

# **Action research as a methodology used to help assess the effectiveness of sustainable design websites**

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## **Abstract**

Despite large investment into information communication tools such as websites, the impact that these websites have within education is rarely assessed. This paper reviews current action research methodology employed to assess how effective sustainable design websites have been in influencing the design decisions of student designers. Website effectiveness encompasses a wide range of elements that stretches further than just website usability. It includes cognitive psychology, human-computer interaction, professional writing, linguistics and persuasive value. This paper shows action research as part of a three year PhD study which looks at the assessment of website effectiveness using data from interviews, observations, questionnaires, usability checklists and design folio observations.

The paper outlines three different areas of action research; creating a sustainable design website, direct support of design project work (both one-to-one and in groups), and raising awareness. Current sustainable design initiatives in education that aim to achieve an integration of sustainability principles through websites are described. These sustainable design initiative websites, such as the Sustainable Design Award, form the main focus of this investigation.

## **Keywords**

Sustainable design, effectiveness, websites, impact, methodology, action research

## **1 Introduction**

In the past, the mention of the label 'action research' risked conjuring visions of a research project of low academic value when compared to other research methodological practices. At one stage there seemed to be an air of unshakeable controversy surrounding the research method, with many researchers questioning its validity. Perhaps as a consequence people tended to overlook its longstanding development: 'qualitative inquiry and action research have a long and proud tradition

that many academics, professors and administrators, and public school teachers and administrators do not realise' (Smith 2004:190).

Today however, it is more widely recognised as one of the most productive and valid forms of research by the leaders in the field (Archer 1992; Norman 1999; Roberts 2000 ; Green 1998). 'A designerly approach, rather than a scholarly or scientific approach, can with advantage be made towards educational research and curriculum development' (Archer 1992:12). Its history and traditions are now also starting to get the recognition to support Archer's assessment of its potential. Take ethical issues surrounding design research for example. The Revised Ethical Guidelines for Educational Research by the British Educational Research Association specifically including guidelines on Action Research for the first time in 2004.

Action research applies 'all the normal rules governing research practice' (Archer 2004:29) but it also generates immediately applicable new knowledge. The methodology used in this paper demonstrates a cyclic method of working within the research process, as championed by several leading researchers (Elliott 1991, and Kemmis and McTaggart 1988). This could be considered as action research due to its practical nature and specific outcomes. The research involves a range of activities that transcend several common research methods, 'the labels action research and qualitative modes inquiry highlight a number of overlapping domains of similar inquiry modes. Teacher research, classroom research, illuminative evaluation, clinical research, teacher autobiography, classroom process studies, diachronic inquiry, etc., are all tapping into much the same territory' (Smith 2004:190).



Figure 1: action research method diagram

Action research projects are structured to contribute, test and/or refute existing knowledge systematically through a series of classroom based activities. As Green writes: 'the fundamentals of action research involve: the questioning of assumptions; the clarification of values; the discovery of the mismatches between espoused values and practice; the understanding of the wider social context in which I work.' (Green 1998:2). Despite its flexibility, action research, in terms of this research project, takes its traditional form of consciously taking an action to gain a result. As Burns outlines in his understanding of action research 'a total process in which a 'problem situation' is diagnosed, remedial action planned and implemented, and its effects monitored if improvements are to get underway' (Burns 2000: 443). It is the instigation of change which makes action research very applicable to research projects such as the PhD study used as an example in this paper. It is researching with a purpose for an outcome.

It is not the result of that action that is necessarily applicable to other areas, but the deeper understanding of the context gained. 'Action research does not attempt to produce results that are immediately transferable to other teaching situations... it is the understanding of the complexities of the particular situation and the recognition of the different ways in which the familiar can be interpreted that is the aspect that is so readily transferable.' (Green 1999: 107)

As part of the study several carefully considered actions were taken to gain some valuable research information. The cyclic nature of the research enabled minor alterations to be made throughout this process. Several interim conclusions were drawn and acted upon. A sustainable design initiative led by Practical Action is described in this paper which provided the context for the research. Action research is then described more specifically in relation to the Sustainable Design Award (SDA) website and the assessment of its effectiveness in influencing design decisions.

