study would be required.

Post-Primary Parents' Responses

Parents and guardians were asked to complete a questionnaire that resembled the questionnaire issued to primary parents. A total of 47 replied. The overall pattern of positive, negative and issues responses in Fig.5. show strong support for the Leonardo Effect. This is very similar to the response from primary parents.

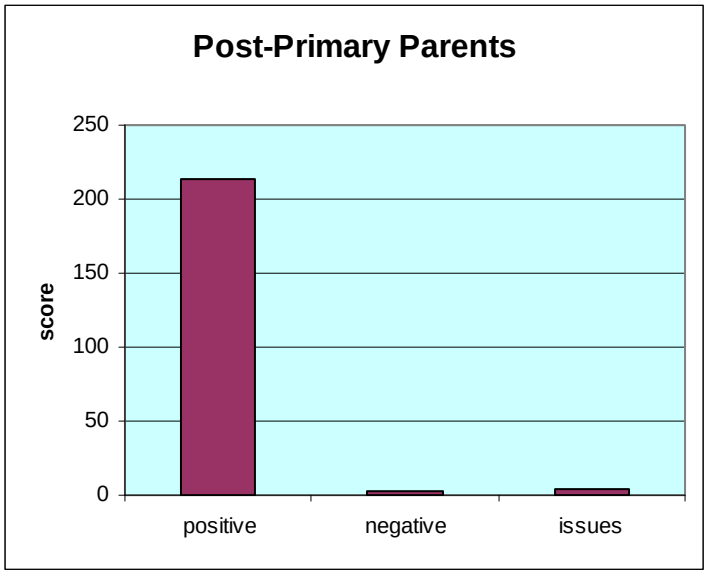

Fig. 5 Responses of post-primary parents
213 positive responses were received and only 3 negatives and 4 issues were raised.

Parents responded as shown below for specific questions such as, "**How would you rate your child's commitment to the project?"**

29	child fully committed to the project
15	child very committed
1	child showed average commitment
1	child showed below average commitment
1	did not answer question

"Did your child's learning surprise you?"

40	positive
4	negative
1	non-committal
2	no response

The accompanying quotes highlight interesting differences in pupils' attitudes:
Pos. *"He looked forward to the sessions. He liked it when there were opportunities for first hand experiences."*
Pos. *"X's eagerness and enthusiasm totally surprised me."*
Pos. *"Yes. Talked about it at home, very interested in what she was doing."*
Pos. *"Yes I noticed eagerness in his approach to the project – always wanting to update us on his progress."*
Neg. *"No. It seemed to have no impact on him. It was very much a school activity with the occasional request for some materials at home."*
Neg. *"No I wasn't surprised because my child shows eagerness in all subjects."*

When asked: "**Would you be supportive of this approach being implemented in children's education?"** Parents were overwhelmingly supportive. Their reasons for this give an important insight into the way in which parents consider their children's education.

Pos. *"This approach to learning marries the creative with the academics and the fundamentals of science – it offers the children a new up to date approach to learning."*
Pos. *"Yes because I found X very interested in this and willing to do it independently."*
Pos. *"Yes. We left school having learned the theory without practice. Working life had to start with practice."*
Pos. *"The attention span seemed to be a lot longer."*
Pos. *"This approach arouses interest and passes some of the control of learning to the pupil."*
Pos. *"Yes. People learn in different ways and my son learned a lot from the project."*
Pos. *"Very much so, as I feel this will let the child understand they must find other ways to find answers other than asking."*

Conclusion

It is clear that the Leonardo Effect was welcomed by parents. This may well be closely correlated with the attitudes of the children themselves, to this way of learning. These are discussed in the following section.

Pupils' Responses

Six children from each class were interviewed, therefore all classes were represented. It was clear that all classes, whatever their academic standard, had greatly enjoyed the Leonardo Effect. We include a large number of their comments to three of the questions asked, to give a true flavour of how they perceived the project.

