# Sustainable design and website use amongst AS/A2 Level design and technology student projects

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## Abstract

This paper examines current design thinking, and design practice within AS/A2 Level design and technology. The paper focuses on website use within AS/A2 Level design folio work, and the use of sustainable design websites. It reports the research data gathered from two trials, illustrating the engagement with sustainable design, websites and sustainable design websites within student design folio work. The paper gives several specific examples of current practice in these areas, highlighting current trends within AS/A2 Level design and technology education.

## Key words

Sustainable development, effectiveness, websites, impact, website use, design and technology

## Introduction

The integration of sustainable development into design and technology education has been a focus for educational institutions and charitable organisations since the Brundtland Report on 'Our Common Future' (Brundtland 1987). This focus has intensified as sustainable development has taken hold in global politics and started to prove a viable marketing tool to businesses. Consumer demand for more sustainable products that address environmental, social and economic issues has helped to integrate these policies. 'Many suppliers are now being asked to meet their customer's environmental requirements' (Bhamra 2004:557). In schools, Awarding Bodies in England and Wales have integrated sustainable design principles into their syllabuses, and the Sustainable Schools (Government 2006) initiative was introduced in 2006 by the United Kingdom government to act as a driver for change. For designers, whether students or professionals, the integration of sustainable development into mainstream design immediately creates a need for more design strategies, knowledge and information on sustainable practices (Simmons 2008).

In order to address sustainable development, an understanding of the issues is needed in order for the designers to make their own judgements; there are no set right or wrong answers. Choosing one material to use over another based on its environmental, social and economic benefits requires a broad understanding of the contributing factors e.g. the source of the material, its transportation, processing, and toxicity consequences. Combine this with some of the other drivers behind design decisions (e.g. cost, client needs, material properties), and it is clear that with the many variables relating to the numerous decisions that designers must make, complex judgements are necessary.

When discussing these issues Norman concluded that the 'information requirements will increase as the designers role widens, and it is inevitable that the internet will play an increasing role in helping to meet designers' information requirements' (Norman 2006:28). Rather than scouring through books and journals, designers now use interactive resources such as the internet to find information (Simmons and Badni 2007a). Once this information has been gathered, or not gathered as the case may be, the designer makes decisions based upon the information they have, the skills they possess and the values which they hold (Lillis and Clark 2008:2).

In this paper the role that the internet plays in supporting sustainable design within AS/A2 Level design and technology are reported. The current structure of AS/A2 syllabuses are described in order to indicate the opportunities that students and teachers have to integrate sustainable design into their work. The research study reported concerns the evidence provided from the detailed examination of students' design portfolios to reveal their use of the internet. In order to provide the context for this research the results of wider survey of the internet use of a larger sample of students are noted. These results have been previously reported.

## AS/A2 Level design and technology

Approximately 3,300,000 pupils attend secondary education in England, with the subject design and technology (D&T) compulsory until they have completed Key Stage 3 (Pitt and Lubben 2007:6). Pitt and Lubben found that around 55% of the pupils choose to continue D&T into Key Stage 4 choosing between: resistant materials, electronics, food technology, textiles, graphic products, and systems and control. The element of designing and making products is a common thread throughout these Key Stage 4 subject choices. At the end of Key Stage 4 students take examinations called GCSEs (General Certificate in Secondary Education). Once they have completed their GCSEs the pupils have an option to

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continue their studies for a further two years. These two years are called Advanced (A) Levels. The first year is known as Advanced Supplementary (AS) and the second year A2. Of the 214,000 who were studying A Levels in England in 2005, 17,900 (8.4%) did D&T. 23,700 pupils took AS level that same year (Pitt and Lubben 2007:7).

The A Level course comprises of 6 modules, 3 in AS and 3 in A2, which include design and make projects. The Qualifications and Curriculum Authority (QCA) are the UK government examination regulator. The QCA regulates four Awarding Bodies: the Assessment and Qualifications Alliance (AQA), Edexcel, the Welsh Joint Education Committee (WJEC) and the Oxford Cambridge and RSA Examinations (OCR). Each school can choose which Awarding Body specification they would like to follow. Figure 1 illustrates the outline structure set out by each Awarding Body showing which design and technology courses they offer.

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 in Wales and Twente University in the Netherlands (Capewell and Norman 2003). The SDA was introduced to increase awareness of sustainable development and place it firmly

on the education agenda in design and technology at AS/A2 Level. *Figure 1* shows the outline structures for the AS/A2 Level design and technology programmes offered by the Awarding Bodies. Sustainable design is applicable to the majority of coursework projects and many of the examination paper topics illustrated in *Figure 1*.

The SDA offered two strategies to support AS/A2 Level design and technology. Firstly, students were introduced to the environmental, social and economic dimensions of sustainable development through product analysis. The SDA also sought to show how these principles could be applied to the student design projects. Secondly, the SDA intended to generate ideas for students' own project work, providing students with access to further sustainable design information and resources, and offer support to their projects (Daniel 2003).