## **2 Sustainable design initiatives**

Sustainability is a key issue for all educators, designers and students; its rising prominence is largely due to government legislation and an increasingly environmentally conscious society. In general terms, sustainability has become a major user consideration in products, people now choose products based on environmental and ethical responsibility as much as they do on form, function, price and aesthetics. Sustainability within design and technology has shifted from a focus of 'end of pipe' techniques to look at the whole product's life-cycle, a 'cradle to grave' approach (Bhamra 2004).

Bhamra (2004) also outlines the challenge that we face in combining technology, culture and nature, the success of which is largely dependent on effectiveness, innovation and creativity of implementation. This research focuses on the area of effectiveness, but also the sustained motivation of the design students and the communication of the information.

Several groups and organisations have taken significant steps to tackle this often testing area. Notably work by the Pré Consultancy in the Netherlands who developed design assessment tools (e.g. *the EcoIndicator Manuals for Designers*) in the late 90s (Goedkoop 1995), the UNEP Ecodesign manual '*Ecodesign: a promising approach to sustainable design and production*' (Brezet and Hemel 1997), the Royal Melbourne Institute of Technology's research work and subsequent publication *A Guide to EcoReDesign: improving the environmental performance of manufactured products* (Gerstakis, Lewis et al. 1997), the Demi website developed for undergraduate students led by Goldsmiths University alongside several UK organisations (Clare 2001), and most recently Practical Action's Sustainable Design Award (SDA) aimed at post-16 students (Capewell and Norman 2003). These could be seen as actions taken to address the area of sustainability. However this only becomes 'action research' when that action is assessed and evaluated.

The Sustainable Design Award (SDA) is led by a charitable organisation Practical Action and it operated from 2002-2007 in partnership with Loughborough University in England, the Centre for Alternative Technology and Twente University of the Netherlands. These are all organisations with acknowledged expertise in the field.

SDA aims to put sustainability on the education agenda in design and technology at AS/A2 level.

As the author, and indeed Loughborough University, have been involved in the SDA project from its beginning, this paper and the research in which it is situated have focused on this scheme and its integration into design and technology education.

<b>Date</b>	<b>Sustainable Design Award Description</b>	<b>PhD Research Notes</b>
Evaluation April 2002	DFID supported projects in the UK and the Netherlands to help to 'raise awareness and understanding' in young people of sustainable development.	Phase 1:1
Action 2003	The Sustainable Design Award was introduced by Practical Action to support the sustainable design principles needed within Design & Technology education (Figure 3). Resources were provided such as the teachers handbook and SDA website.	Phase 1:2 Phase 1:3 Phase 1:4
Evaluation 2006	Evaluation of the Sustainable Design Project by James Pitt and Fred Lubben of the University of York. This report evaluated the project through educational resources are key (Figure 4)	Phase 2:5 Phase 2:6 Phase 2:7
Action 2007	Project on-going but now driven through resources and teacher training rather than 'direct input' based	Phase 2:8

Table 1: sequence of some of the action-evaluation cycles which took place within the Sustainable Design Award

The scheme can be seen as an action (Table 1) taken to impact upon the education of students at 16+ level. Each part of the scheme in terms of inputs and resources could also be seen as actions taken by the SDA to have a specific purpose within classrooms. After the SDA projects' pilots studies were completed in 2002-03, 150 schools were enrolled in the 2003-04 and up to 241 schools in 2005-06. The SDA was awarded to 882 students between 2002-06, and this covered AS and A2 level (Pitt and Lubben 2007).

The results or success of the SDA scheme, and the actions taken, is perhaps best measured by the design outcomes of the students who undertook the award and their design work since then. It could also be measured in terms of awareness and the educational push towards sustainability within design, at an educator and legislative level.

### **3 The first action research cycle: the Sustainable Design Award website**

The SDA is the first scheme in the United Kingdom to focus specifically on post-16 students and, as outlined by Capewell and Norman (2003), the scheme took several actions to support classroom education in terms of:

- teacher information days;
- a sustainability pack;
- student study weekends and school visits;
- electronic communication via email and the website.

The scheme has also developed as a result of these initial actions. The *Sustainability Handbook* (Daniel 2007) has now been written and sent out to schools free of charge as a support to teachers and students, it refers back to specific sections of the SDA website where appropriate. This progression towards a greater reliance on communication tools such as the website and the handbook is a result of an iterative process undertaken within the SDA development team in assessing the scheme after a particular action was taken.