"Was participating in the project more enjoyable than your normal lessons?"

positive	negative	issues
52	0	1

Pos. *"Yes – very sure of that."*
Pos. *"You would never think you would get interesting things from books. Like this killer duck I found out about. It wasn't set work."*
Pos. *"Got to give opinion more and normally can't do that, don't get chance."*
Pos. *"Art and science at same time is tricky – had to investigate and look up stuff- no restrictions."*
Pos. *"I didn't really like art or science, now I'm thinking that I do."*
Pos. *"The project is one of the most interesting things I've done."*
Pos. *"Art and Science classes since the project are not as good."*
Pos. *"Got a chance to make own decisions about what to do."*
Pos. *"Got to do what you wanted, not just what the teacher wanted, like in other subjects."*
Pos. *"It's challenging, like at the end of this you have to make something that flies."*
Pos. *"I liked the homeworks. Much better than your normal homeworks."*
Issue. *"I don't like art."*

"What do you feel are the advantages of learning in this way?"

positive	negative	issues
20	0	0

Pos. *"I think you learn more – makes everything more fun."*
Pos. *"They (art and science) complement each other – one helps the other."*
Pos. *"More time because learning two subjects."*
Pos. *"Never thought the two would go together."*
Pos. *"Better to join them altogether – easier."*
Pos. *"Makes science interesting."*
Pos. *"It's more interesting because art's boring.*

"Would you recommend the project to schools that have not taken part?"

positive	negative	issues
34	0	1

Pos. "*Definitely, it helped me to learn, stays with you. I remember all the things I learned."*
Pos. *"Still in my head."*
Pos. *"Yes, it's class, fun, interesting."*
Pos. *"Would recommend it."*
Pos. *"All lessons are not like that (Leonardo Effect). You can know the stuff already and they (teachers) still tell you it."*

"*Get to learn new stuff."*
Pos."*Yes, the majority of it was very good, very interesting, learned a lot."*
Issue *"Didn't like doing everything eg. having to write what happened – we already knew and the teachers knew, no purpose."*

Conclusion

It is clear that the children who undertook the project thoroughly enjoyed the experience. While the major task of education is not to make children enjoy school it certainly helps their learning and development if they find their time in the classroom enjoyable.

Acknowledgements
We gratefully acknowledge the financial support of the National Endowment for Science, Technology and the Arts (NESTA) in the running of this project and the assistance we have been given by principals and teachers in very many schools.

Appendix 1

TEACHERS' QUESTIONNAIRE (Primary)

1. Planning

Please comment freely on your planning processes for the project including: pupil involvement; school involvement; influence of the project on other curricular areas.
How did you find the open ended approach to planning?
Would you have integrated art and science before? Please explain.

2. Joint Learning Outcomes

Did your awareness of the commonalities between art and science make it easier to construct joint learning outcomes, for example, investigation, gathering information, experimentation, imagination?
To what extent were joint learning outcomes feasible?
Were there any materials which helped in the preparation of joint learning outcomes? Please explain.
Please provide three examples of joint learning outcomes you used in your lessons.

3. Teaching

How were you challenged to teach more creatively?
How did the delivery of the project affect your teaching methods?
If this new approach was fully supported by curriculum bodies for the long-term would you be willing to apply it to topics other than flight? Please explain.

4. Learning

Identify examples of the most valuable learning experiences for the children?
How did the processes pupils were involved in enhance learning?
(Eg Experimenting with ideas, evaluating their designs, gathering information)
Did pupils' responses to the Leonardo Effect project differ from their usual response to the learning of science?
How did the children's achievement in Science compare with what you would normally expect?
How did the children's achievement in Art compare with what you would normally expect?
Did pupils' involvement in art through the Leonardo effect project differ from their usual experience of the subject? Please provide examples.
How did children of below average ability benefit from the project?
What did the most able pupils gain from the teaching approach?
Did the children's learning surprise you? If so give examples.

5. Transferable Skills

Consider the opportunities for developing transferable skills. Please explain with examples.
Intellectual Skills (including critical and creative thinking skills, problem solving and decision making).
Communication Skills (including visual, oral and written communication)

Information and Communication Technology Skills (such as use of computer, digital camera, digital blue).

Interpersonal Skills (improving own learning and performance, working with others).