The integration of sustainable development into AS Level design and technology would vary depending on the examination board. For A2 Level design and technology students there would be less variation in the SDA marking criteria. All of the awards would be judged on the integration of sustainable development issues into the students' major designing and making project (Daniel 2003).

| Examination Board | Edexcel | AQA | OCR | WJEC |
|---|---|---|---|---|
| **D&T Courses Offered** | DT:Food Tech. DT:Product Des - Res. Mat Tech - Graphics with Mats - Textiles Tech. DT: Systems & Control Tech | DT:Food Tech. DT:Product Des - Textiles Tech. - 3 D* DT: Systems & Control Tech | DT:Product Des DT: Systems & Control Tech | DT:Product Des DT: Systems & Control Tech DT:Food Tech |
| Unit 1 | Industrial & Commercial Practices 11/2hr paper. (EA) 30% | Materials Paper 11/2hr paper (EA) 30% | System Case study – 20 hrs. Investigate a system set by OCR – examples given. Students chooses specific context. (EA) 30% | Written Paper – 21/2hrs Designing and innovation. Prod analysis, mat's and components. Industrial and commercial practices. (EA) 30% |
| Unit 2 | Product Dev (IA) 40% | Project Coursework. Approx 50hr. Either Project/s (IA) 40% | Product Study - analysis and development. 50%product analyses and 50%testing for modification. (IA) 40% | Design and Make task – one product (25hrs) plus folder(15hrs) (IA) 40% |
| Unit 3 | Materials components and systems 11/2hr paper (EA) 30% | Design Paper (2Hrs). Theme sent to centres. Students not allowed to use research in exam. (EA) 30% | Written Examination (EA) 30% | Case Study – 5-10day work placement – (EA) 30% |
| **A2 Assessment Units (50% overall)** | | | | |
| Unit 4 | Further study of Materials, Comps and systems. 11/2hr paper. (EA) 30% | Product Study. Approx 25hr In-depth study of designing and making product. Can combine with work experience. (IA) 30% | Designing – 40hrs. Topic selected by candidate. (IA) 30% | Written paper (3hr) themes human responsibility, processes, public interaction, production systems and control. (EA) 40% |
| Unit 5 | Product Development Coursework (IA) 40% | Project . 50hr. Using any materials. Assessed by D&M criteria (same as for AS level – but top band only for A2) Exemplar tasks (IA) 30% | Making and Evaluating – 40hrs(IA) 30% | Designing and Making: 8 themes to choose. Optional personal choice. (IA) (60%) |
| Unit 6 | Design and Technology Capability. 3hr Exam. (EA) 30% | Examination Paper (3hrs). 3 sections, Materials classification, Design and market influences, processes and manufacture (EA) 40% | Written Examination – 21/2hrs 5 Design problems. (EA) 40% | |

*Figure 1: the outline structures of AS/A2 level Design & Technology for Awarding Bodies in England and Wales (Hellier 2007)*

# Sustainable design and website use amongst AS/A2 Level design and technology student projects

Potentially sustainable development may present insurmountable barriers to design and its practitioners. The 'challenge for designers is to find meaningful tools which engage with the design process and help them to tackle design for sustainability' (Bhamra and Lofthouse 2007:65). Quick, easy-to-use tools that focus on detailed information e.g. how a material is manufactured or the weight of a material when considering transportation issues. Eco-design tools may provide the information needed to help designers make quick but decisive judgements, rather than relying on searching through vast amounts of information that covers sustainable design more generally.

The results of several 16+ based student trials (Simmons and Badni 2007b) showed that addressing sustainable design issues was, for at least some students, now part of practice in Design and Technology education within England. In order to support these developments, the SDA have funded several resources, including the SDA website (www.sda-uk.org). This was seen as a suitable channel to communicate with students and teachers, who would then be able to access the information that they needed (Simmons and Badni 2006). Sustainable design tools were expected to be an important feature of the SDA website and appropriate tools were specially developed (shown below).

According to the SDA website statistics, the SDA website averages 13,700 visits a week (MediaHouse 2006), the majority from academic servers. The SDA steering Committee ran various feedback and improvement sessions in order to establish the content required by the students and teachers. The website has provided a practical platform for making this information available.

## Sustainable design tools

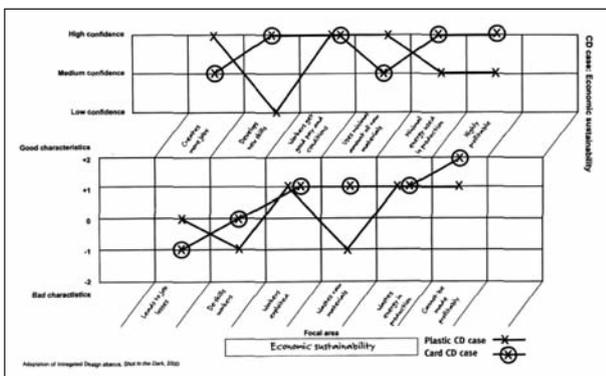Sustainable design tools have been developed to help designers make design decisions when sustainable design issues are at the fore. There are various tools available for designers to use. Bhamra and Lofthouse (2007) split these into five sections:
- environmental assessment;
- strategic design;
- idea generation;
- user centred design;
- information provision.