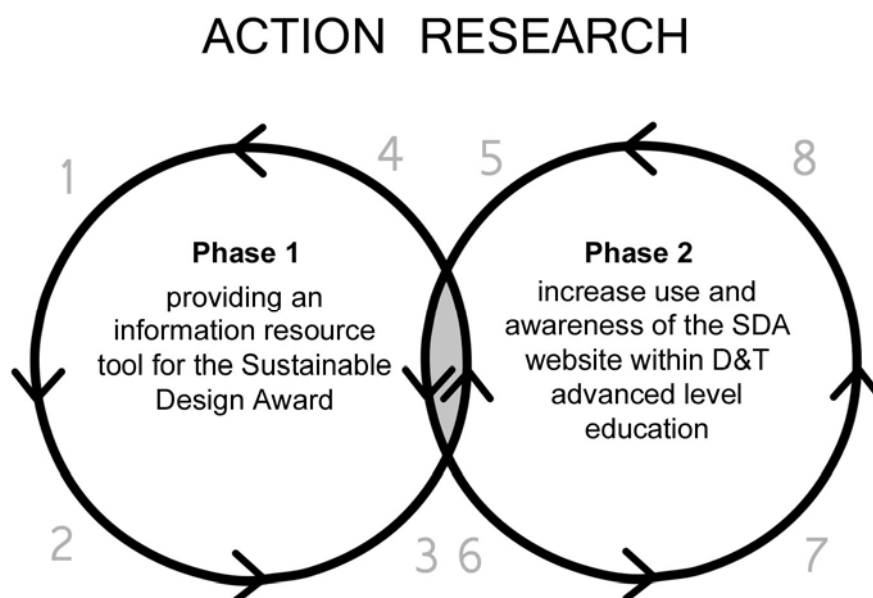


Figure 2: an overview diagram of SDA action research

Judgements were made on the success of the SDA website, and as a result, recommendations for further developments to have a greater impact and appeal to teachers and students were made. Figure 2 shows both phases 1 and 2. It is an

overview of the process of the SDA introducing information resource tools (phase 1: 1 to 4), and then looking at the use of the SDA website specifically (phase 2: 5 to 8). These are given in more detail in Figure 3 and Figure 4.

