Conducting Research over the Internet: an interactive, image-based instrument for investigations in environmental education

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ABSTRACT Image-based instruments for investigating student teachers’ perceptions of environmental issues have been developed at the University of Reading, United Kingdom. As an extension of this research, a collaborative project has been undertaken with the University of Exeter as part of its Joint Information Systems Committee (JISC) New Technologies Initiative. An interactive, image-based instrument has been developed for investigating environmental preferences and understanding of, reactions to and beliefs about environmental issues, particularly among student teachers. The instrument is available, with supporting papers, on the World Wide Web. The development of the instrument is described in the context of a theoretical framework based on personal construct theory. Some technical considerations in developing the Web Site are outlined and the potential of collecting research data from image-based instruments through the Web is considered.

Background

Researchers at the University of Exeter have been investigating the use of image-based multimedia technologies in education and the potential of the Integrated Services Digital Network, SuperJanet and the World Wide Web for individual, institutional and curriculum development in the use of these technologies (see, for example, Davis, 1996). Simultaneously, researchers at the University of Reading have been investigating aspects of policy and the practice of environmental education in England, particularly as they relate to the expertise and professional concerns of teachers and student teachers (see, for example, Gayford & Dillon, 1995).
At the Nineteenth Conference of the Association of Teacher Education in Europe (ATEE) in Prague, Dillon & Gayford (1995) described a survey instrument which had sections dealing with:
- students’ teachers’ past experiences of, and attitudes towards, environmental education;
- their knowledge, understanding, perceptions of, and attitudes towards the environment and environmental issues; and
- their environmental preferences.

In the last two sections, they used visual images as a means of eliciting information, an approach that was seen to offer potential for further development.

There has been a long tradition of collaborative work between the Universities of Exeter and Reading in the development and use of educational multimedia (see, for example, Wright & Dillon, 1990). Funding through the JISC initiative provided an opportunity for taking the image-based ‘environmental’ instrument developed at Reading and restructuring it at Exeter for use on the World Wide Web.

The Web Site address is:
http://www.ex.ac.uk/telematics/JISC/intro.htm

At this Site, it is possible to access the following:
- The image-based survey instrument in the form of an interactive questionnaire. There are two versions of the questionnaire, one suited to those accessing the site using a system with a fast video display card and a high resolution screen and the other suited to those using a system with a lower specification.
- An interactive version of the article on ‘environmental education, personal values and perceptions of environmental issues’ by Dillon and Gayford presented at the Nineteenth Conference of the ATEE in Prague in 1994.
- A transcript of a discussion between two of the authors (PD and BW) in which the former explains the thinking behind the development of the original image-based questionnaire and ways of establishing people’s perceptions of the environment and environmental issues, and the latter suggests how information and telecommunications technologies may be used in support of such investigations.

The collaborative work undertaken enabled us to address a number of different research issues (and to some extent the tensions between them) including:
- the need to ask certain questions in environmental education;
- the use of image-based instruments to collect data on those questions; and
- the use of the internet as a medium for collecting data through image-based instruments.
The first of these, concerning environmental education, is discussed in Dillon & Gayford (1995). The purpose of this paper is to report how we developed a Web Site and in so doing addressed the second and third issues. The emphasis is deliberate. In conventional research, questions are posed, suitable methods and media are adopted, and data are collected. The JISC initiative was development driven, i.e. its starting point was the medium (which is why we have included a transcript of our original discussion as part of the Web Site). We describe the image-based instrument and its theoretical basis and then explain how we developed the Web Site around it. In so doing, we raise a number of questions about moving from paper to digitally-based images, and from a restricted access to an open access instrument. Finally, in the light of exploring these questions, we return to the first and central research issue about environmental education.

The Survey Instrument

The image-based instrument is known as the ‘interactive environmental questionnaire’. It has ten questions organised in three parts. The first part (questions 1-7) asks for the usual information about respondents so that sample groups may be defined: names, email addresses, institutions, countries of location, gender, age and short statements about occupations, courses of study and/or professional interests.

The second part (questions 8-9) is concerned with respondents’ understanding of, reactions to, and beliefs about the environment and environmental issues. It is based on a series of seven images, each image exemplifying at least one major environmental issue. The seven images and the principal issues exemplified are:

- A computer simulated image of the earth showing regions of ozone depletion (ozone depletion).
- A road system in a residential area (urbanisation and transport).
- Logging (deforestation and use of natural resources).
- A monoculture, where a single crop is grown (intensive agriculture).
- High-rise housing (urbanisation and population growth).
- Recycling bins (use of natural resources).
- Wind turbines (power generation and scenic impact).

The series of images is presented three times so as to build a cumulative profile of respondents’ understanding and beliefs. The image of a road system in a residential area is shown in Figure 1.

