Children Challenging Industry

Summary of the research report

A study of the changing views of primary school children and their teachers as a result of industry-based science activities.

CHEMICAL INDUSTRY EDUCATION CENTRE at the UNIVERSITY OF YORK

With sponsorship from Thomas Swan & Co. Ltd.

JOY PARVIN

March 1999

Children Challenging Industry

Summary of the research report

1. Origins of the project

In 1994, a MORI poll, indicating that the public perception of the chemical industry remained at a low level, inspired an industrialist to action. Tom Swan, of the chemical company Thomas Swan & Company Ltd, invited the Chemical Industry Education Centre (CIEC) to initiate a project which would tackle this public perception by working with young children.

The project that emerged from discussions between Tom Swan and the CIEC was for a project officer, who had experience in primary school teaching and knowledge of the chemical industry, to plan and carry out practical science activities in primary schools. These activities would demonstrate a range of industrial processes, whilst covering aspects of the National Curriculum for science. The main aims of the project were to

- improve primary school children's perception of the chemical industry and its relationship with science.
- to provide classroom-based training for teachers in the teaching of the National Curriculum for science.

2. Methodology

This three-year phase of the project involved over 1300 children and 44 teachers from 38 schools in County Durham. All 241 County Durham primary schools were invited to participate, and 38 of the 54 schools accepting this invitation were selected. All of the classes had 9-11 year old children, with a small number also having 7-8 year olds. Each school participated for a half term period. Participation was characterised by the project officer presenting a series of dynamic science activities set within an industrial context. The activities therefore demonstrated the relationship between science and the chemical industry.

2.1 The classroom methods

Teachers chose from three sets of classroom activities taken from existing CIEC publications, focusing on

- the use of rock salt as a de-icer
- the use of cooling water in industry
- the properties and uses of plastics.

Each set of activities offered opportunities for practical and investigative work. Other types of activities were dependent on the set of activities chosen, and could include

- a practical demonstration (e.g. expand and mould polystyrene)
- a technology practical (design and make an effective parcel, within a budget)
- a video (showing relevant industrial processes).

All schools were invited to submit proposals to participate again a year later, and six schools received this second input from the project officer. The aim of this second intervention was to extend the project to other children and teachers within the school.

2.2 Site visits

Although not originally part of the project design, the site visit became a desirable component. Five companies in County Durham and one in Teesside became involved in site visits. Two schools received visits from industrialists. Visits were arranged for 57% of the children involved, and conducted after the classroom sessions.

2.3 The research methods

Each teaching programme was `topped and tailed' with research activities, which used interviews and questionnaires to collect data. The methods were designed to ascertain

- children's views of science and industry
- teachers' views of science and industry
- the impact of the classroom intervention on these views
- the impact of a site visit on these views.

Open-ended questions were used predominantly, to maximise the information gathered. Some closed questions were used on the children's questionnaires, along with questions asking children to provide drawings, which added another dimension to the data collected.

3. Key findings

3.1 Pre-intervention views held by the majority of children

A wealth of data was collected and analysed from 150 children on their views of science and industry. This section will describe the key findings from these data, and thus present the most common images described by the children.

Children's ideas are gathered from several sources to form one image of industry. The most common sources of information were the television, family, and passing industrial sites. The predominant characteristics of the industries involved in the production of products, such as plastic bottles and sweet wrappers, were

- a large mill or warehouse
- a production line
- lots of chimneys
- ovens and furnaces
- lots of people
- lots of machines
- loud noises
- dark
- hot.

People working in these factories carry out mainly manual jobs, such as operating machinery or pouring, heating and mixing raw materials. The raw materials are transported by lorry to the factory and the finished product is transported away to shops and supermarkets. Science and scientists play no part in this process.

3.2 Changes to children's views

All children expressed new ideas about some aspect of industry. These new ideas could encompass a completely different image of industry to the one originally held; some focused on particular pieces of information, such as the size and scale of a chemical plant. Measurement of individual views was possible with 65 children. 90% of these children altered their views and were better informed.

Overall, a more accurate awareness of industry was measured in the following areas

- raw materials used
- processes involved, and the number of processes per site
- equipment used to carry out processes
- general appearance of a chemical site
- working environment
- range of jobs carried out and their desirability, especially those requiring scientific and technical knowledge
- industry's involvement in scientific research ('testing').

Gains were found in these areas with and without a site visit, though greater changes were measured when children had visited a company which had modified their site visit to meet the needs of the children and their science curriculum. Cases where children were given a 'standard' site tour resulted in little change of view and, indeed in some cases, reinforced the negative stereotype of the industry.