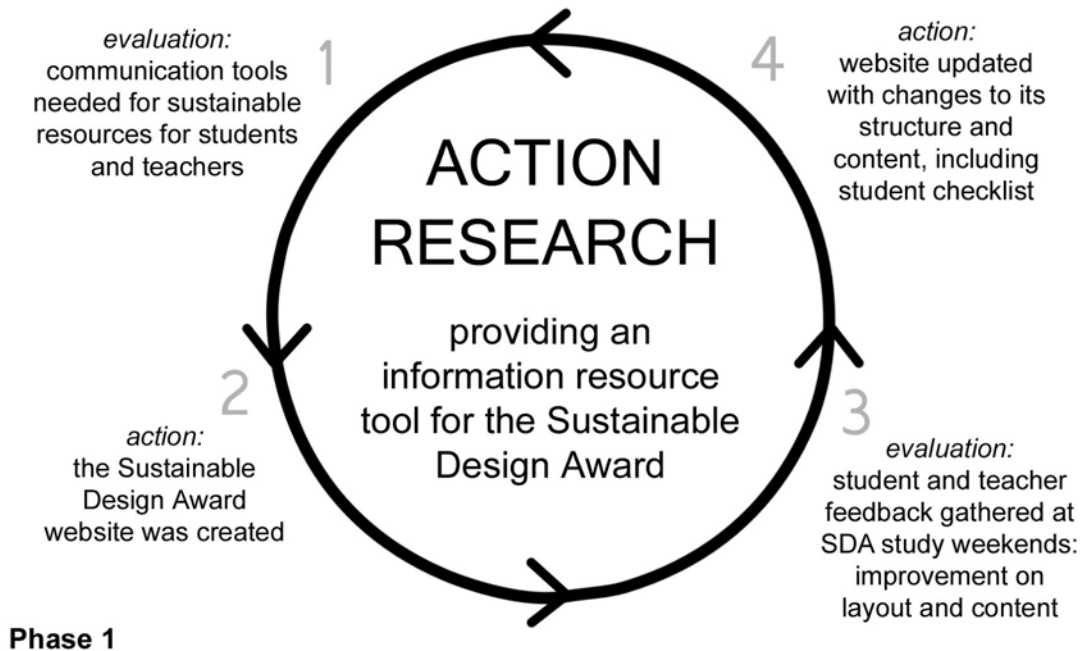


Figure 3: (phase 1) the SDA action research method diagram

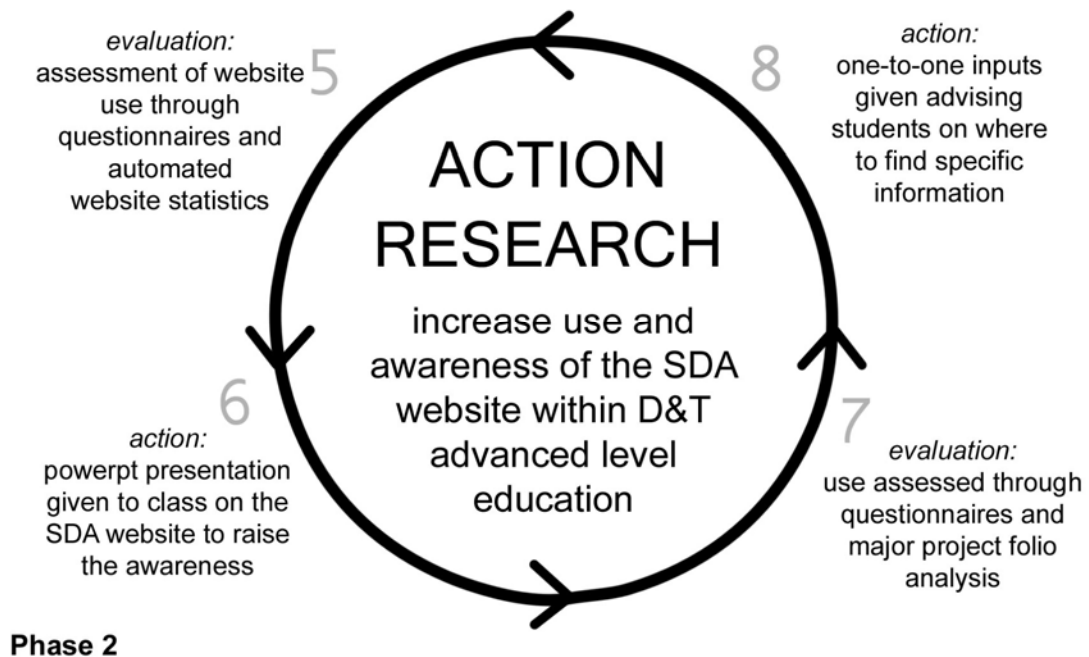


Figure 4: (phase 2) SDA website effectiveness action research method diagram

Communication has proved a vital component in the development of the scheme to both teachers and students through different forms of media, from handbooks to teaching sessions and a dedicated website. From training days to key one-to-one inputs in schools, the SDA scheme aims to raise the profile of sustainability for the designers of the future. The need for a website became a viable option to the SDA Steering Committee, both in terms of funding and use. The website would be a versatile and accessible resource for both students and teachers to reach key information to support their educational needs. The Sustainability Handbook and other SDA resources would support this by advertising the website as a useful resource tool. As such the website could be seen as an action taken by the SDA to enable sustainable design practice to become an integral part of 16+ Design and Technology education for students in England and Wales.

An initial website was set-up and developed through feedback during a number of study days held by the SDA. Both students and teachers were asked to give feedback (Figure 3) via group PowerPoint presentations. The feedback proved useful in refining the website, and as a result key changes were made; splitting the website into a 'teachers' and a 'students' section and adding a checklist for students to use during their project work.

The Sustainable Design Award website ([www.sda-uk.org](http://www.sda-uk.org)) averages around 13,700 visits a week (MediaHouse 2006), the majority from academic servers. The SDA website has become a practical way of making sustainable design information available to students. These website statistics indicated that the website is being accessed by a number of people at least weekly. Data was also gathered via questionnaires in classrooms, this looked at website usability, website use in general and specifically at sustainable design websites when students used websites in their work, and what information they were looking for.

