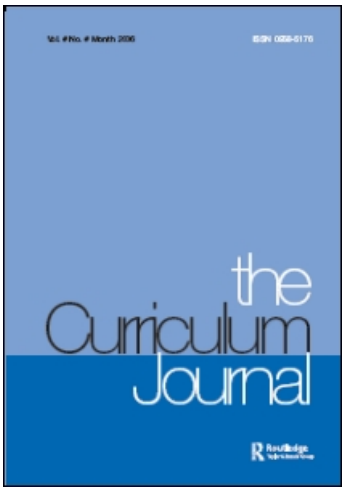

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From rhetoric to reality: advancing literacy by cross-curricular means

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From rhetoric to reality: advancing literacy by cross-curricular means

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Cross-curricularity, literacy and critical literacy are currently promoted as components of a curriculum appropriate for the twenty-first century. The first two, in particular, are prescribed elements of classroom experience in Northern Ireland, which is the immediate context of this article, but also more widely in the UK. Teachers are implementing cross-curricular and interdisciplinary initiatives, but rhetorical imperatives can translate into superficial realities. The reasons for this are explored, as are the reasons why interdisciplinary studies, literacy across the curriculum and critical literacy are deemed to be of significance for education at the present time. The 'Making Science: Making News' project is described, in which Key Stage 3 science and English classes worked together, with input from a research scientist and a journalist, to produce articles on space science which were published in local newspapers. The outcomes of the project are discussed from the perspectives of both teachers and learners. It is argued that this project is an example of genuine interdisciplinary activity; that it went beyond literacy skills to a deeper development of scientific discourse; and that, through its media connection, there was potential for building an ongoing awareness in pupils of critical literacy and scientific literacy.

Keywords: critical literacy; cross-curricularity; literacy; newspapers; science; scientific literacy

Introduction

Curriculum development is always situated within, and influenced by, a wider context. In Northern Ireland, as in the rest of the UK, some major emphases have characterised that context in recent times. There has been an ongoing programme to raise literacy standards, with literacy expected to be promoted, not merely in English classes, but right across the curriculum. Furthermore, a Revised Key Stage 3 Curriculum is being phased in over the period 2006–10. This places a strong emphasis on cross-curricular links and calls for interdisciplinary cooperation among teachers. Although Northern Ireland's educational establishment has developed its own way of pursuing these goals, a focus on literacy and on cross-curricularity is commonly encountered in contemporary approaches to the curriculum, the argument being that these are necessary features of an educational agenda which is appropriate for the twenty-first century. More widely still, there is an interest in critical literacy and in scientific literacy, again on the grounds that these are essential in an information-saturated society, dominated by media which are influenced by spin, propaganda and hype. This article discusses a project recently conducted in a number

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of Northern Ireland schools – 'Making Science: Making News' – and reflects on the issues of literacy, cross-curricularity and critical literacy in the light of the project's outcomes and evaluation.

Literacy

The demand that every teacher should be a teacher of English was first made as long ago as the Newbolt Report (Board of Education 1921). It was renewed in the Bullock Report (DES 1975), which devoted a chapter (chapter 12) to arguing the case for 'language across the curriculum'. Over the following ten years schools, to varying degrees, sought to implement this in the classroom (Marland 1977). With the advent of the National Curriculum, the practice if not the idea was all but lost as teachers became absorbed in applying the programmes of study for their individual subjects. However, the National Literacy Strategy explicitly restored 'literacy across the curriculum' as a primary concern of schools at all key stages (QCA 2000, 2001). In Northern Ireland the literacy programme required all schools to draw up a literacy policy and appoint a literacy coordinator (DENI 1998). This has undoubtedly had a positive impact as schools have developed coherent and consistent approaches to literacy across subject departments. There has, however, been an understandable tendency to concentrate on those aspects of literacy which can readily be handled by non-literacy specialists. Thus, for example, in the science classroom attention gets paid to lexical matters such as scientific terminology, or writing frames may be devised to teach the stylistic conventions for reporting experiments and investigations. This is worthwhile and supportive of pupil learning in the subject; many subject specialists are taking seriously their responsibility to incorporate literacy into their subject teaching. It may nevertheless be superficial; what would be genuinely empowering for pupils is also time-consuming and challenging for teachers, namely, inducting pupils more deeply into the discourse of their subject. In science this would be less likely to be accomplished by taking notes and filling in worksheets than by extended writing, by engaging in structured oral activities, or by reading for meaning and understanding from texts other than textbooks. This involves a move from functional language use and practising skills to cognitive development within a subject through internalising appropriate language practices at a deeper level.