3.3 Pre-intervention views of teachers

85% of the 44 teachers had no industrial experience, so it is not surprising that half of the teachers interviewed were not confident to describe the chemical industry. The chemical industry was described as making 'things' or chemicals by over half of the teachers, with a third referring to the industry as polluting or dangerous. One quarter of the teachers felt the industry was difficult to describe, as it was a mysterious and remote industry on which there was limited information available.

Teachers were aware of the wide-ranging nature of the products associated with the chemical industry, including plastics, household products, synthetic fibres for clothing, inks, dyes, paints, pharmaceuticals, oil, petrol and agrochemical products.

The use of these products, and risks associated with the industry, were cited as the main impact on the teachers' lives.

Two-thirds of the teachers acknowledged the fact that their views were based on media images. Many knew they therefore received a biased and negative

picture of the industry. A quarter of the teachers gleaned anecdotal information from family and friends working in various sectors of industry (not just the chemical industry).

Only 10% of the teachers referred to industry in their science lessons, and did so in relation to pollution, nuclear power, and the building industry. 30% of the teachers linked industry with geography, predominantly with pollution. 52% of the teachers made no links with industry at all.

3.4 Changes to teachers' views

76% of the teachers cited new knowledge about the chemical industry and, as with the children, this new knowledge varied from providing a totally new image of industry to specific pieces of information about industrial jobs or processes.

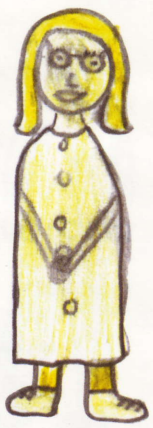
The learning outcomes that were more significant to the teachers were those which related to their teaching. 64% of the teachers felt they had learned how to teach about industry, 40% had learned about how to teach science more effectively, and 31% had learned about using industrial contexts to teach science.

All of the teachers felt the children had responded positively to the classroom activities. 70% of the teachers described the motivation and enthusiasm with which the children responded. They felt that the real industrial context and contact with industry provided children with a reason for doing science.

17 teachers were interviewed one year after the project intervention. 41% of the teachers had repeated the classroom activities, and a further 36% had planned the activities for the second year of their curriculum cycle. However, only 18% had used similar written teaching and learning resources offered after the project intervention. 32% of the teachers shared the activity packs with other teachers, which was almost three times more than the number of teachers who said they would do so.

Teachers rated the industrial visit highly, with all those visiting industry feeling the experience had been valuable - even when links with the children's work had not been made. The majority of those who were unable to visit industry, would have liked the opportunity to do so. Of those interviewed one year later, 32% of the teachers did organise. an industrial visit, though not to the company to which they were introduced during the project.

Along with the repetition of the classroom activities, changes to the methods used to teach science proved to be a significant area of change. 16 of the 17 teachers made generic changes to the methods they used to teach science, including nine teachers who used more practical and investigative work and five teachers who had adopted techniques and ideas used during the classroom sessions.



4. The way forward

1. The research indicates that the model used to link industry with the primary curriculum established during this project was successful. The classroom activities were found to motivate both the children and teachers. Therefore, this model is now being used, with some minor modifications, in the next phase of the project.

Successful elements:

- provision of high quality written materials that support the science curriculum
- training for teachers on science-industry links
- provision of science resources and apparatus
- industrial visits or visitors to schools.

Modifications:

- avoidance of the first weeks of the academic year
- flexibility of the pace of the sessions
- training for project officers, to ensure the appropriate conceptual levels are taught
- inclusion of the whole staff in the project.

2. Chemical and allied companies would benefit from sponsoring future phases of the project for the following reasons (all arising from the 1998 Inventory of Chemical Industries)

- support recruitment
- support the community as a good neighbour
- improve the company profile within the community
- improve understanding of the chemical industry as a whole
- provide professional development for company personnel.

Children became aware of the wide range of exciting job opportunities within the chemical industry, from the forklift truck driver to the research scientist and engineer. They also viewed companies they visited as part of their own lives and their community. Children gained a more accurate picture of the chemical industry as a whole. They appreciated the relationship between the industrial workplace, the science they carried out in school and the products they used every day.

Little data were collected on the professional development of company personnel. Many, however, received training on conducting effective site visits, thus improving their skills of communicating with young people and their awareness of the knowledge these young people bring with them on a visit.

