Technological approaches to environmental education

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Abstract
Developing autonomy, confidence and competence in a variety of curricular contexts with a range of media is a central concern for environmental education. We believe that technology plays a crucial role in this.

This paper describes the research and development of a multimedia CD-ROM for primary aged children which links the world of the classroom with 'their' environment. It suggests that the processes of this research and development not only generated an impressive technological resource but contributed significantly to the professional development of the team and their interaction with learners.

Background to the Project

The Renewables in View CD-ROM[1] learning resource resulted from an approach by the Department of Trade and Industry to formulate a proposal for a curriculum resource for Key Stage 2 pupils about Renewables; that is, energy technologies using renewable sources. The gap in existing resources had been identified for some time by the department, who were also aware of the need to offer schools resources in an appropriate form. At this time HyperStudio2, a multimedia authoring software package became available allowing development of the resource to be seen in terms of using a range of information technology (IT) media, soon to be available across all educational computing platforms. This multimedia approach made the use of a CD-ROM for the resource imperative, particularly in terms of the storage volume required and in the light of plans by the Department for Education to support the widespread introduction of multimedia equipment in primary schools.

Methodology

The research described below has been allied closely to pedagogic practice, and aims to yield results immediately applicable to the classroom, as well as seeking to extend our understanding of learners and learning. In this paper we wish to focus on the development of a flexible and relevant IT environment supporting differentiation, progression and equality of access with the facility for learners to reflect on and record their experiences with IT and elsewhere. This is based on a child-centred perspective on learning through pedagogy-centred development, with the inclusion of practitioners in the research and development at all stages, engaged themselves in action research.

The research team included teachers of varying experiences from local schools, and a professional designer. A group of five schools, from various demographic contexts and across three different local education authorities was convened. The teachers were chosen for their experience as general classroom teachers from a range of backgrounds. Some had been identified for their development work in design and technology while others were responsible for science or information technology. On contacting the teachers it was obvious that although all had an enthusiasm for the subject area their prior experience of renewable energy was sporadic and isolated. It was also obvious that they came with few or no preconceptions and were willing to involve themselves and their pupils as fully as possible.

Our commitment to develop a resource which was firmly based in classroom practice was welcomed by the teachers and, while anxious to retain more traditional ways of presenting information, they were keen to work towards a ‘multimedia’ classroom. For all members of the team the project created opportunities for personal and professional development. For the teachers this included the continued sharing of ideas and resources; the

introduction to new software and computing equipment and their roles in curriculum development.

We also actively involved undergraduates in the project, and were able to recruit an education student completing his BA(Ed) and a BA Design Studies student in her final year in key research roles, as well as second year students on the BA(Ed) programme who had made an in-depth study into Renewables. Team colleagues were closely involved at every stage of the development as research partners, steering the project and developing and evaluating draft materials, including determining the different levels of access, the practicability of the resource, the interface used and the level of control a teacher would have. We also worked with other professionals including those from the field of renewable energy and associated agencies.

As well as clarity in the way we wished to work in researching and developing the field, we were clear about the requirements of the software vehicle we envisioned in the light of the resourcing situation in primary schools. The possibility of powerful computers with CD-ROM -based peripherals becoming widespread prompted us to look at a multimedia resource as a genuine possibility. Before addressing the hardware, however, we were determined that any resource should interact with learners. We favoured a transparent interface as described by Ihde's[3] into which the learner extends her/ his sensory field, having some presence , which would be more than simply a context for learning (Patterson[4]).

We were impressed with the possibilities offered by some formof limited virtual reality for the learner, and intended providing some translucent presence in the world of Renewables. At the same time we were acutely aware of the role of the teacher mediating the learner's presence and the journey taken by that learner in such a resource . We agree with Chandler[5] in the importance he attaches to the learner taking part in developing the resource, adding to or representing information and exploring the information presented in such a way as to emphasise learning above the information itself. We intended that the resource should be a rich and dynamic learning environment, promoting largely self-directed learning, arbitrated by a teacher, and actively engaging the learner through the use of a personal journal.

We aimed to create an explorable world, as described by De Diana[6] , rather than an (other!) electronic book, using IT equipment available to all schools over the next few years. At the same time we shared the concern of Harrison (1981), cited by Underwood and Underwood[7], for the continued importance of text, not losing its value but being one of many communication media in the multimedia repertoire. Barker[8] describes interaction with such a system as occurring through multiple channels, and stresses the importance of two-way communication; not only information transmitted from the multimedia resource to the learner but from the learner in the other direction, by way of a dialogue. We feel that only through such a dialogue can the learner have a presence in the resource, and further we are concerned that the communication channels are not limited to those that are based on IT. An early requirement for our computer-based project was that it should be able to exist within, and promote activities using non-computer based media but at the same time being flexible enough for a teacher to use on its own if necessary.