Interdisciplinary teaching and learning

The new Revised Curriculum for Northern Ireland is strongly committed to cross-curricularity (CCEA 2003). To some extent this simply carries forward into secondary schools the kind of teaching possible in primary classes where one teacher teaches a number of subjects. Compartmentalisation of subjects is perceived as undesirable and greater integration across disciplines is now favoured. This was realised under the National Curriculum by cross-curricular themes; pupils following the Northern Ireland Curriculum were expected to encounter themes such as economic awareness, education for mutual understanding, health education and cultural heritage as they studied the various subjects on their timetable (NICC 1989). All too often this could mean paying lip-service to the themes and making token gestures in their direction, with the substance of subject teaching remaining unaffected. The emergence of the skills agenda in the 1990s switched attention to generic skills which feature in learning across all subjects. The Revised Northern Ireland Curriculum characterises itself as a skills-based curriculum and the kinds of skills around which it is organised and which are applied in all subject areas

include critical and creative thinking skills (managing information; creativity; problem-solving/decision-making) and personal and interpersonal skills (self-management; working with others) (CCEA 2003). At Key Stage 3, schools will be required to offer 'thematic learning', that is, identify suitable topics and then develop a programme of study to which different disciplines will contribute. Schools are consequently interested at the present time in collaborative work between subject departments; whether this will deliver on the expectations that learning will thereby be made more relevant and interesting remains to be seen. The same problem may arise as with literacy across the curriculum: how to go beyond skills development to engage in disciplinary understanding at a deeper level.

Critical literacy

The current literacy agendas in the UK and to a lesser extent in Northern Ireland have concentrated on specifying what should be taught and on producing lesson plans and resources. A consequence of this has been that there is limited engagement with principles and practice deriving from 'critical literacy', even though this is an approach that has international currency and is considered particularly relevant in the prevailing print culture. Originating from the ideas of Paulo Freire (Freire and Macedo 1987), at school level critical literacy means encouraging young people to question texts and to recognise that words can be loaded and that language can express power relations. Pupils should be enabled to increase their proficiency in the interrelated dimensions of language use described in the 'four resources model of literacy'. This was developed in the 1990s in Australia by Peter Freebody and Allan Luke. They identify the textual resources that students need to access in order to be literate as: code breaker, text participant, text user and text analyst (Freebody and Luke 1990):

- Code breaker (How do I crack this code?)
- Text participant (What does this mean to me?)
- Text user (What do I do with this text?)
- Text analyst (What does this text do to me?)

Freebody and Luke argue that students need to orchestrate and combine all of these textual resources in order to lead literate lives in the twenty-first century and to become more aware of the ways in which texts are constructed to convey particular ideas and to influence people.

A related concept is that of 'scientific literacy'. It is argued (Tyler, Duggan and Gott 2001) that pupils need to have a critical understanding of the nature of scientific evidence and a grasp of the way that wider issues influence debates about science and the value that is placed on formal scientific evidence. Pupils should actively engage with topical science-based issues so that they will feel more confident to access the relevant information and participate in discussion on science-related controversies. If we believe in a democratic society, it is desirable for all citizens to be both equipped and empowered to take an active role in science-based issues, and so education needs to consider seriously how these aspects of science can be incorporated into the curriculum. Science-literate people are those who do some basic evaluation of sources of information, understand enough about the process of science to believe that it is useful, apply that understanding to the news stories they read and hear, and can then interpret and place the information they receive into a context that is meaningful and useful for their own lives (Pingree, Hawkins and Renee 2000). As with

critical literacy, scientific literacy is important because of the nature of today's society where, for example, health information can be accessed on the world wide web or where consumers read nutritional information on the products on supermarket shelves.