Three of the sustainable design tools that were developed by the SDA for use within AS/A2 level work are; the design abacus (Figure 2), the eco-design web (Figure 3), and eco-indicators (Figure 4). Each tool has a basic framework which designers can apply to their own projects and considerations. The design abacus and eco-design web are reliant on the designer making their own judgements; using their own knowledge and values. In contrast, the eco-indicator relies on the knowledge, and to some extent values, of 'experts' who have given each material/process grades relating to its sustainability. This reduces the judgements that a designer has to make or at least the knowledge base that he/she has to have, and thus markedly reduces the time required for each decision.
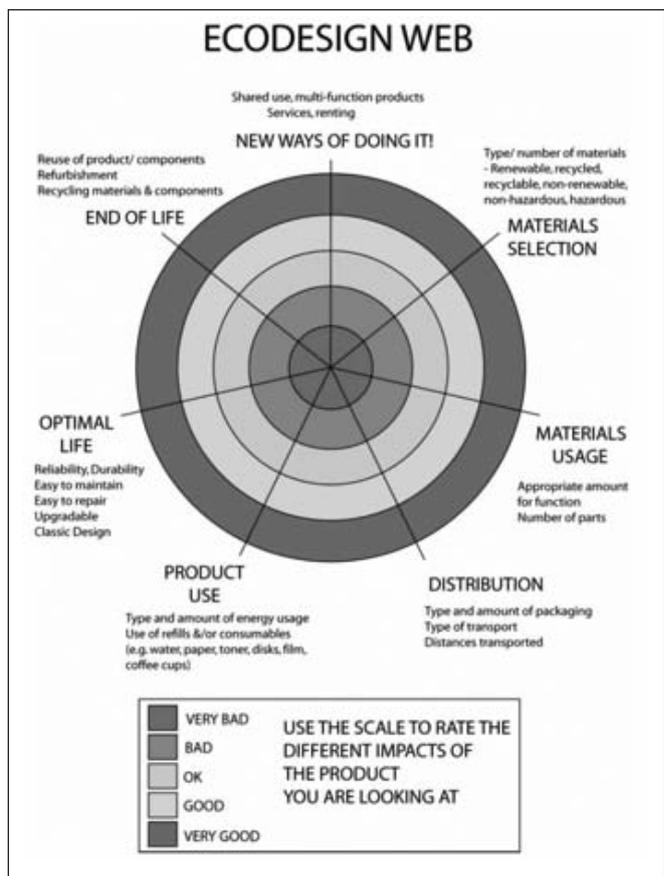


*Figure 2. the design abacus, example from www.sda-uk.org (SDA 2004)*



*Figure 3. the ecodesign web, example from www.sda-uk.org (SDA 2004)*

# Sustainable design and website use amongst AS/A2 Level design and technology student projects

**Context for the reported research findings**
A three year PhD research project looking at the effectiveness of sustainable design websites has been established for completion between 2005 and 2008. A key aspect of this research comprised of two trials within design and technology AS/A2 Level education. The detailed results of the first trial, Trial A, were published at the Linking Learning: The Design and Technology

Association Education and International Research Conference in 2007 (Simmons and Badni 2007b).

Trial A consisted of the gathering of feedback on website and sustainable design use within design and technology via a questionnaire followed by an input on sustainable design and in particular the Sustainable Design Award (SDA) website. The aim of Trial A was to research how regularly websites in general, sustainable design websites and the SDA website were used. The researchers also focused on when the websites were used during design projects.

Five schools participated in Trial A, four schools who had volunteered at a SDA study weekend and one other. The trial involved 72 students aged 16-18 all studying design and technology at AS/A2 Level. As might be expected the results of the questionnaire used in this trial indicated that sustainable development is a prominent part of design and technology education for this sample with 78% having had some sustainability input. Around two thirds of the students were intending to take, or had taken, the SDA.

The majority of the students (79%) 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. There was a similarly reducing pattern of usage for both sustainable design websites in general 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.

This paper reports the findings from Trial B that comprised of the reviewing of a smaller sample of student design folios, a follow-up questionnaire and the recording of direct consultancy advice given to the students. The latter is an indication of sustainable design issues that the students might have considered and that associated websites might have supported.



*Figure 4. the eco-indicator, example from www.sda-uk.org (SDA 2004)*

# Sustainable design and website use amongst AS/A2 Level design and technology student projects



*Figure 5. An example of the Trial B website use questionnaire*

## Data Collection
### Trial B: design folio examination and consultancy

Trial B consisted of 18 student case studies from two of the schools used in Trial A.

The students were chosen at random and included a mixture of AS and A2 Level students. The students had different levels of sustainable design knowledge and competency of website use. The analysis was designed to enable a comparison with the initial findings from Trial A that looked at overall website use and deeper analysis of such use. In order to facilitate the comparisons, information was gathered through questionnaires similar to those used in the Trial A. An input had been given to the whole group following the completion of the questionnaires in Trial A, which had raised awareness of the content of the SDA website. The questionnaires in Trial B enabled a comparison to be made in order to see whether this group input had influenced the use of the SDA website.

Detailed notes were taken of the design folio work whilst the students completed the questionnaires (example provided in Figure 5). Photographs of this work, and where possible copies of the work, were collected. The student design folios were examined for any references to any use of the internet or sustainable design issues. These were recorded (Figure 6) and cross-referenced to the photocopies or folio copies.

Through some follow-up questions the students were then asked to expand on these notes concerning any key areas of their work that had been highlighted. This helped to clarify their use of the internet or the sustainable design issue that they were addressing. The students were also advised of specific areas of the SDA website that may be able to help them with their project work. This advice was again documented as part of the research data (*Figure 6*).

This paper reports the collated results from Trial B, which indicated what students were using the websites for, the type of websites they used and when they used them. It also revealed how sustainable development has started to be integrated into mainstream design and technology education.

# Sustainable design and website use amongst AS/A2 Level design and technology student projects

School D, Trial B1, Student 113

| Observations | Photo ID | Student additions | Follow-up questions (prompts) | Advice |
|---|---|---|---|---|
| environmental constraints. ↳ looking for existing products. | P8 | built up → using 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 pennine outdoor. fabrics Dewesbury | SDA website. ↳ material use fabrics. | |
| blown up design | P17. | | | |

*Figure 6. Example of the notes taken from the folio work*

### The use of websites within AS/A2 Level student design folios

This section looks at website use within student design folio work for design and technology AS/A2 Level education. It illustrates when during the academic year websites were accessed, which areas students browsed when using the internet, and specific detail of what students used within their design folio work.