We were concerned that the resource should be supportive of teachers' curriculum planning, learning management and assessment of pupils' progress and performance giving teachers the facility to choose from a number of activity types in each Renewable domain according to the demand they placed on individual learners. In terms of assessment we decided that learners' journals should be saved between sessions and should represent learners' reflections and descriptions of a number of explorations. In addition to learners' journals we intended the teacher to be able to have a record of the time and date learners visited any part of the resource; essentially giving a microscopic audit of the learners' explorations.

Professional development through the project

While the partners, particularly the teachers, brought a great deal of experience to the

project it was not immediately clear to them how valuable their involvement would be. Discussing and exploring the area of Renewables at regular workshops, developing activities both on and off the computer and using the computer hardware and software were all aspects of their involvement representing professional development. From the responses to the first meeting this aspect of the project was clearly on the agenda.

> The session was very interesting and provided an invaluable opportunity to share ideas and to discuss processes with colleagues. The project lends itself to curriculum development to a high degree with the context of the NC and I feel that it could prove useful to my school.

It was also obvious from the meeting that, while the teachers were enthusiastic and felt that the project could be very exciting, they all had their own concerns about the design and use of such a resource.

> I feel this project could be very exciting but I am worried that materials produced may not be too user friendly. Lots of people (especially in my school) dislike science and D&T and I would hate this to turn into a missed opportunity to enthuse teachers.

In our work with partners the intention was to start with resources with which they were familiar, and when the flexibility and range of possibilities that multimedia could offer had been established, training in this field was offered. Equally important, equipment and software which offered easy accessibility was chosen both for the development work and the trialling in schools.

Action research

In their roles as research partners the teachers investigated existing resources in a range of IT and non-IT media and evaluated these with reference to the project. They also developed and trialled sample non-IT activities. The final activities produced grew out of these, the teachers having identified what was likely to be successful in terms of conceptual demands and manageable in terms of the classroom.

Extensive searches of published resources indicated little as currently available; what was available was discussed in terms of learner access and classroom application and we debated how a CD-ROM resource might offer solutions to these issues. The need to address the range of learners' entry levels was given a high priority as was the issue of how the CD-ROM itself should be used in the classroom. Discussion took place on the children's 'journey' through the activities and through the information and how the various strands might be linked to arrive at an understanding of the diversity of the subject. The need to make a system which encouraged progression was identified but also allowing reiteration to consolidate work already covered.

Issues which had arisen from trialling the activities were discussed and it was noted that the children had been sensitive to the need for fair testing and carefully considered the presentation of their results. It was clear that discussing different energy sources could fit into various areas of the curriculum and children's personal experiences could be drawn on. Hands-on technological activities, such as making paper windmills, were seen as having great potential. In general the children seemed to be competent at understanding ideas, such as solar heating, but did not all grasp the concept of where the energy comes from; a common mistake was to mix the terms energy and electricity, a problem not restricted to young learners!

Comments from teachers in feed-back sessions indicated they found their action research very productive, they appreciated the approach being well organised, flexible but appropriately structured. They all considered the work very exciting and worthwhile and appreciated the opportunities to contribute and share ideas.

Initial case study

Sarah Richardson (research and development partner and early years teacher)

Context

- This teacher worked with six children at the top end of Key Stage 1, 3 boys, 3 girls spread across year 1 and year 2. The children worked outside the classroom context for

1 hour each day. Although the situation was an unnatural one in that the children were taken out of their day to day environment, this experience was approached as a mini-topic for these children.

- The section of the CD-ROM studied was 'general energy' considered the most appropriate for their age and the most interesting for them as it linked in with their prior experience giving them some background information to draw on. Their computing skills were limited prior to using the Apple Macintosh. They had not used a mouse previously and the software currently used for printing out their work did not allow for independent operation by the children. In view of this the teacher anticipated problems would arise with:
  i) manipulation
  ii) orientation
  iii) functioning of the mouse.

- The children, however, were keen to work on the computer and felt privileged to be involved.