The research sought to investigate the impact of the SDA and its website at both AS and A2 level, and decipher how regularly websites in general, sustainable design websites and the SDA website were used. It also looked at the stages at which the websites were being used during designing. This information would help to progress the research study as it would help to assess where the SDA website had been effective in meeting the needs of its primary target audience.

A questionnaire (Figure 5) was derived from the research questions of the main



study. Its focus concentrated on the use of websites within design and technology and at what stage during designing they were utilised. The questionnaires were initially trialled at 'School A' with 11 advanced level students, and it was then later refined for the main study.

Name..... Age 18.....

~~SSOP~~ A2 Graphic products

**Sustainability and website use in design projects**

1) What is your background in sustainability? Have you studied it as part of your design lessons?

Yes. In Graphic products as part of my project I decided to do the sustainability award

2a) Are you taking part, or considering taking part, in the Sustainable Design Award?

Yes. I'm doing the second part of the award

2b) Have you been on any study days/weekends such as the Sustainable Design Award?

No

3a) Have you used any websites in general to help with your design work, if so, which ones?

Sustainability website

3b) When do you use websites in your design work? (please tick as appropriate)

0-30 days into your project: all the time  sometimes  rarely  not at all

30-60 days into your project: all the time  sometimes  rarely  not at all

60-90 days into your project: all the time  sometimes  rarely  not at all

More than 90 days: all the time  sometimes  rarely  not at all

4a) Have you used any sustainable design websites? If so, which ones? Which parts, if any, did you find useful?

Information on economic & social issues

4b) When do you use sustainable design websites in your design work? (please tick as appropriate)

0-30 days into your project: all the time  sometimes  rarely  not at all

30-60 days into your project: all the time  sometimes  rarely  not at all

60-90 days into your project: all the time  sometimes  rarely  not at all

More than 90 days: all the time  sometimes  rarely  not at all

4c) Which parts of sustainable design websites did you like and dislike?  
*The help with the course work and areas of sustainability to do with the experts*

5a) Have you been on the Sustainable Design Award (SDA) website? Which parts, if any, did you find useful?  
*Yes, the ecoweb analysis was very useful*

5b) If yes, when did you use the SDA website in your design work? (please tick as appropriate)

0-30 days into your project: all the time  sometimes  rarely  not at all

30-60 days into your project: all the time  sometimes  rarely  not at all

60-90 days into your project: all the time  sometimes  rarely  not at all

More than 90 days: all the time  sometimes  rarely  not at all

5c) Which parts of sustainable design websites did you like and dislike?  
*I liked how they simplified the information making it easier to understand*

Thank you for your time and feedback.

Figure 5: Example of the refined website use questionnaire

\*note 'all the time' was explained as every two days

Five schools participated in the study, four who volunteered at a SDA study weekend and one other, covering 72 students aged 16-18. The results of the questionnaire indicated that sustainability is a prominent part of design and technology education with 78% having had some sustainability input. Around two thirds of the students were intending to take, or had taken, the Sustainable Design Award.

79% of students said that they had used websites within their design work and that this use was more frequent at the start of their design projects. The use of websites was seen to decrease throughout a project. This was a trend throughout the results for both sustainable design websites and the SDA website. Around half of the students had used sustainable design websites but only 28% of the students had used the SDA website (Figure 6).

Have you used the SDA website to help you during your AS/A2 level major project design work?