The graph in *Figure 7* illustrates where in the student design project the internet was used, and this has been illustrated through months of the academic year. October and November proved prominent months for website use with 21 and 24 instances of websites being accessed during those months respectively. AS/A2 Level students in England and Wales typically start their projects in September, and so October and November represent a period when the projects were likely to have been well underway. It was observed that during this period students
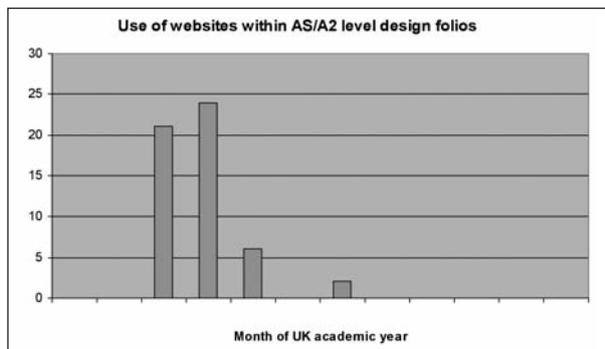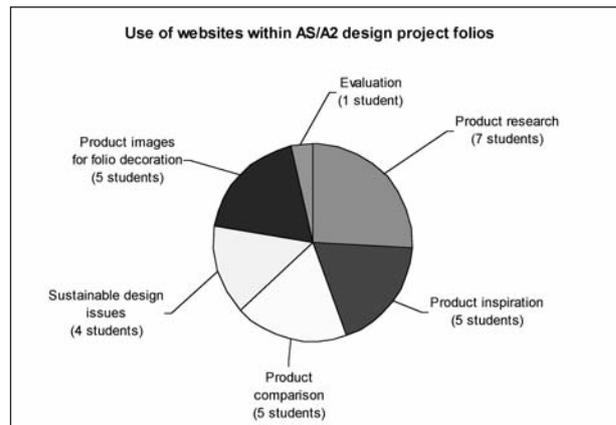
*Figure 8. Pie chart of what students are using websites for within AS/A2 student design folios*

are likely to be researching and developing their initial design ideas.

For many students use of websites within folio work has become second nature and almost an expected resource to be used within their work. The students appeared to access websites on a range of areas based around the current products on the market. These instances covered six different areas with varying degrees of regularity:
   • product research;
   • product inspiration;
   • target audience and product comparison;
   • sustainable design issues;
   • images searching;
   • evaluation.

*Figure 7. Use of websites within student design folios*
*Website case studies*

# Sustainable design and website use amongst AS/A2 Level design and technology student projects
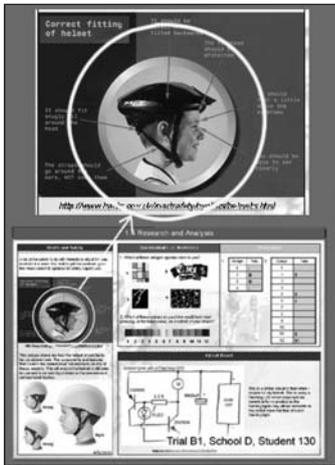
For each of these areas students had referenced a use of the website in their design folios, and examples of five of these are given below.

In *Figure 9*, student 130 refers to two instances within their design research where websites have been used to further their knowledge. The first instance looks at health and safety, and the second on circuitry for a flashing LED with a solar cell. In both cases the projects based large sections of their work on what was discovered. Such is the nature of the internet, that there is a danger that students could become reliant on inaccurate information. In this instance the student has used government advice on health and safety and so this information would appear to be reliable. But throughout the projects there seemed to be a sense of trust in information found on the web with very little questioning as to its validity.

Several students used images from the internet in their work, mostly looking at similar or inspiring products,

including the example shown in *Figure 10*. In this example, student 117 looks at images of current waste bins for inspiration in their own work. The student comments on the environment it would be used in, its bright colours, the materials used and its construction. These are all factors that may have influence during the later development of design ideas.

*Figure 11* shows product comparison being made within student folio work. Student 7 has used images of kettles and information taken from the internet to help them make comparisons between the different products available on the market.

*Figure 12* shows product images taken from the internet by Student 10 to include in their design folio work. In this instance the student has searched for images of antique coffee tables and collated them on a page in the folio. These were used to show the range of products currently on the market and used for inspiration for their design



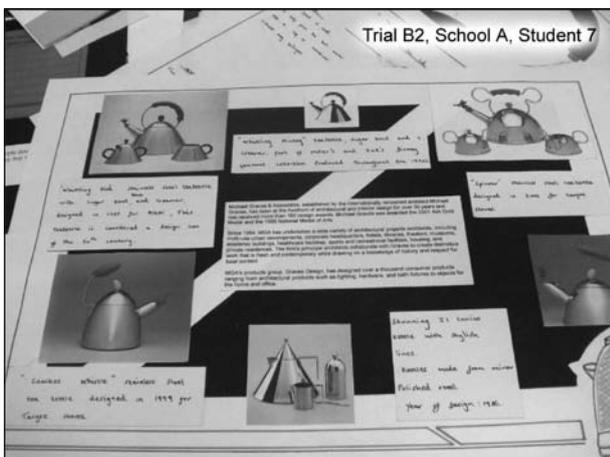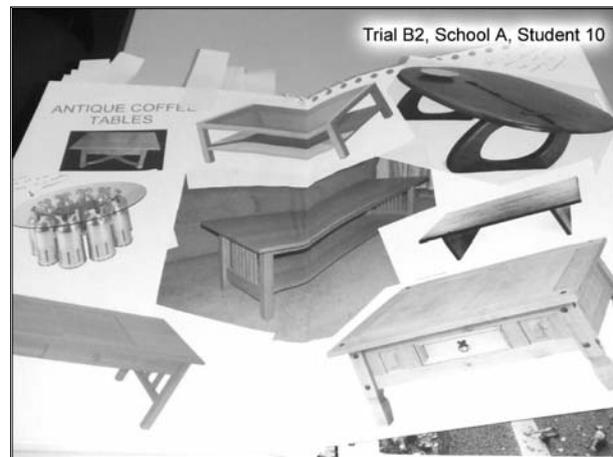*Figure 11. Example of product comparison within a student design folio*