6. Assessment

To what extent can you assess pupils' knowledge of art and science by observing the processes and the products from the synchronised art and science lessons? Please give examples.

Do you feel you can assess children using joint learning outcomes?

Did the project allow for greater visual, aural, kinaesthetic experiences than the traditional approach to art and science teaching?

Would you say that the project resulted in greater pupil engagement and application?

In what ways do the imaginary flying creatures/machines reflect children's knowledge gained during the project?

How were the children's observational drawings informed by their science knowledge?

7. Literacy

Did the project provide opportunities for the development of children's literacy skills? Please provide details.

Did you utilise any opportunities to have specific literacy tasks during the project? Please provide examples.

How motivated were the children in approaching literacy type activities during the project compared to their usual commitment during literacy?

Did you observe higher order literacy skills throughout the project such as critical thinking and problem solving?

Did you observe the children employing a range of literacy skills throughout the project and also the development of these skills?

Was there evidence of children taking specific literacy roles, for example, scribe or reporter during group work in the project? Please provide examples.

Were you able to assess the children's literacy skills developed through the project?

8. Resources

Which resources did you find most valuable in the delivery of the programme?

Did you use any helpful resources, which were not supplied by St. Mary's?

Were you provided with any resources, which were not useful?

9. Extension

Please describe the nature of your extension activity.

The extension activity was intended to provide opportunities for children to make further connections and apply their knowledge acquired in stages 1, 2 and 3 of the project. To what extent was this goal achieved?

What were the educational gains from participation in the extension activity?

Can you suggest any other types of extension activities?

10. Reflection

What were the most rewarding aspects of the project for you as a teacher?

What were the greatest challenges for you?

What difficulties did you experience implementing the project?
Did you observe a difference in children's attitudes to art and science during the Leonardo Effect Project?
Is there a lasting legacy of the project for you/the children/the school?
If the Leonardo Effect was to be implemented nationally, what difficulties would you foresee?

11. Finally

How would you explain the synchronised integrated approach to teaching and learning to a teacher who did not have experience of the Leonardo Effect?
Did this approach make your teaching more enjoyable? Please explain.
What is the Leonardo Effect?

PRINCIPALS' QUESTIONNAIRE (Primary)

1. Planning

The project required a more flexible and creative approach to planning.
What do you see as the advantages/ disadvantages of this?

2. Joint Learning Outcomes/Intentions

Did you find the BERA* paper useful in explaining the commonalities shared by art and science and highlighting a way forward for subject integration at curricular level?
*BERA Paper - Flights of Imagination: Synchronised Integration of Art and Science in the Curriculum. Presented at BERA (British Education Research Association) September 2005. This was circulated.
Teachers found the use of joint learning outcomes for art and science to be an effective means of subject integration (in keeping with revised curricula nationwide.)
Would you be happy for your staff to adopt the use of joint learning outcomes where appropriate?

3. Teaching

Did you observe whether the delivery of the project affecting teaching methods in a positive manner? Eg Creative
If this new approach was fully supported by curriculum bodies for the long-term would you be supportive of your school applying it to topics other than flight? Please explain.

4. Learning

How satisfied were you with the level of learning achieved by the most able children?
How satisfied were you with the level of learning achieved by the least able children?

5. Skills

How satisfied were you with the extent to which skills were developed through the project?

6. Literacy

Literacy was not the main focus of the project yet teachers reported that it provided many opportunities for the development of children's literacy skills?

7. Response from Parents

Parent questionnaires have indicated a very positive response to The Leonardo Effect. Would parents normally be so positive about an approach to their children's learning?

8. Reflection

What were the educational benefits for your school?
Is there a lasting legacy of the project for in your school?
If the Leonardo Effect approach was to be adopted nationally, how would you feel about this?
What difficulties would you foresee?

TEACHERS' QUESTIONNAIRE (Post Primary)

1. Planning

The project required a more flexible and creative approach to planning. Please comment on each of the following:

a. How the children's interests influenced the focus of the project.
b. The open ended approach to planning.
c. The integration of the two subjects.