Despite their importance, however, it requires conscious forethought to incorporate scientific and critical literacies in the traditional curriculum. In an already packed and prescribed curriculum, they are easy casualties. This issue can be considered further, together with those of literacy and cross-curricularity through looking at the 'Making Science: Making News' project.

'Making Science: Making News' project

The 'Making Science: Making News' project, funded by the Particle Physics and Astronomy Council (PPARC) and based at the School of Education, Queen's University Belfast, ran from 2004 to 2006. It was an ambitious, cross-curricular and community-focused initiative. Its aim was to encourage schools to establish partnerships with local newspapers with the intention that their pupils research and write astronomy-related articles for publication. Participating in the project were seven schools ranged geographically across Northern Ireland to permit each of them to link up with a different local newspaper. There were three grammar schools (two all boys and one all girls), three secondary high schools (two mixed and one all boys) and one integrated school (mixed). The pupils, almost 180 in total, were in Year 10, which in Northern Ireland is their third year of post-primary schooling and the final Key Stage 3 year (ages 14–15). The science and English teachers who taught the Year 10 class collaborated to run the project during timetabled lessons.

There was an ideal plan of how it was envisaged that the project would proceed and this was adhered to in its broad outline by the schools, although obviously small variations arose because of local circumstances. The principal involvement of the university researchers was to arrange the links with outside agencies – the visiting scientist, the local newspaper and one of its journalists. Seven leading research scientists from the School of Mathematics and Physics at Queen's University or from Armagh Observatory were linked with the schools. The scientists offered several topics on which they would be prepared to talk to pupils and the science teacher decided which topic they thought was most appropriate in their context. Eventual topics included: the Hubble telescope; the moons of Jupiter; solar winds; potential asteroid impacts; gamma ray bursts. Astronomy-related topics were favourably received by the teachers because, while some knowledge of space science features on the KS3 syllabus, not all science teachers are comfortable with teaching it. The scientist then provided the school with a 'press release', giving a general introduction to the topic, explaining its importance and perhaps citing some websites where further information could be found. This permitted advance preparation for the scientist's visit; this groundwork was done in both science and English classes from their subject perspectives. The pupils studied the press release, discussed the relevant issues and planned questions to ask the scientist. A journalist then visited the class and, to help the pupils get into role, they were issued with attractive 'press passes' and a notebook and pencil. The journalist advised the pupils on how they might make the best use of the press release and assisted them in preparing for the scientist's presentation and question-time – 'press conference' and 'interview'. The journalist also reviewed the major features of newspaper articles – headline, graphics, structure, etc. The journalist's visit was followed by the scientist's visit, giving a short talk on the selected research topic and then answering questions. The challenge then was for the pupils to work together as a news team to find

out more about the topic and to present all that they had learned, through text and graphics, in an attractive, interesting and newsworthy way. This work occupied a number of science and English lessons. The final articles were forwarded to the editor of the local newspaper, who selected from the material received for publication.

When the school phase of the project was complete, the university researchers administered a pupil questionnaire and interviewed all the participating teachers. They also obtained all the articles written by the pupils. In addition to the literal 'hard copy', therefore, there was considerable information on the effectiveness of the project, pupil attitudes to it, and the kinds of learning that resulted from it.