*Figure 12. Example of image use within a student design folio*

# Sustainable design and website use amongst AS/A2 Level design and technology student projects

ideas. These findings would support the work of Nicholl and McLellan who explored fixation within Design and Technology at GCSE level (Nicholl and McLellan 2007). When students are designing a product, in this instance a coffee table, they look for inspiration at other coffee tables. Supporting the idea that 'thinking is constrained by what we already know and therefore imagination is structured in that people will generate ideas to given problems that are easily predictable. This suggests a default tendency to think along the path-of least resistance' (Nicholl, McLellan et al. 2008:17).

An area that was not so prominent in the design folios was the use of the internet during evaluations. However, one example was Student 127 in **Figure 13** used the internet for correspondence via emails to gain feedback on their work from potential clients and sales staff. Other internet facilities such as message-boards and chat forums were not used at all for feedback.
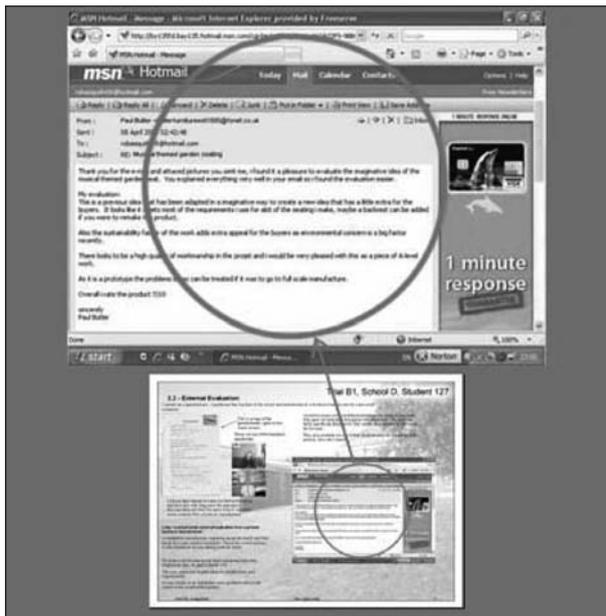


*Figure 13. Example of emailed evaluation within a student design folio*

### Sustainable design within AS/A2 Level student design folios

**Figure 14** shows the incidence of sustainable design issues within project folio work indicating the stage in the academic year they were prominent. Generally the students looked at sustainable design during the first three months of their design work. 5 instances of sustainable design activity were recorded for October whilst November saw the most focus on sustainable design issues with the students referring to sustainable design within their work 13 times.
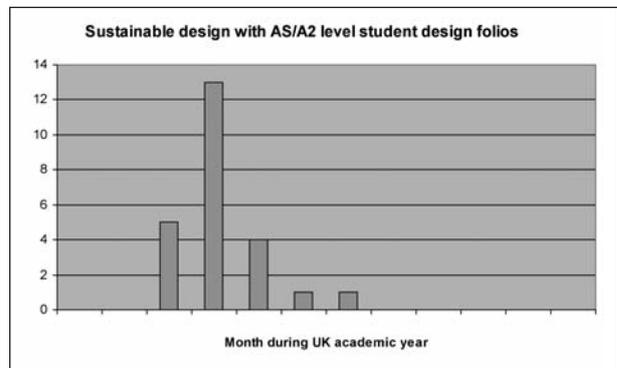


*Figure 14. Use of sustainable issues within student design folios*

This figure (14) decreases with four instances where sustainable design can be seen in the student design folios during work completed in December and just one instance in January and February. None of the students have recorded instances of sustainable designing after February.

The results indicate that students address sustainable design issues through product inspiration and material selection during the research and initial design phase of the project. During latter project activities such as modelling and making and associated evaluation, no sustainable design issues were recorded in the design folio work.

The areas of sustainable design explored in the student design folios are shown in Figure 15. The work showed three main areas that these students had concentrated on:
  • product disassembly;
  • materials and recycling;
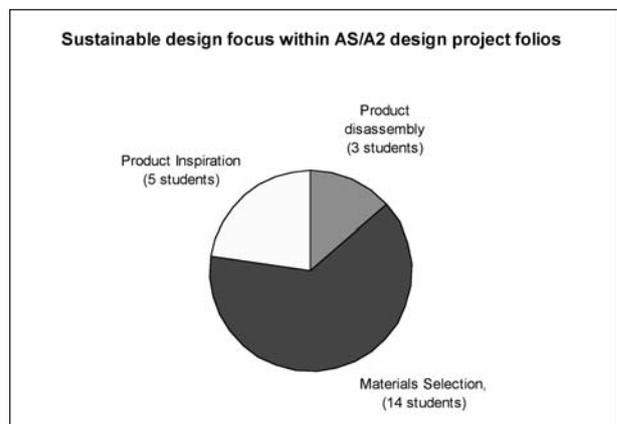  • product inspiration from existing sustainable products.