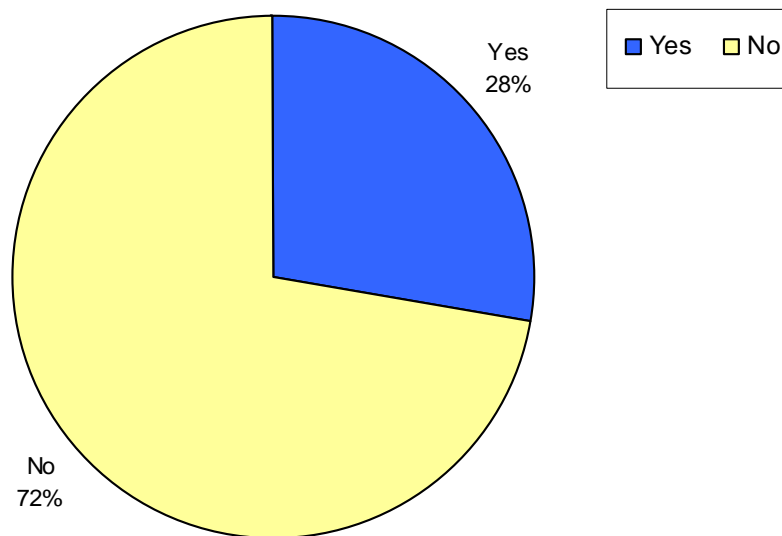


Figure 6: Sustainable Design Award website use chart

## 4 The second action research cycle: classroom inputs

Initially there was no action taken as such, the students were merely asked key questions relating to website use in Design and Technology. This assessment was deemed important in order to have a foundation upon which other actions could be implemented. The next phase of the research looked to assess the impact of the group PowerPoint presentation (see Figure 7 for example of one slide in PowerPoint presentation) that outlined the areas of the SDA website, pointing the students to relevant areas for their design folio work. This reassessment embraces the idea of a cyclic method as used by practitioners in their research work (Figure 1).

- The signpost asks you to pick where you are in your project
- 'I need help' takes you to various design contexts and ideas for projects
- Vast amount of information and resources on specific sustainability areas set by CAT, Practical Action & Loughborough University

Figure 7: An example of a page from the Powerpoint presentation

This section of the paper relates to classroom inputs that are shown as number '6' in Phase 2 (Figure 4). In this instance the SDA steering committee felt that communication tools were needed to help implement sustainability in Design and Technology education. This outlines the actions taken to achieve this through the introduction and evaluation of the SDA website. The conclusions from this input/action would help to shape further proposed actions in order to assess website

use and website effectiveness.

This second phase indicated that a large number of the students were not considering sustainability when looking for design information. When using web-based resources their focus appeared to be on other areas (Simmons and Badni 2007). The students that had accessed the SDA website had used it throughout their project, but with only 28% of the students using it, this may suggest a greater focus is needed in motivating designers to access the website in the first place. Several actions that focus on improving the 'before use stage' phase of websites were therefore proposed (Simmons and Badni 2007).

These actions looked at introducing the website to classes as a group and giving one-to-one design consultancy with students, advising them on key areas of the SDA website that were applicable to their work. Students were also introduced to the Sustainability Handbook by their teachers that referenced many pages on the SDA website specifically.

After the questionnaires (Figure 5) were completed, a further action was taken by introducing the students to the SDA website through a group PowerPoint presentation (Figure 7). This aimed to raise the awareness of the website within the class so that students could use it to help with their design work. Some of the students had been on the website but not seen all of the specific areas, such as the materials selection pages. However the majority had not been on the website at all.

The PowerPoint presentation illustrated the various pages of the website available to students, highlighting areas that may prove useful in their design work. Further trials have been planned to assess the impact of this group input on the website use and content.

## 5 The second action research cycle: consultancy sessions

After the second action research cycle, classroom inputs, it was felt that the next phase of analysis should involve an assessment of whether the actions taken during classroom inputs had any affect in improving the use of the SDA website (number '8' - Figure 4). The analysis was also designed to enable a comparison of the initial findings that looked at website use. This information was gathered through questionnaires similar to those used in the classroom inputs (Figure 5).

School D, Trial B1, Student 117

Name: \_\_\_\_\_ Age: 18  
AS or A2: A2 Examination board: OCR  
Project title: Recycling bin

**Sustainability and website use in design projects**

**Student Notes**

1a) When do you use websites in your design work? (please tick as appropriate)

0-30 days into your project: every 2 days  sometimes  rarely  not at all   
30-60 days into your project: every 2 days  sometimes  rarely  not at all   
60-90 days into your project: every 2 days  sometimes  rarely  not at all   
More than 90 days: every 2 days  sometimes  rarely  not at all

1b) What were you looking for?  
I was looking for existing products which would guide me in the direction of a understanding a sustainable design and product. I also wanted to explore a range of ideas for this.

1c) How long did it take you to find it?  
I spent about an hour searching for a range of ideas.