Data from teachers

The English teachers generally oversaw the writing tasks, though some schools encouraged the writing to be completed in both subject classes. However, there was a full contribution from science as regards understanding of the topic, clarification of the content and further research. Teachers reported that pupil response to the writing task was initially positive and motivated, although this depended to some extent on level of ability. Engagement with the writing task seems overall to have been reasonably well sustained. After some falling away of interest, for a number of pupils interest and involvement picked up again. They had to grapple with the need to make the article interesting for the newspaper reader; rather than recording facts, they had to tell a coherent, fact-based story. Getting involved in tackling these issues helped to sustain interest, as did the word processing of the articles and the design of the page. Working in pairs or in groups also helped to maintain engagement with the task, so long as each pupil was producing their individual article. Division of tasks within a group was not found to be effective, as some had to do much more writing than others. The goal of publication was a motivator, and many pupils took pride in their end result.

In general teachers found more interest in the project than they expected, with pupils showing pride in their product. One teacher felt that interest related more to motivation than to ability. The project worked for all levels of ability, although there was some feeling that it suited the more able. One teacher made the interesting comment that while more able pupils might write the best product, less able pupils would benefit most from the process. Some English teachers reported that boys became interested in writing because of the science topic, but the project was generally thought to have worked well for both boys and girls. The majority of pupils became interested in the space science topic and the visit of the scientist made a real impact in relation to learning. Having to write for newspapers stimulated the pupils' interest in science writing, and they enjoyed the writing for the most part. English teachers reported that it had a positive effect on the writing of pupils who would have been regarded as easily bored and turned off by 'writing up'. Seeing their work in print and in the context of 'real journalism' had a stimulating effect on the planning and composition elements of the writing:

> It was written not just because you had to do it but because they did actually enjoy it.

> It gave their self-esteem a real boost.

At the heart of the project was the deployment, in the context of an astronomy topic, of skills of questioning, research, analysis, synthesis and written communication in the distinctive style of a newspaper article. Both science and English teachers felt that the major learning outcomes achieved through the project related to skills development.

In particular they mentioned the development of writing, questioning and listening skills. ICT and research skills were also referred to by some of the participants. It was suggested that the project had allowed the students to experience the transfer of skills between subjects and to see that one subject could become a vehicle for learning about another, with examples reported of students transferring learning from English to science or from science to English.

Most of the teachers reported that there was science learning specific to the topic and that it 'put ideas into real context and reinforced existing knowledge'. Some teachers reported that the project had helped to generate research skills, in particular the use of websites. A few teachers said that the topics needed to be more firmly embedded in the school's science schemes of work if long-term learning was to be achieved. Science teachers reported that it had encouraged pupils to write about science in interesting ways and English teachers reported that it had helped to bring the subject of writing for newspapers to life and made the media an accessible reality. It challenged the pupils not only to think about *what* they would write but *how* and *who for*? Science teachers reported that it encouraged the pupils to read around their chosen topic and thus broaden the context in which science learning took place. One science teacher was so impressed by the learning benefits of the project that he planned in future to set the writing of newspaper articles as assignments. English teachers emphasised the benefits of bringing 'real-life' situations into the classroom, thus stimulating the pupils' thinking about science in applied situations.

Data from pupils

Pupils responded on the learning that they thought they had gained through the project (see Table 1). Additionally, Sixty-six per cent of the pupils said that they found the astronomy topic interesting. Half of them said that they found that listening to the scientist helped them to understand the astronomy topic a lot more, while three-quarters of them felt that they subsequently understood the astronomy topic quite well. There was a range of pupil views on the perceived level of difficulty in understanding the topic (see Table 2). With regard to writing about the topic, pupils' responses were as shown in Table 3. The pupils felt that different parts of the project had contributed to their understanding of astronomy either a lot or a little more, as indicated in Table 4.

What is particularly interesting here is that three-quarters of the pupils stated that writing the article had helped their learning in science.

The pupils drew attention to a number of things that they thought they had learned about writing for a newspaper, including the honest remark that it was 'harder than you

Table 1. Pupil questionnaire responses to what they thought they had gained.

Learning both English and science	67%
Using English to help learn science	25%
Using science to help learn English	5%

Table 2. Pupil views on difficulty in understanding topic.