2. Joint Learning Outcomes

To what extent were joint learning outcomes feasible?
Did your awareness of the commonalities between art and science (as outlined in your copy of the BERA paper*) make it easier to construct joint learning outcomes, for example, investigation, gathering information, experimentation, imagination?
Which materials helped in the preparation of joint learning outcomes? (For example, the Programmes of Study.) Please explain.
Please provide three examples of joint learning outcomes you used in your lessons.

3. Teaching

How were you challenged to teach more creatively?
How did the delivery of the project affect your teaching methods?
If this new approach was fully supported by curriculum bodies for the long-term would you be confident to now apply it to topics other than flight? Please explain.

4. Team Teaching

Had you any experience of team teaching prior to your involvement in the Leonardo Effect project?
What were the benefits for children's learning?
How did you, as a professional, benefit from team teaching?
If you had the opportunity, would you like to team teach again? Please explain.

5. Learning

Identify examples of the most valuable learning experiences for the children.
How did the processes that pupils were involved in enhance learning?
(Eg Experimenting with ideas, evaluating their designs, gathering information)
Did pupils' responses to the Leonardo Effect project differ from their usual response to the learning of science/art?
How did the children's achievement in science/art compare with what you would normally expect?
How did children of below average ability benefit from the project?
What did the most able pupils gain from the teaching approach?
Did the children's learning surprise you? If so give examples.

6. Transferable Skills

Consider the opportunities for developing transferable skills. Please explain with examples for each of the following.
Intellectual Skills (including critical and creative thinking skills, problem solving and decision making)
Communication Skills (including visual, oral and written communication)

Information and Communication Technology Skills (such as use of computer, digital camera, Digital Blue)

Interpersonal Skills (improving own learning and performance, working with others.

7. Assessment

To what extent can you assess pupils' knowledge of art and science by observing the processes and the products from the synchronised art and science lessons? Please give examples.
Do you feel you can assess children using joint learning outcomes?
Did the project allow for greater visual, aural, kinaesthetic experiences than the traditional approach to art/science teaching?
Would you say that the project resulted in greater pupil engagement and application?
In what ways do the imaginary flying creatures/machines reflect children's knowledge gained during the project?
How were the children's observational drawings informed by their science knowledge?

8. Literacy

Did the project provide opportunities for the development of children's literacy skills? Please provide details.

Did you observe the children employing a range of literacy skills throughout the project and also the development of these skills?

Was there evidence of children taking specific literacy roles, for example, scribe or reporter during group work in the project? Please provide examples.

9. Resources

Which resources did you find most valuable in the delivery of the programme?

Did you use any helpful resources, which were not supplied by St. Mary's?

Were you provided with any resources, which were of no use?

10. Reflection

What were the most rewarding aspects of the project for you as a teacher?

What were the greatest challenges for you?

What difficulties did you experience implementing the project in a Key Stage Three environment?

Did you observe a difference in children's attitudes to art and science during the Leonardo Effect Project?

Is there a lasting legacy of the project for you/ the children/ the school?

If the Leonardo Effect was to be implemented nationally, what difficulties would you foresee?

11. Finally

How would you explain the synchronised integrated approach to teaching and learning to a teacher who did not have experience of the Leonardo Effect?

Did this approach make your teaching more enjoyable? Please explain.

How would you describe the Leonardo Effect?

PRINCIPALS' QUESTIONNAIRE (Post Primary)

1. Timetabling

Curricular bodies across the British Isles are advocating flexible timetabling at KS3.

What challenges did flexible timetabling present for your school during the Leonardo Effect project?

For the benefit of other schools facing the challenge of flexible timetabling, can you suggest how this might be addressed?

2. Team teaching

Curricular bodies across the British Isles are advocating team teaching where appropriate at KS3. What challenges *(beyond timetabling)* did this present for your school during the Leonardo Effect project?

For the benefit of other schools facing the challenge of team teaching, can you suggest how this might be addressed?

3. Planning

The project required a more flexible and creative approach to planning. This involved an openness to following the interests of children.

During the Leonardo Effect, how did your teachers respond to this?