How the work was structured

- Initially the teacher wanted to focus on food energy, following this up with looking at other forms of 'general energy', and to follow the sequence on the computer. Children talked in general terms about 'What is energy?' and their responses included:
  "its fast ... like electricity shock"
  "energy ... you might say energy gets you loads of air in your lungs"
  "when you run there's energy".
- Their comments indicated that they all showed an understanding about the concept of energy. They went on to talk about where energy comes from and from where we get energy:
  "You get it from your body"
  "You have a rest to get more energy"
  "You get energy into your body when you eat".

- The children, having talked about energy, referred to the section about chemical energy. Afterwards, using the lunch box information (CD-ROM), the children were asked to
  i) design their own lunch box
  ii) design their own packed lunch.

- This was an activity which the teacher thought would be fun to do as well as considering it a good way to investigate the energy content of certain foods.

- Using collage, the children made their own 'packed lunch' and then investigated how many kJ energy were in packets of crisps, yoghourt, biscuits etc. The results were not exact, but from the information gathered they understood the points being made:
  i)some foods have more energy than others
  ii)all foods have energy
  iii) kJ on packaging equals energy.

- As an extension activity and with more time the teacher intended to ask the children to calculate the total kJ in their individually designed 'lunches' and compare the results. However, she wanted the children at this point to move onto thinking about other forms of energy.

- Worksheets printed from the CD-ROM and photocopied were given out once the various objects (battery and mains operated devices) appearing on them had been discussed. The teacher had arranged a display of several items (not the objects on the worksheets) and left the children to fill the sheets in.

- The children had the opportunity to work on the computer as a small group after being shown how to use it. After this initial encounter they went on to work in pairs. They were encouraged to print out their favourite page and write about it as well as explore in a self-directed way.

Findings

- The children picked up how to use the mouse astonishingly quickly. As one child explained to another how to control the mouse and to manipulate the puzzle:
  "click it and hold it and pull in into the puzzle ... let go".

- All the children, despite their age, managed to use the mouse effectively - the teacher's expectations that it would be problematic were ill founded.

- A great deal of identified co-operative learning took place. When one child found the red circles (identifying active areas on the screen) and they flashed off before he could locate the 'hot spots' another child suggested :

  "Look, go up to the top red and see what we can find".

- This was after the short introduction on how to use The Room.

- Printing was very easy. The children easily succeeded at this: "Wow its true!" said one child as the image was printed onto the paper from the screen. The ease which pages can be printed has implications for the children to be more in control of their own work. The boxes on the menu (available throughout the CD-ROM information pages) giving more information, print etc., ensured that the children were in control of their learning. They used the various options by themselves.

- Overall, the children had tremendous enjoyment with the computer and the CD-ROM. They loved the music and speech. Also, from their responses, they were attracted to aspects of movement, for example, the fish swimming in the tank (an item in The Room) and Natalie running (in the General energy domain).

- The teacher herself reported she had gained a great deal from working on the project and that was a really unique experience for her as well as being fun!

Conclusion

The project team have now embarked on the second research phase of this project. The initial phase can be described as supporting the development of the CD-ROM and associated material. Detailed notes have been kept of the interactions of the research team as a whole, and some responses are summarised above. The second phase includes two samples. One consists of the partner teachers and their pupils and the other involves schools not involved in the development work. The data collected is of five forms: teacher questionnaires, teacher interviews, pupil questionnaires, pupils' journals and activity logs. The analysis of the data will be in the light of the criteria set out above regarding the authors' intentions in setting up the CD-ROM resource and these prompt a number of research foci to be addressed in the second phase:

- the teachers' overall evaluations of the CD-ROM,
- extent of support in teachers' curriculum planning,
- learners' uses of the CD-ROM,
- learners' reflections on explorations, and
- the CD-ROM and non-IT classroom activities.

References

1 Compact disk read-only memory, an extremely large volume computer storage medium based on optics technology

2 HyperStudio from Roger Wagner Publishing

3 Ihde, D.A. (1975) cited in Underwood, J.D.M. & Underwood, G. (1990) *Computers and learning* Oxford: Blackwell p13-14

4 Patterson, J. (1994) Learning and computers: a paradigm shift for education in Paine, N. (ed) *All our learning futures* Glasgow:SCET p48

5 Chandler, D. (1984) *Young learners and the microcomputer* Milton Keynes: Open Univ. Press

6 De Diana, I.P.F (1994) ' The guest editorial: aspects of courseware authoring' JCAL (1994) 10 p65

7. Underwood, J.D.M. & Underwood, G. (1990) *Computers and learning* Oxford: Blackwell p18

8. Barker, P. (1989) Multi-media CAL in Barker, P. (ed) *Multi-media computer assisted learning* London: Kogan Page p32