Quite difficult	31%
Not very difficult	51%
Very easy	12%

Table 3. Pupil views on enjoyment and difficulty in writing about the problem.

	Writing about topic
Enjoyable	19%
Interesting	47%
Dull	23%
Boring	10%
Quite difficult	39%
Not very difficult	53%
Very easy	6%

Table 4. Pupil views on contribution of project to their understanding of astronomy.

Listening to scientist	88%
Studying topic in science class	84%
Writing newspaper article	76%
Talking about article in English class	61%

think'. They mentioned the need to be objective, the importance of the first paragraph, finding a catchy headline and good quotes, being 'brief but accurate', thinking about layout and structure, and about how to make it interesting.

Pupils' comments on what they had learned in science included:

> It is not all experiments. There is a lot of written work involved too.
>
> That English helps! When you actually put your facts and information in an article it helps you remember.
>
> It is interesting and can be fun to write about.

Each of these comments shows how pupils were becoming more interdisciplinary in their thinking, compartmentalising subjects less and recognising how skills associated with one subject could be applied in another.

Aspects of the work that pupils reported that they had particularly enjoyed included carrying out their own research on the internet, interviewing the scientist and reading the final product – 'reading your finished article and seeing you had done a good job'. The things that they said they did not enjoy were the more mechanical aspects such as taking notes during the talk and typing up drafts on the computer.

Literacy learning

While it was always anticipated that there would be useful literacy learning, the wide range of literacy skills which were practised through the project was genuinely unexpected. For example, all the teachers remarked on the enthusiastic and pertinent questioning of the scientists, and pupils stated that this was one aspect of the project which they particularly enjoyed. This development of oral skills was not originally envisaged to be as significant as eventually transpired. The pupils' oral questioning and listening to the scientist's responses were an important contributor to their success in compiling their newspaper article.

The learning outcomes in relation to writing were the most evident results of the project. However, this covered many aspects of writing. It was essential that the topic be

understood, and then it had to be explained clearly and discussed accurately. In addition, the topic had to be made attractive and interesting. The young writers had to consider how to structure their article and then how to present it well. All articles were word processed, many in columns as in a newspaper. Quite a few pupils provided sidebars to their main articles providing supplementary information, for example 'Did you know? ' facts. One or two pupils used a 'fancy', and therefore inappropriate, font. All of the journalists had discussed with the pupils the features of good headlines and there were numerous examples where what they had learned was applied; for example, in the use of rhyme in the headline 'Hubble Trouble' or in the wordplay in headlines relating to the SuperWASP (Wide Angle Search for Planets) camera: 'SuperWASP Keeps Astronomers Buzzing'; 'The Camera with a Sting'; 'There's a Buzz about the WASP'.

It was hoped that pupils might become aware of how images can be constructed to convey messages, but this important aspect of contemporary literacy was less securely understood. In many cases photographs without captions accompanied text. They were decorative elements in the page design rather than functioning as information-givers in their own right. Most pictures were obtained from the world wide web; in one case a pupil found suitable graphics on a German scientific site and made use of one of the internet's online translation services to identify the most fitting one for their article. The use of ICT for research purposes turned out to be a highly positive source of literacy learning. Many pupils said that researching their articles was a part of the task that they had especially enjoyed. It involved a range of reading skills including scanning, comprehension, selection and evaluation of material.

One of the very positive features of the project was that it so obviously entailed writing 'for real purposes'. This is something that can be difficult for English teachers to offer, except in a contrived way. Teachers reported that pupils were motivated to work well by the potential goal of their article appearing in the newspaper. They also enjoyed taking on the persona of an interviewer. There were initial fears that the press pass and notebook that were issued to each pupil might seem childish to young people of their age but this was definitely not the case, instead contributing to a sense that what they were doing was 'the real thing'. It is recognised that, for literacy learning to be effective, it helps if it does not seem too much like doing exercises. The experience of questioning the scientist and listening to the journalist reinforced the way in which literacy is a necessary tool for real-life activities.