*Figure 15. Pie chart of sustainable design issues present within AS/A2 student design folios*

RESEARCH

# Sustainable design and website use amongst AS/A2 Level design and technology student projects

Trial B shows that three of the students in their research looked for information on product disassembly, five looked for inspiration through other sustainable products in the market and fourteen included information on sustainable materials and recycling in their design work on materials selection. On limited occasions the internet was used to gather this information.

### Sustainable design case studies

*Figure 16* illustrates two examples of student work that focuses on product disassembly within their design projects. It shows that sustainable design issues do appear in current design and technology practice. *Figure 16* shows the student considering using slots in the wood to join the materials to allow for an easy disassembly of the product. The product disassembly aspect would also indicate that students are considering sustainable design issues throughout a product's lifecycle (Bhamra 2004). Product disassembly may also influence other areas such as material selection and appropriate joining techniques.

Recycling and material selection were other areas that were highlighted in the student design folios. *Figure 17* shows two instances of this, the first image shows a list of recyclable materials collected to use within their design project. The second image highlights the choice of materials within their evaluation of products during their
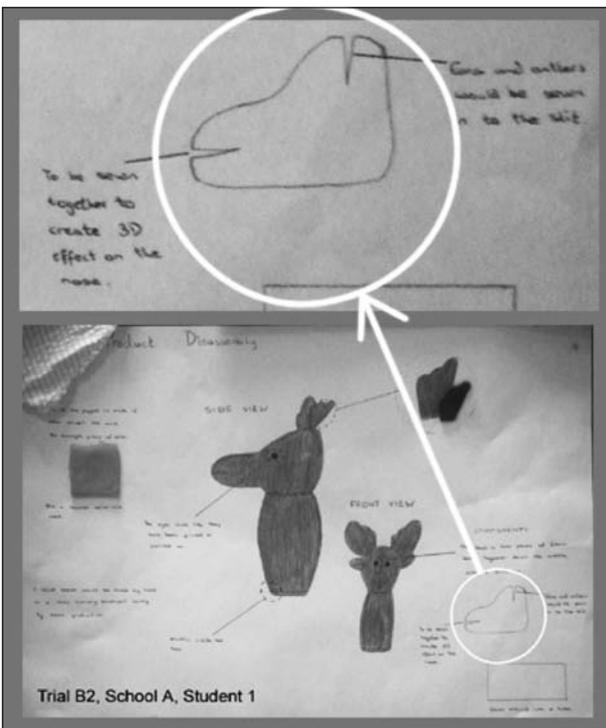
research. This was then considered when making choices for their own design project. Student 127, for example, produced a bench from reclaimed timber (Figure 17).

Other students' work, shown in *Figure 18*, illustrates sustainable products that have been used as examples for both comparison and inspiration. The ideas gathered from the internet, largely images, helped to inspire ideas within their design work. Its analysis and supporting product information may have helped the students make more informed decisions.

These examples are all useful in providing a detailed look at how students have engaged with sustainable design in some AS/A2 Level design work. They highlight areas of sustainable design that the students in Trial B were seeking to develop such as product disassembly and material selection.
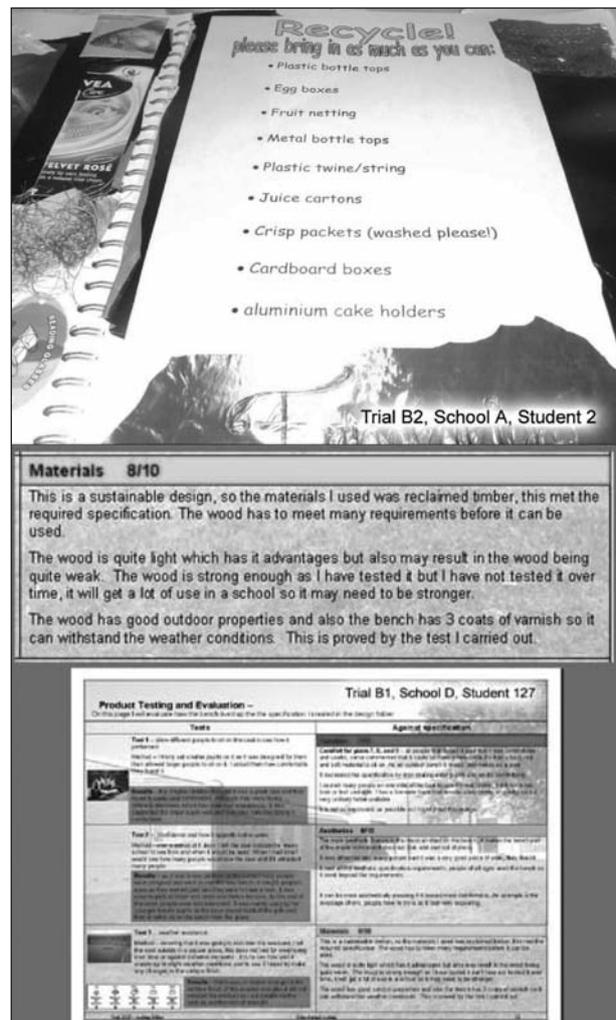
Figure 16. An example of a product disassembly sheet from a student design folio

Figure 17. Examples of materials and recycling sheets within student design folios