In the first presentation, respondents are shown the images in turn and are asked to state the major environmental issue that they associate with each. The premise is that if respondents have a basic level of understanding of a given issue, they should be able to associate the issue with an image which depicts it or aspects of it.
In the second presentation, the same seven images are shown in turn. This time, respondents are provided with a list of environmental issues and asked to select from it the one which, in their opinion, best relates to the image. The issues given are: global warming; the greenhouse effect; ozone depletion; deforestation; wetland change; marine change; soil erosion; desertification; acidification; eutrophication; toxic pollution; population growth; urbanisation; power generation; transport; biotechnology; genetic engineering; tourism; scenic impact; intensive agriculture; conservation of wildlife; use of natural resources. This exercise extends the exploration of respondents' understanding of environmental issues. It enables them to reflect on the responses given when the images were first presented, and if necessary to revise or supplement the responses in the light of new information.

60mm

Figure 1. A road system in a residential area.

In the third presentation, the same seven images (with the exception of the first, where the computer simulated image of the earth showing regions of ozone depletion is substituted with one of a beach crowded with people sunbathing) are shown again, this time accompanied by a statement explaining the principal issue depicted. In each case, respondents are asked to:

x List the main factors which may make the activity depicted in the image questionable or contentious.

x State the likely consequences, outcomes or environmental effects for each of the factors.

x State what they think should be done about the factors.

This exercise moves beyond the basic level and explores respondents' detailed understanding of the environmental issues under consideration and their beliefs about what should be done about them.
A pilot survey with student teachers (Dillon & Gayford, 1995) suggested that some single issues are readily recognised, others not. For example, whereas most students readily associate the use of fertilisers, pesticides and hedgerow removal with modern farming, few, unless prompted, recognise the over-arching issue to be intensive agriculture. Deforestation, on the other hand, is both readily recognised and its characteristics generally understood. Issues like ozone depletion and global warming continue to confuse – the technical detail is often poorly understood, but there is a better understanding of the outcomes or consequences of the problems. The responses of many students show a preoccupation with secondary issues – in the case of the sunbathers on the beach, they identify the effects of overcrowding, congestion, and pollution. The responses to what should be done about the problems often reveal a concern with treating the consequences rather than the problems themselves. For example, only a few students specifically recommended taking steps to reduce ozone depletion; most were concerned with using barrier cream and educating about the health risks. Many of the courses of action suggested by the students to alleviate the environmental problems involved restrictive legislation.

Figure 2. Images showing the same coastline deserted and crowded.

The third part (question 10) is concerned with respondents’ environmental preferences. It is based on five pairs of images. For each pair of images, respondents are asked to select the one which they prefer or which appeals to them most, and give reasons for their choices. The pairs of images are:
A scenically interesting stretch of coastline with no people; the same stretch of coastline crowded with sunbathers.
A field with a colourful monoculture; a field with a colourful mix of wild flowering plants.
A scenically interesting wilderness area; a scenically interesting townscape.
The interior of a room in a modern house; the interior of a room in a pre-modern house.
An aerial view of primary woodland; an aerial view of a cityscape.

The premise is that although respondents are not asked to be explicit about their understanding of, or beliefs about, the environments depicted, the choices that they make will nevertheless be indicative of these factors. The pair of images showing the deserted and crowded coastline is shown in Figure 2.

The pilot survey with student teachers (Dillon & Gayford, 1995) suggested that students generally prefer historicised environments to new, rural environments to urban, varied environments to uniform ones, and those they perceive to be unsullied, unpolluted or unthreatening. These preferences were supported by large majorities.

**Theoretical Basis of Instrument**

The survey instrument is developed from a recognition that respondents' behaviour towards the environment, as citizens and, in some cases, as professionals, is as much dependent on their beliefs and the value they place on the environment as it is on their knowledge and understanding of it (Appleton, 1986; Green, 1995). When people encounter a new environment, they try to make sense of it and at the same time become involved with it. They review what they know about the environment, or need to know about it, in order to interpret it. They also respond, or react, to the environment; judgments are made based on how the person feels about it. The overall meaning that the environment holds for an individual is a synthesis of all of these factors (Dillon, 1995).

The questions posed around the images of environments in parts two and three of the interactive environmental questionnaire are a mix of the 'interpretational' and the 'judgmental'. They elicit information on respondents' understanding of, reactions to, and beliefs about the environment and environmental issues. Personal construct psychologists, using approaches derived from Kelly (1955), describe these processes as 'construing'. Construing involves thinking, feeling and reacting; it has cognitive, affective and conative dimensions, and thus provides a means of establishing how individuals experience the world and make sense of those experiences. There are often tensions between what individuals know about environmental issues and how they respond to environments. These tensions
can be used as a means of identifying and acknowledging prior experience and existing knowledge and beliefs, and working towards an agreed agenda for further learning and reflection.