The relevant genre of writing was that of a newspaper feature article. In a number of cases there was undue interference from the genre of newspaper writing with which pupils were familiar. Report writing, in the context of newspapers, is commonly taught as consisting of five Ws: who? where? when? what? why? The great majority of pupils had been trained in this type of writing since primary school and had some difficulty combining it with, and adapting to, the more discursive and informational style appropriate for their space science topic. In a few cases the tabloid influence was marked – 'A Belfast-based project is sending shock-waves through the astronomical world' – while one or two of the articles were more personalised than expected in an objective report. The importance of objectivity and accuracy was well learned by pupils:

> Show no favouritism.
>
> I must not be biased.
>
> You have to be clear in what you say.
>
> Keep everything straightforward and concise.

This was where the task became really challenging. A great deal of mental and compositional energy was taken up with ensuring that the writing was clear and accurate. It was asking a lot to demand that the article should additionally be engaging and attractive for a reader. This may have been the reason why one pupil said plaintively that it 'takes a lot of work to write a newspaper article'. Another made the astute observation: 'It is very hard to get the balance between informative and interesting.'

The importance of critical literacy in the literacy curriculum has already been noted. Given the nature of modern society and the pervasiveness and influence of media communications, young people need to have an explicit understanding of how the media operates and to exercise criticality in handling media texts. It is important to learn that news is not simply 'gathered' but that journalists 'construct' news through selecting what story to cover, what information to report, what sources to access, what angle to present and what values to portray. Pupils should also learn about the constraints under which journalists write – constraints of time, space and expertise. Crucially, they may come to understand that what is not said or written may be as important as what is said or written. Since the development of critical literacy skills is a less overt and more long-term aspect of literacy learning, this project did not produce direct evidence that pupils had become able to read science articles in the media with greater discernment and with understanding of how and why the facts might be distorted, though comments by them quoted earlier show that they were aware of the need to avoid bias. What can be asserted, however, is that the process in which the pupils were engaged was an effective means by which they could become aware of the issues that need to be considered when encountering science in the media.

Curricular issues

Although the scientists' presentations were perhaps the pivotal and most memorable part of the project, they were only an incidental part of the research. All schools reported that the scientists were very successful in bringing advanced and complex science to the level of Key Stage 3 pupils. Their enthusiasm in itself was compelling. Some ways in which they helped pupils' understanding were by showing its relevance (the effect of solar winds on mobile phones); relating it to the young people's contemporary world (the fact that the lenses for the SuperWASP camera were bought on eBay); conveying the inherent drama of their subject matter (the potential threat from near-earth objects); and inspiring a sense of wonder (vast distances in space). These are pedagogical ways in to difficult curriculum topics in any subject. Kieran Egan's literacy taxonomy is a detailed schema built up of 'cognitive tools' such as a sense of wonder, or the extremes of experience and the limits of reality (Egan 2005), which can be useful, as can be the *Habits of mind* approach to learning which outlines 16 'intelligent behaviours' which lead to productive learning and which include 'responding with wonderment and awe', 'listening with understanding and empathy' and 'creating, imagining, innovating' (Costa and Kallick 2000).

'Making Science: Making News' was conceived as a cross-curricular venture, the activity being, in essence, a literacy project operating across two subject departments. One teacher contrasted this with her school's more customary approach, in which the literacy coordinator would work with individual departments but one department would not collaborate with another. None of the teachers of science and English involved in 'Making Science: Making News' reported having collaborated on a joint project prior to this initiative. However, four participants, all teachers of English, had previous experience of interdisciplinary working. This occurred in the context of subjects, with art, history,

geography and RE being specified, and in the context of cross-curricular themes, with literacy and citizenship being specified. A further two participants reported limited links with teachers of cognate subjects: science with mathematics and English with drama. Teachers with no significant prior experience of interdisciplinary working expressed their support for the process:

> I haven't really worked in this collaborative way before and really saw the benefits.

