DISSEMINATING SUSTAINABLE PRACTICE: AN EVALUATION OF THE IMPACT OF VIRTUAL SITE

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There is a growing body of research on sustainable domestic construction; however, it is questionable whether the results of such studies are presented in the most appropriate way for students and practitioners to use. Rather than dissemination through academic papers alone benefit may be gained through more visual representation. Multimedia resources are increasingly being used for teaching and learning. A web site has been created to disseminate construction information - the Virtual Site. Recently, work has been undertaken to present the findings from research of those engaged in the design and construction of sustainable housing. Graphics within the site are being used to make the data and good practice easier to understand. The Virtual Site uses animation created with Flash technology, embedded video clips and photographs to stimulate greater interest. While it is now relatively easy to release such information on the web, it is often difficult to know whether such education sites are of interest to relevant student groups. Preliminary research has been conducted into student and practitioner interest in the site and its potential usefulness. Feedback shows that the site is of considerable interest and gives students access to an experience that otherwise could only be achieved via site visits.

Keywords: E-learning, sustainability, teaching and learning, virtual environments.

INTRODUCTION

The causes and impacts of climate change are now so well-documented and evidenced that it has become difficult to dispute (Metoffice 2009). Construction, the use of buildings and the building's performance has been identified as a key factor in the UK's contribution to the problem (Abanda and Tah 2008; Johnston *et al.* 2005; 2008). Unfortunately, the response to sustainable building techniques has been mixed (Hall 2006), despite the government's encouragement to use more sustainable approaches (Egan 1998; POST 2003) industry has been slow to respond. It is argued that one of the major reasons for the reluctance to adopt sustainable practice has been the limited knowledge and understanding of methods that can improve a building's performance (Hall 2006; Abanda and Tah 2008). There is a considerable amount of information on domestic sustainable construction, but the use of the information and adoption of sustainable construction is low (Abanda and Tah 2008). It is posited that the current information may not be presented in a way that is easy to digest and understand. With the current web technology both access to the information and the potential to present data in different formats, improving the ability to match with user needs, has increased.

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Regardless of whether the solutions come from modern methods of construction, good traditional practice or adaptations to current construction technology, there are many methods of improving building performance. Students and practitioners need the information in easy to digest formats so that they understand it. This initial research was used determine whether the information being created was of interest to students and practitioners.

Background

In addition to the call for better practice and performance, the dated, yet still well cited reports of Latham (1994) and Egan (1998) made recommendations for improved learning and training. Seemingly, little has been done to respond to such demands and, in the light of the recession, such recommendations seem more important. With the need to quickly train, learn and respond to any opening in the market, new vehicles for re-skilling and supporting the recovery are needed. It is already apparent where some up-skilling is needed, for example, there is a clear need to understand sustainable construction. Wall and Ahmed (2004) identified improved access to learning and training as a key driver to making improvements to the industry. However, it is purported that the demands of the working environment mean there is often insufficient time and appropriate resources available for effective learning to take place (Construction Industry Council, 2004). Methods of training and professional development need to be flexible and accommodate the needs of modern life. The technological advances of the internet have opened up new opportunities that promote and encourage access to training, professional development and other learning opportunities (Klein and Ware 2003; Wall *et al.* 2007).

Delivering information and disseminating knowledge

There is a need to ensure that information, based on rigorous research programmes, feeds its way into the curriculum, ensuring that the next generation of practitioners are well informed. The internet and web based services not only provide a medium that enables research to be published quickly; the tools can make the resources interactive, interesting and meaningful. De Freitas (2008) has noted that virtual environments have been created that encourage deep exploration and interaction. The environments have increased opportunities for new learning experiences and have provided different pathways that can capture the learner. The overlays of information, images and data and the interplay between the learner – teacher and virtual environments offer a new scaffold to the learning process. The connections between information, real life and the link back into the classroom is going well beyond traditional learning.

People are increasingly using e-learning to support education and deliver training (Wall and Ahmed 2005). With the growing acceptance of web technologies and the increasing need to embrace them for education there is a need to know how they are used, what prompts use and how useful the tools are (Wall and Ahmed 2005). The use of the web and its supporting technology has released a learning resource with huge potential but, as with all new things, we are not entirely sure how to use it to achieve the most effective benefits.

Tangible benefits of E-learning

It is easy to talk-up the benefits of IT and the new learning experiences that come with it, but it is not always easy to identify the tangible benefits. Although e-learning is becoming an integral part of the curriculum, it can be difficult to define exactly what the tangible benefits of an e-learning environment might be. Some benefits are easily

quantifiable both in terms of cost and development activities. Large scale assessment, which offers solutions to well defined problems, gives readily measurable cost savings, whereas other more pedagogically motivated interventions may manifest in improved recruitment and retention (JISC E-Learning Team 2008). The more innovative developments may involve more investment and less immediate return, but are expected to bring future benefits (JISC E-Learning Team 2008).