What do you see as the advantages/disadvantages of this for your school?

As principal, how would you feel if your staff following less concrete schemes of work?

4. Joint Learning Outcomes/Intentions

Did you find the BERA* paper useful in appreciating the commonalities shared by art and science and highlighting a way forward for subject integration at curricular level?

*BERA Paper - Flights of Imagination: Synchronised Integration of Art and Science in the Curriculum. Presented at BERA (British Education Research Association) September 2005. This was circulated.

Teachers found the use of joint learning outcomes for art and science to be an effective means of subject integration (in keeping with revised curricula). Would you be happy for your staff to adopt the use of joint learning outcomes where appropriate?

5. Teaching

Did you think that the delivery of the project affected teaching methods in a positive manner?

If this new approach was fully supported at KS3 by curriculum bodies for the long-term would you be supportive of:

- your school applying it to art and science topics where relevant? Please explain.
- Your school applying it to other disciplines such as music and science, where relevant?

Do you believe teachers' responses to the Leonardo Effect were influenced by any of the following: *Please Circle*

* Examinations Least influenced 1 2 3 4 5 Most
* Work Load Least influenced 1 2 3 4 5 Most
* Inexperience of team teaching Least influenced 1 2 3 4 5 Most
* Resistance to change of practice Least influenced 1 2 3 4 5 Most *
Other *(please state)* Least influenced 1 2 3 4 5 Most

How could teachers' commitment to the approach have been improved?

6. Learning

How satisfied were you with the level of learning achieved by the most able children?

How satisfied were you with the level of learning achieved by the least able children?

7. Skills

How satisfied were you with the extent to which pupils' transferable skills were developed through the project?

8. Literacy

Literacy was not the main focus of the project yet we have found that that it provided opportunities for the development of children's literacy skills?

9. Reflection

Were there any additional benefits for your school?

Is there a lasting legacy of the project for in your school?

If the Leonardo Effect approach was to be adopted nationally, what difficulties would you foresee?

If the Leonardo Effect approach was to be adopted nationally, what advantages would you foresee?

Focus Group Questions (Primary)

1. What did you like about the project?
2. Was the Flight project more enjoyable than your normal lessons? Explain/give reasons for your answer.
3. How was the project different to your normal lessons?
4. Do you think you learnt a lot during the Project? Give an example of something you learnt. (probe re Science and Art)
5. What was your favourite part of the Project? Why was it your favourite part?
6. Was there anything you didn't like about the Project? Explain.
7. How would you describe the Project to someone who has not taken part in it?
8. Would you recommend the Project? Explain.
9. If you did another Project like this what would you like it to be about. Why?

Focus Group Questions (Post Primary)

1. How would you describe the project to someone who has not taken part in it?
2. Was participating in the project more enjoyable than your normal lessons? Explain.
3. How did it differ from your normal lessons?
4. What are your views about learning Art and Science together as one? (Do you think it is a good idea?)
5. What do you feel are the advantages of learning in this way?
6. What do you feel are the disadvantages of learning in this way?
7. What was your favourite part of the project? Explain.
8. Do you think you learnt a lot during the project? Give an example.
9. Was there anything you didn't like about the project? Explain.
10. Would you recommend the project to schools that have not taken part?
11. If you were to do another project like this, what would you like it to be about?

PARENTS'/GUARDIANS' QUESTIONNAIRE (Primary and Post Primary)

1. How would you rate your child's commitment to the project?
Not Committed 1 2 3 4 5 Fully Committed
Please circle and comment further if desired.

2. Art and science were given equal weighting and taught simultaneously within lessons for the Leonardo Effect project. Do you have any views on this?

3. Did your child's approach to learning surprise you in any way during the project? E.g. Re-call of facts, eagerness to learn. Please comment.

4. What were the most valuable aspects of the project for your child?

5. Pupils worked like Leonardo Da Vinci – with first hand experiences, following their interests, working independently, developing ideas and creating. Would you be supportive of this approach being implemented in children's education? Please explain.

6. Did the project impact on you as a family? If so please explain.

7. Do you think this project will have any long term effect on your child?