> I think ... it is good for children to be able to link subjects together.

There were a number of features of 'Making Science: Making News' that were considered to encourage an interdisciplinary approach. Some teachers indicated that, throughout the undertaking, extensive staff interaction had been required to ensure the project's effective operation. This, in itself, promoted cross-curricular perspectives and heightened the possibility of cross-curricular practice. As one respondent recounted, 'It was forced cooperation, but it worked'. Other participants referred to specific phases of the project where they had worked together particularly closely, each contributing specialist expertise. Thus, for example, at the preliminary stage in one school, the English teacher and the science teacher described how they had worked in partnership to prepare the pupils for questioning the visiting astronomer. The former focused on 'how to question' and the latter on 'what to question'. It was a notable feature of the project that both subject specialists in each school were primarily contributing their individual subject knowledge.

It was considered worthwhile for pupils to observe teaching colleagues working together by making complementary contributions. This broke down the barriers between subjects and demonstrated the connections between different areas of knowledge:

> For example, I would have taken the children down to the computer suite and [the English teacher] would have come in. We would have been working together and they would have known this. So if they were stuck on a line in my class [the English teacher] would have been there to back up. For them to realise that it was not just two separate subjects and that two subjects were combined for a while was good that way.

All participants pointed to aspects of the project which would have encouraged pupils to view it as a cross-curricular venture. At the very least, it was suggested, teachers of English and science could be observed talking and working together. Their joint attendance at both the scientist's talk and the journalist's talk was also cited. Most respondents, however, highlighted practices that had the potential to further reinforce its interdisciplinary nature. The very fact that the young people brought the same folder to both English and science classes underscored the unity of purpose. That English teachers were talking about science in English lessons and science teachers were talking about English in science lessons was considered to send a powerful message to pupils that knowledge and skill acquired in one subject area could apply in another:

> It's good stimulation for them to talk about a subject in more than one room, to someone who is not the subject teacher. It gives them another perspective on it. We talked about loads of scientific things – Homer Simpson and the donut-shaped universe, Stephen Hawking ...

In some schools the tasks were spread, seamlessly, across the total time available:

> They knew ... that it was an interlinked project, a cross-curricular project that was not based in two classes, where you did solely English in an English class and solely science in the science class. They were mixed together.

One English teacher referred to the ease with which pupils accepted the need for 'crossing over and merging' of knowledge and skill in the specific context of 'science in the media'. She makes an interesting point. Undoubtedly, writing a science-related article for publication in a local newspaper represents a particularly uncontrived and purposeful example of interdisciplinary endeavour. The same teacher related how, on this occasion and on others, she actively taught her pupils to guard against compartmentalising what they learned in different subjects:

> I would have spoken to them about that, and how important that was, that things do not sit in their own boxes and their own categories.

Regardless of the degree of planning towards this end by staff, if students do not see a project as interdisciplinary then its impact in this regard is surely diminished, if not absent altogether. The teachers participating in 'Making Science: Making News' were asked if they thought pupils involved in the project saw it as cross-curricular. Almost all reported that they believed this to be so. For example:

> Yes, they were keen to bring their science knowledge into the English classroom.

The project created a genuinely two-way learning process:

> The pupils used their scientific research to create a piece of writing. The writing of the piece encouraged pupils to reflect upon scientific learning while developing their writing skills.

The project exemplifies a teacher- and school-centred model of curriculum development. A more prescriptive model for developing the curriculum is currently prevalent, providing teachers with lesson outlines and lesson plans, which they then deliver. The danger is that the overall result is to de-skill teachers. In 'Making Science: Making News', the researchers aimed to resource schools by making the links with scientists and with newspapers that it was more difficult for schools to set up by themselves. Once the resourcing was in place, the researchers withdrew, giving schools autonomy to use their teachers' expertise to adapt the project in the manner that best suited their local circumstances. The project sought to effect change and support curriculum innovation by empowering teachers in their classrooms.