# Sustainable design and website use amongst AS/A2 Level design and technology student projects
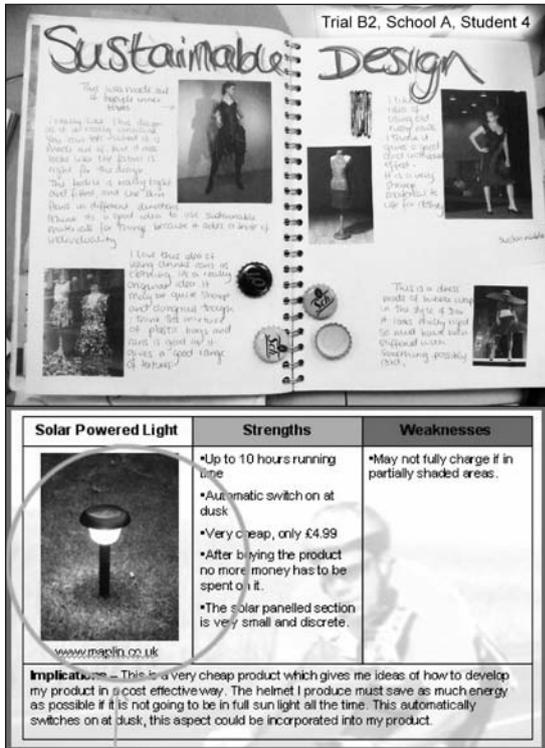
*Figure 18. Examples of comparisons between inspirational sustainable products within student design folios*

### The use of sustainable design websites within AS/A2 Level student design folios

*Figure 19* shows the use of sustainable design websites with AS/A2 Level design work gathered in Trial B. It shows when sustainable design websites have been used in the folio work investigated during the academic year. The results indicate that seven instances of sustainable design website use occurred in October. Six instances occurred in November with three being recorded for December. No sustainable design websites were looked at after December.
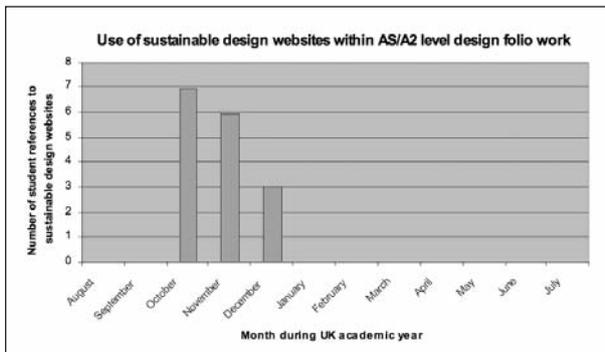


*Figure 19. Use of sustainable design websites within student design folios*
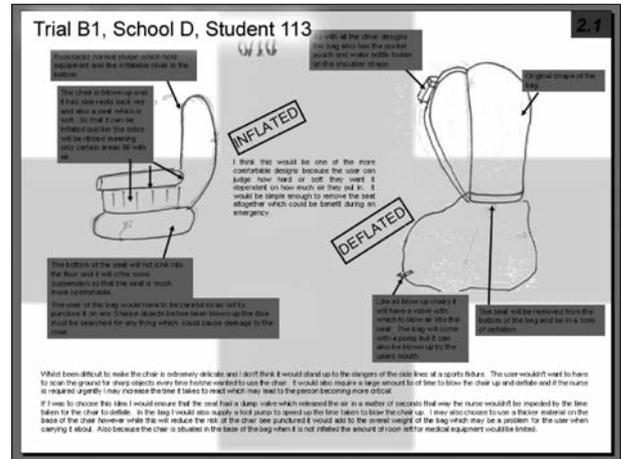


*Figure 20. Example of inflatable product idea taken from the SDA website*

### Sustainable design website case studies

Three of the students in Trial B indicated in their AS/A2 Level design folios that they had accessed the SDA website directly to help them with their work. Figure 20 shows an example where the idea of an inflatable product has been explored after looking through the inspirational products section of the SDA website. Student 113 notes that the inflatable idea may make the product more sustainable due to its ability to be reduced in size and therefore more could be transported during distribution.

Student 116 has used the SDA website at the start of their project, indicating sustainable materials will be considered during the project with the SDA website materials section being consulted (*Figure 21*).



*Figure 21. Example of specific information on materials being used from the SDA website*

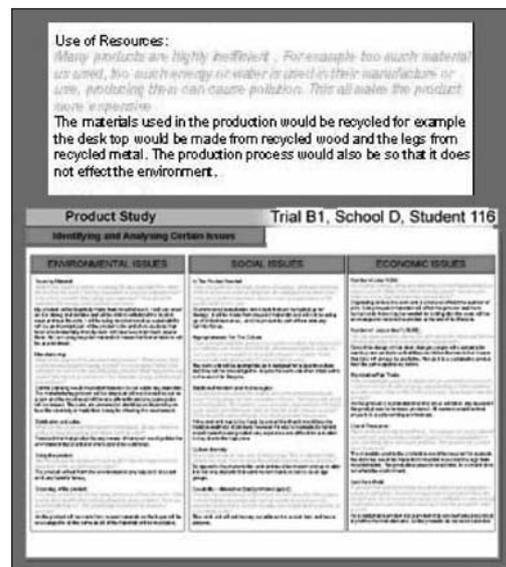# Sustainable design and website use amongst AS/A2 Level design and technology student projects