3. Site visits were incorporated in to the project, rather than being a planned component at the outset. These visits proved to be valuable and improved children's knowledge of industry (when the visits had been adapted for the needs of primary school children). Therefore, it is important that any companies offering to take children on site visits in future phases of the project, do so after receiving training from the Chemical Industry Education Centre and agreeing to offer appropriate visits. To encourage teachers to continue to liaise with industry after the project intervention, it is important to involve them in planning the project visit.

4. The majority of teachers had either planned to, or had made use of the industrially-linked science activities after the project intervention. In addition, most had also made changes to the methods they used to teach science. This shows that the motivation and enthusiasm expressed by the teachers immediately after the project had continued a year later. However, it was possible to interview only 17 of the original 44 teachers to establish these data. Therefore, all of the teachers will be contacted during 2002, to establish a wider picture and to ascertain whether those who planned to carry out activities as part of the school's two-year curriculum programme actually did so.

5. The post-intervention data were collected immediately after the input and no children were interviewed after this. Therefore, a longitudinal study has commenced, in July 2002, to establish whether any of the knowledge that children had gained had a long-lasting effect in terms of their understanding of industry and its connection with scientific research and the classroom science they have been taught since.

6. The research shows that the project did provide useful training in science teaching, with many teachers learning and implementing new techniques and ideas. Although this classroom-based training can continue for small numbers of teachers in the classroom, a greater number can be reached by disseminating ideas more widely. Two ways in which the CIEC is doing this are using the project model and the research findings to:

(i) Produce training materials and a quality-assured training methodology for use nationally. The Primary Science Enhancement Programme, begun in April 2002 aims to do this.

(ii) Write articles for primary school journals.

"The project has shown that industry has a wealth of knowledge and experience from which both children and teachers can gain"
Kath O'Sullivan, Co. Durham teacher

"I never imagined being in a classroom could be so exhilarating"
Dai Hayward, Thomas Swan & Co.

"Industry can provide real relevance for much of the curriculum teachers deliver in the classroom"
John Adams, Pfizer

"To be effective in communicating our initial interests, we need to be accepted by those within the education community as partners"
Colin Coates, Monsanto

"We certainly noticed a marked difference between the school parties who are part of this project and others; their ability to question and the quality of their feedback has impressed us greatly."
Vanessa Humphrey, Hydro Polymers

For further information please contact:
Joy Parvin
CIEC Promoting Science
Department of Chemistry
University of York
Heslington, York, YO10 5DD
Tel: 01904 322523
Fax: 01904 324460
Email: ciec@york.ac.uk
Web: www.ciec.org.uk

www.ciec.org.uk

How to become involved

The Children Challenging Industry project has extended into four northern regions of the UK; Bradford, Humber Bank, North-west, and the Tees Valley. The aim is to extend to other geographical locations, and to maintain it in the existing regions.

These regional projects are currently supported by:

- Chemical and allied industries
- Education-business links organisations
- Local Education Authorities
- Education Action Zones
- Excellence in Cities
- Regional Development Agencies.

By gaining support from similar organisations in other parts of the country, further regional Children Challenging Industry schemes will be established.

Each year, each region requires £45,000 (based on 2002 figures). This will enable 35 schools to participate, reaching around 1000 children and 350 teachers.

Each regional scheme will be managed by an advisory science teacher who will

- report to the Chemical Industry Education Centre
- recruit schools to participate
- advise these schools on a whole-school approach to science education
- develop and extend, in partnership with classroom teachers, their science teaching and learning approaches
- provide, where appropriate, professional development courses to spread good practice within the participating schools
- promote properly planned visits to local industry, especially to the chemical and allied industries
- provide training to industrial personnel involved with these schools
- promote awareness of new teaching and learning resources.

Another way for individual companies to become involved is to offer a group of local schools the opportunity to receive a day's training on Children Challenging Industry (CCI) on site. Company personnel would also receive training on effective site visits with primary children. This 'mini CCI' can be tailored to the company's requirements, and costs around £2000-3000, depending on the number of teachers involved.

Outcomes

The outcome will be

- teachers making use of a fuller range of teaching strategies to enthuse children for science and to encourage a better understanding of science in the industry;
- improved use of industrial sites to support science and technology teaching in primary schools;
- greater awareness of the availability of exemplary teaching resources, including those from CIEC.

Funding

Those interested in supporting a regional scheme are invited to contact Joy Parvin at the Chemical Industry Education Centre.

Children Challenging Industry

an investment in all our futures