**Developing the Web Site**

The images available at the Web Site provide a surrogate experience of selected environments. There is a range of technical matters which have to be addressed in creating such a Web Site (McLean et al, 1995; Barron et al, 1996) but the discussion here will be restricted to those that relate to visual content. These matters are concerned with template construction, copyright, image quality and quality of interaction.

By template construction we mean designing Web pages which integrate images, text and the means by which responses can be made. For some responses, information about the respondents, for example, there is no alternative to an input of text, and for these word processing facilities may be incorporated at the required points. Other responses, for example where images are being matched with environmental issues drawn from a list, offer more innovative possibilities. Thus, for the second presentation of the images in question eight, a matrix was designed which carried the seven images on one axis and listed the twenty-one environmental issues on the other axis. ‘Radio buttons’ were used to enable an image to be linked with an environmental issue (Figure 3). Whilst this offers a novel method of response with good visual feedback to the respondent, it does require a high resolution graphical window (1024 x 768 minimum) and a fast graphics card on the browsing computer. As these facilities will not be available to all potential respondents, a second, lower specification response system involving drop-down menus has been developed.
Figure 3. A section of the ‘radio button’ and images matrix developed for version 1 of the matrix.

It goes without saying that the copyright protocols which apply to the creation of a Web Site are similar to those which apply to any other visual or printed medium. The copyright holder of an image must be traced and an agreement reached before it can be used in a publicly accessible format. This is frequently a difficult and sometimes an impossible task. Ultimately, most researchers resort to commissioning or producing their own images. The pilot version of the instrument described here, where images were used in their original published format (typically books and magazines) contained a pair of contrasting panoramic views of modern Thames-side London and pre-modern Thames-side London, the latter from an old master painting. These were important in establishing if respondents preferred historicised environments to modern ones. It was not possible to trace copyright on these images, nor was it possible to re-photograph the scenes, and the pair had to be substituted with images portraying a different content exploring the same theme (the interiors of rooms of pre-modern and modern houses).

It is possible, using commercially available software, to produce ‘pastiche’ images which are composites, with sections of the images drawn from different sources and re-worked to resemble a copyright bound original. With sufficient re-working this may overcome copyright problems but the process is demanding and time-consuming. The ‘cityscape’ used in the instrument described here is a composite image.

In terms of quality, the ideal is to have images within Web pages as big as possible so that reasonable detail can be seen. However, when these pages are accessed via a slow modem or other Internet link the image file size needs to be as small as possible. This tension can be overcome by saving images in a Joint Photographic Expert Group (JPEG) format rather than the Graphic Interchange Format (GIF) more commonly used within Web pages. By setting the compression level to around 40% substantial file size reduction is possible while image quality and detail is maintained.

The use of email as a method of feedback is commonly utilised within Web pages. Its use for responses to questionnaires however needs careful design. The structure and format in which the responses are presented to the recipient is important so that data is easily accessible for later dissemination and/or analysis.

Future Directions

Gathering data over the Internet for this research raises a number of logistical and methodological questions (Foster, 1994). Foremost among these are the ways in which populations and samples are defined. The ‘open’ access offered through the Internet carries with it the advantages and disadvantages of demographically and geographically diverse samples.
Whereas in theory the entire population is accessible, in practice the availability of the technology and levels of literacy impose their own forms of selection. In order to derive meaningful data it may be necessary to pre-define samples and target these through, for example, an initial contact with a course tutor, or to introduce screening, for example, based on information that respondents provide about themselves, at the point of receipt of responses.

There is also the question of the particular form that discourse takes when conducted over electronic networks. Foertsch (1995) argues that it lies on a continuum between the context-dependent interaction of oral conversation and the contextually abstracted composition of written text. The interactive environmental questionnaire has been designed so that the images establish their own context. However, in the absence of a focused use of the images, which may be possible when the questionnaire is administered face-to-face, the context may be difficult to maintain. Responses of ‘distance-users’, free of the constraining influence of the researcher, are limited only by their imagination. In some circumstances, it will be necessary to establish criteria for accepting responses into the pool of research data.

After completing the interactive environmental questionnaire, respondents have the option of emailing their responses to one of us (PD) who is conducting comparative research. At the moment responses are analysed manually and the provision of feedback is a time-consuming process. The longer-term aim is to add data-logging and user-response facilities and thus turn the facility into a self-contained research and distance education instrument. The instrument could be generic in that, with the substitution of new images and questions, it could be adapted to carry any specified content and thus could have an application in a wide range of research and educational situations (Pool et al., 1995).

The responses will be used in comparative work on the perceptions of environmental issues and environmental preferences held by student teachers and other target groups in different national and cultural settings. Amongst the questions being investigated are:

- Why are some environmental issues better understood than others?
- What is the relationship between an individual’s beliefs about the environment, his or her environmental preferences and his or her understanding of environmental issues?
- Is it possible to generate generalised profiles of individuals so that their experiences and preferences might be categorised and their further educational or professional needs identified?

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