Information on sustainability issues was also identified early in student projects, Student 116, for example, uses the SDA website to help inform their project generally looking at materials and the impact on the environment: 'by visiting the SDA website I am able to gather information on how different materials and products affect the environment' (student 116: *Figure 22*).
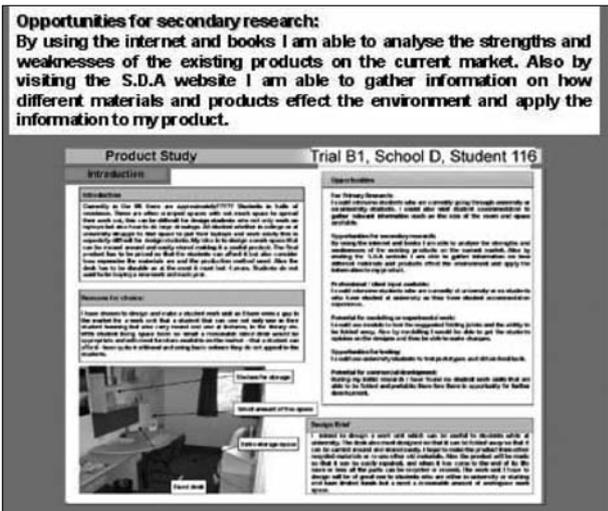


*Figure 22. Example of sustainability information being used from the SDA website*

The SDA website was again used during testing and evaluation at an early stage in the project by student 127 as shown in *Figure 23*. The website was used to help to evaluate materials, supporting the student with the information they needed in order to make an informed choice.
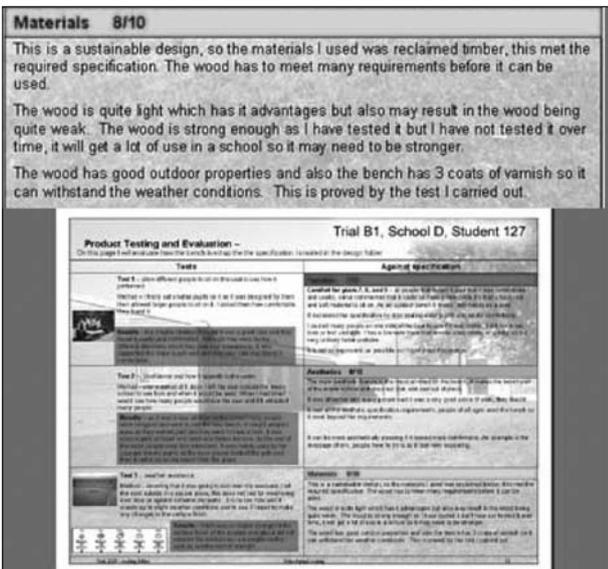


*Figure 23. The student uses the SDA website to help evaluate the materials use in some initial product testing.*

## Discussion and Conclusions

Website use within AS/A2 design project folios varied amongst the 18 students looked at in Trial B. Only one student used the internet to help evaluate their project, five of the students used images from the internet within their design folio work, and four looked at issues that could be considered as sustainable design issues. Product images on the internet were used for inspiration and visual product comparison by five students. The internet was used for product research by seven students, looking for specific information e.g. looking at a specific material's properties to help evaluate its suitability.

Despite an emphasis having been placed upon sustainable design tools as a key part of sustainable design education in the development of the SDA website, none of the students' folios showed any tools being used within their design folio work. Even though some of the students had been introduced to the sustainable design tools at the SDA study weekends, and used the SDA website, they did not use the sustainable design tools that were present on the SDA website within their design folios.

However, some sustainable design issues had been addressed in the AS/A2 Level design folio work looked at in Trial B. A few of the students had considered sustainable design issues alongside other factors that had arisen within their work, and it can be overlooked, just as other areas can be. A focus on educating designers about the importance of sustainable design, and where to access resources, may help to convey and implement sustainable design principles. Now that for some students sustainable design is an integrated part of their work, its prominence within work may become less clear. The research indicates that students are beginning to take on board issues such as disassembly, material selection and product inspiration in their project work.

The design folios analysed indicates that sustainable design issues are not considered throughout a design project at AS/A2 Level. Sustainable design issues seem to have some prominence at the start of AS/A2 student design projects in Trial B, but were not integral to every aspect of the students' designing. During the 'making' part of designing there were no mentions of any sustainable design issues within their folio work, such as process selection, evaluation or the use of eco-design tools.

Websites were used regularly in the AS/A2 design folio work examined. The students in this study used websites at the start of design projects to help address two main areas:
- specific information, for example legislation or material selection;
- general research looking at products on the market.

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Students looked at specific information to support their work, e.g. some of the students explored government legislation or properties of materials that could help them meet specification requirements. Some of the students reported in this study would use images from the web to 'decorate' their folio work as inspiration, or to help compare the latest products and technologies available.

Only four instances were recorded were students had accessed sustainable design websites, with the majority of those visits looking at the SDA website. Although 22 instances were recorded were students addressed sustainable design issues within their design work, sustainable design websites were only used on four occasions to support their work. When sustainable design websites were used, the information they found related to the same sustainable design issues that the students who did not look at websites were addressing. The sustainable design website information found in student design folios related to:
- disassembly;
- material selection;
- product inspiration.

All three areas of sustainable design found appear to have been useful in supporting the student in making design decisions in their project work.

In conclusion, the majority of the students amongst the 18 case studies used websites within their folio work. The majority of students interviewed are not using websites throughout their designing but just for product inspiration or to use product images. There are indications that sustainable design has started to integrate into mainstream design and technology education at AS/A2 Level. The vast majority of students interviewed are not using online resources to support their sustainable design decisions, despite knowing that the resources are available for them to use. The few students that did use the sustainable design websites did integrate them into their design folio project work.

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