2a) When do you use sustainable design websites in your design work? (please tick as appropriate)

0-30 days into your project: every 2 days  sometimes  rarely  not at all   
30-60 days into your project: every 2 days  sometimes  rarely  not at all   
60-90 days into your project: every 2 days  sometimes  rarely  not at all   
More than 90 days: every 2 days  sometimes  rarely  not at all

2b) What were you looking for?  
I was looking for ways in which I could make my design as sustainable as possible.

2c) How long did it take you to find it?  
I only searched about an hour in different areas for a range of ideas.

3a) When did you use the SDA website in your design work? (please tick as appropriate)

0-30 days into your project: every 2 days  sometimes  rarely  not at all   
30-60 days into your project: every 2 days  sometimes  rarely  not at all   
60-90 days into your project: every 2 days  sometimes  rarely  not at all   
More than 90 days: every 2 days  sometimes  rarely  not at all

3b) What were you looking for?  
Here I was looking for ways to improve my design with the website from ideas and choices given.

3c) How long did it take you to find it?  
I was told to use it by my teacher. I spent about 30 mins using it.

Thank you for your time and feedback.

Figure 8: An example of the second website use questionnaire

Whilst these questionnaires (example provided in Figure 8) were being completed, detailed notes were taken when looking at the student's design folio work for their advanced level major project. Photographs were taken of this work (Figure 9), and where possible copies of the work were collected. The notes (Figure 10) highlighted any reference to use of the internet and any reference to sustainability issues within the student design folios. The notes were cross-referenced with these photographs and folio copies.