Conclusion

The 'Making Science: Making News' project invites reflection on the issues which were outlined earlier: literacy, cross-curricularity and critical literacy. First, the experience of this project suggests that *literacy* and subject discourse can indeed be learned and practised across the curriculum, but to do so it is necessary to go beyond a narrow skills agenda. One of the most striking elements of the views expressed by the pupils is the focus on interest, excitement, novelty and their positive response to engagement with 'real-world' professionals. These affective elements are those parts of educational experience that are impoverished by an exclusive focus on skills or the measurable aspects of educational progress. But it is precisely the mobilisation of the affective that is crucial for the engagement of the pupils' interest. The discourse of English has long been concerned with the affective domain, but it is perhaps underdeveloped in the discourse of science education. Pupils, of course, are enthusiastic about the practical aspects of the science classroom and good science teachers are acutely aware of the importance of this. One of

the benefits of the project has been not only to confirm the importance of this but also to provide a link to this aspect of science education and the application of it to aspects of 'real life' which are not primarily concerned with science, i.e. communication and the media. Science is embedded in life activities and the animation of these activities in the classroom is seen here to be crucial to engagement with science. English/literacy has been the vehicle by which this distinction has been made, that is by lifting 'science' from an exclusive focus on its content or 'skills' to a consideration of how it is applied not just to real-world problems but by real people in specific situations. Science needs not only to be located in 'real-life' activities but also to be seen to be part of *life*. Pupils do not do science and then communicate it, but discover it as part of a process of curiosity, engagement, problem-solving and reciprocal communication. Science teachers thus see that role play, group work and presentations are not just communication or English activities to be consolidated in the science classroom but form a crucial aspect of science education.

Second, there can be genuine rather than facile *cross-curricularity*, which is more than the lowest common denominator of the subjects concerned. Teachers collaborate enthusiastically in interdisciplinary teaching, especially if they participate from the standpoint of their subject mastery and have the independence to plan learning according to their own judgement and the knowledge of their students. They appreciate being treated as professionals rather than technicians. Thus both science and English teachers on this project commented on how the collaboration opened up windows for them and that each was able to offer expertise and perspectives that the other was able to make use of. This was particularly marked in the discovery by science teachers that issues such as communication and presentation are actually *part* of science and not something to be imported into the science classroom. Similarly, English teachers, who were ruefully willing to confess their ignorance of the subject matter they were asked to deal with, also spoke of the genuine interest that the pupils' enthusiasm and the scientists' expertise awakened in them as the project progressed. There was a genuine process of sharing occurring between professionals who were speaking from a secure mastery of their own discipline which they were applying to a worthwhile learning activity.

Third, activities involving the media are an effective means of addressing the issues of *critical and scientific literacy*; however, these are longer-term goals and not objectives that can be realised by a one-off task. The problem here is that both sets of teachers need to realise that both are part of their subject curriculum. Activities such as those fostered by this project are useful for both awakening and enthusing teachers to take these issues up in their classroom in an ongoing way. They are not solutions in themselves, but part of a process of staff education and development. The long-term benefit is an engendering of commitment of teachers to the pedagogic and learning issues that have arisen and which are then applied to practice in their own classrooms. Projects that aim to replace subject autonomy with ongoing involvement are likely to be over-ambitious and misplaced. Subject disciplines have their own purposes and discourses, and collaborative projects such as the one described above should respect the integrity of the domain of the other. There can be no cross-curricularity without distinct curriculum content. Subject domains were established not by ex-cathedra decree but by the processes of historical and social development. Subject learning evolved to meet educational needs and to provide routes and maps for learners. Effective cross-curricularity constructs new paths to make new connections but does not seek to ignore broad highways worn by custom and use leading to known destinations.

The real obstacles in the way of curriculum development along these lines are often practical matters such as negotiating school timetables and finding time to plan for

innovation. The rhetoric around interdisciplinary and literacy learning can become reality and, even though change may happen slowly, there are beneficial outcomes for pupils' understanding and experience.

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