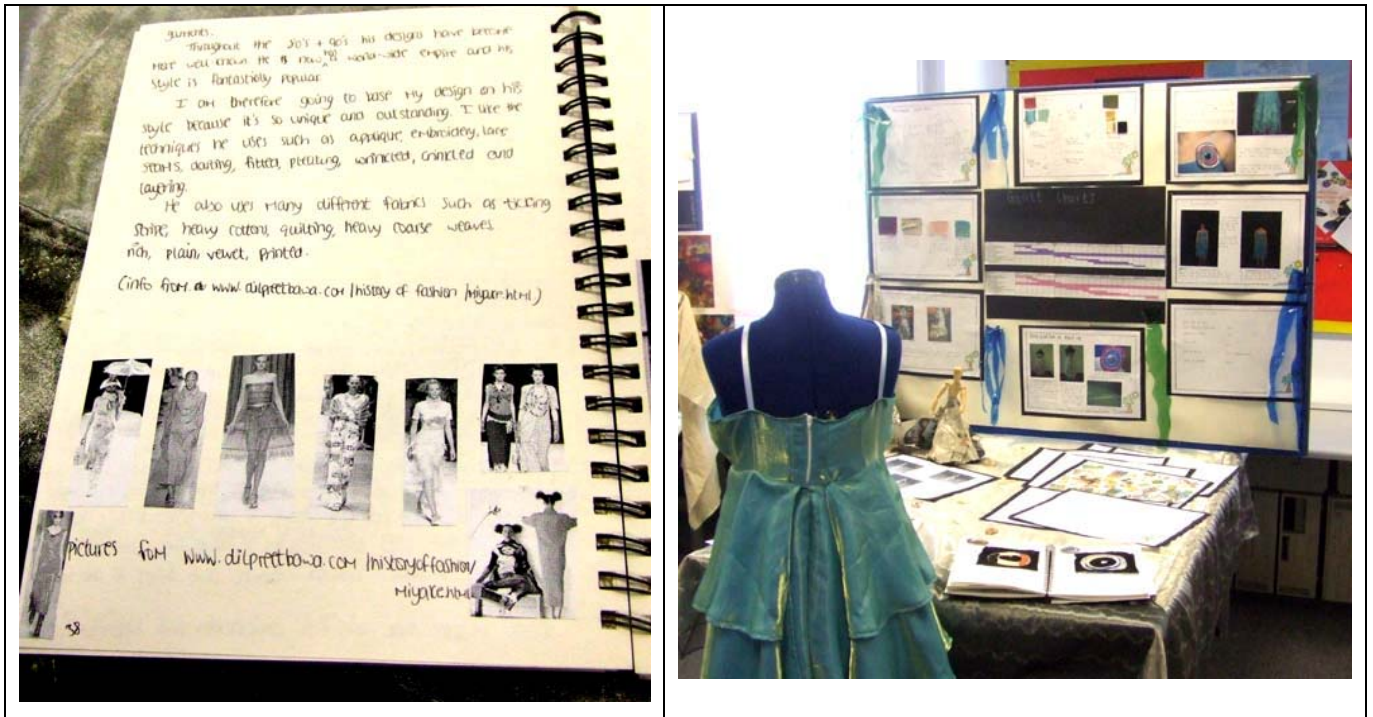


Figure 9: Example of the photographs taken of the folio work

Once these notes were completed further additions were made to the notes by the students who were asked some follow-up questions to help expand on any key areas of their work. Again the students were able to point out any moments during their folio work where they used websites or referred to sustainable design principles. Another action was then taken by advising the students of specific areas of the SDA website that would help them with their project work. This advice was again documented as part of the research data (Figure 10).



Observations	Photo ID	Student additions	Follow-up questions (prompts)	Advice
environmental concerns. ↳ looking for existing products.	p8	built up → why October/Nov. flicking through to start.	a) What issues were you explaining? b) Did you consider using websites to help? c) Which one did you look at? d) Did they help, if not why not?	adjustment of chair for size/age nontoxic fabrics etc.
Existing methods of storage. ↳ medical equipment	p8	skopos penne outdoor. fabrics Davesby	SDA website. ↳ material we fabrics.	
blank up design	p17			

Figure 10: Example of the notes taken from the folio work

The consultancy sessions enabled a more detailed analysis of website use during student's design folio work. It helped to indicate what students were using the websites for, the type of websites they used and when they used them. It also revealed how sustainability has started to integrate into mainstream Design and Technology education. The questionnaires enabled a comparison of the initial information gathered on student website use with their use after the initial input on the SDA website. It also helped to indicate what the students look for when accessing the websites during their design folio work.

## **6 Conclusion and Future actions**

As a research method 'action research' has proved an invaluable tool in assessing website use at post-16 education level. Action Research does have its disadvantages as it can be seen as a very specific form of research of which the findings may only be applicable to a very narrow set of users or circumstances. For the study outlined in this paper the method of research has been suitable, as it is within a defined user group that the study was designed to address. Its nature has enabled an informed response, with questionnaires and design consultancy feedback being used to help indicate several key trends in website use with 16+ students.

The action research process in this instance took the form of gathering data, taking an action, evaluating that action and then gathering more data. This cycle of evaluation and data gathering allowed for a reassessment of the students work to help to confirm the findings of the initial studies. The iterative nature of action research also allowed for several key variables to be altered to help to reach conclusions. It also indicated areas that need more investigation.

The classroom inputs that were part of the second action research cycle, did indicate that the actions taken had had an impact on improving sustainable design website use within classrooms. The consultancy sessions which were part of the second action research cycle focussed more on one-to-one consultancy but based around the same questions. This allowed for a comparison between the two trials. Similar trials could then be made for different audiences to reach more generalised conclusions across a broader range of designers.

The major benefit of the research method is that the information is gathered through direct contact with people in a natural environment. This allows for a natural assessment with the students performing acts which are part of their coursework rather than the researcher creating staged or experimental studies on which to gain feedback. It allows for observation, questionnaires and one to one consultancy without hindering the validity of its outcomes. Action research has enabled a unique assessment of website use with users and their folio work. The information generated is in varying forms; photographs, copy of folios, user notes, discussion, focus groups and questionnaires. This presents the whole picture of designing through differing methods that reflect the act of designing itself.

The main SDA programme funding ran from 2002-2007, and the SDA steering committee produced a number of resources that aimed to continue beyond this funding as self-running activities. The scheme would continue but through use of the SDA website, the Sustainability Handbook and other similar resources. The training of sustainable design teachers within different areas of the United Kingdom would also play a role in the success of sustainability within schools.

As indicated in this paper (Figure 6) recent research has indicated that only 28% of the students questioned have used the SDA website. This is an area that clearly needs addressing if the SDA scheme is to rely on the website for its continuation.

Future actions will look at the 'before use' phase of website usability, focussing on awareness raising at undergraduate and professional level. This will enable an iterative style of research using the same actions and analysis, but with a different target audience.

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