A recent study undertaken by the JISC E-Learning Team (2008) showed evidence of significant benefits resulting from investment in e-learning activity. The tangible benefits were summarised under the following broad headings:

- Cost Savings / Resource Efficiency
- Recruitment and Retention
- Skills and Employment
- Student Achievement
- Inclusion
- Widening Participation and Social Equality
- Other Benefits

Where traditional paper based sources of educational information are placed on the web and made interactive, students have improved access and may be able to benefit from being able to work with others outside the classroom (Byron, 2009). Open access material also makes it easier for others, including parents, employers and potential employers to see the nature of work being undertaken. It is suggested that such access is better for encouraging parental and wider society engagement (BECTA, 2009). The methods of using the material to secure the benefits also need to be identified. For example, just publishing material on the web does not secure the involvement of others to assist learning. As Byron (2008; 2009) suggests, effective use of technology is an interplay between the learner, those guiding and governing learning and the boundaries given. How to achieve the most effective use of the web technologies is not just a matter of looking at the e-learning material itself, but how it is being used and if it is being used as intended. Users may be getting benefits out of the web site that were not previously recognised while other preconceived ideas of the site's use may have been ill founded.

Virtual environments and potential application

The use of virtual environments in education has been facilitated through web applications that allow downloading, sharing of documents and files, holding meetings, networking and hosting virtual seminars (de Freitas 2008). The nature of the virtual world varies, while environments such as Second Life increase in use animation and links to real world activities, other virtual environments exist that are based on data captured directly from the real world. Virtual worlds and e-learning resources have already emerged and, although augments exist over whether such tools are beneficial or not, they are being used (Byron 2008). Virtual environments and e-learning offer a medium that can be used to disseminate information and experiences around issues on sustainable construction.

Why sustainable e-learning resources?

In the UK, as in most industrialised countries, the domestic sector contributes substantially to national energy use and CO2 emissions. Currently, just under 30% of the UK's total CO2 emissions are attributable to the energy that is used to heat, light and power dwellings (Johnston *et al.* 2008). Recent research and consultancy work in

the field of energy efficient housing has highlighted that designers, constructors and developers are failing to construct new housing that meets the notional designed energy performance and carbon emission targets (Johnston *et al.* 2005). Despite this a wealth of knowledge and expertise exists on design and constructional issues that are known to influence the energy and carbon emissions attributable to dwellings. As part of the Virtual Site the Low Carbon Housing Learning Zone was developed as a vehicle to disseminate the available knowledge and experience to students.

Figure 1 Low Carbon Housing Learning Zone - www.leedsmet.ac.uk/teaching/vsite

The Low Carbon Housing Learning Zone (LCHLZ, Figure 1) resides on the School of the Built Environment's Virtual Site. Virtual Site is an open access web site, enabling the resources to be freely available to industry, academics, students and interested individuals. Wherever possible, visual material has been incorporated within the LCHZ using a range of techniques in order to enhance and enrich the learning experience creating a stimulating and interactive environment. Such techniques include video clips, panoramic movies and photographs of construction sites, dwellings and various construction related activities. It is hoped that the use of such techniques will have the following advantages:

It will enable the findings and observations from research and consultancy work on low carbon housing to be integrated directly into learning.

It will give individuals access to an experience that otherwise could only be achieved by actual site visits.

It will enable the principles of low carbon design to be demonstrated within the context of real schemes.

RESEARCH METHOD

At this early stage in the development of the web site, this research was undertaken to determine whether the material that had been created was of interest to the students. Practitioners were also asked for their opinions of the site and material that was created.

Considerable effort is going into the creation of an on-line resource that supports applications such as Virtual Site and Low Carbon Learning Zone. Unfortunately, development is taking place without proper consideration of the impact. As further effort is to be extended into developing interactive web based material across the sector, it is important that we learn whilst developmental work is taking place to

ensure that resources are responding to the wide and changing needs of those that need them.

An action research methodology has been used as part of the approach to iterative evaluation and development of the Virtual Site resource. Action research is interpretative research where the researcher is directly involved in the research setting and, to some extent, the experience itself (Nunes and McPherson, 2002). The cyclic approach to action research is often described as plan, act, observe and reflect. Action research involves learning through action and reflection, while work is taking place, and it is often conducted in educational contexts (McNiff and Whitehead, 2002). Action research has been used to develop and evolve the Virtual Site on-line resources. The research approach is to plan and explore options on the web site, experiment with multimedia tools, develop tools, implement the tools, gather feedback via workshops and interviews. During this process the team have reflected and continued to observe use. Initially, this study of teaching resources on the Virtual Site has explored interest levels and potential use through interviews.

The web-based interaction materials were also presented to 62 final year Construction and Project Management students and feedback via interviews was obtained. These students had been exposed to some of the earlier material on the site during their studies, but had not been exposed to recent developments. Students were interviewed to obtain information on their interest in the material and how they felt new interactive material would have benefited the next generation of students. The interviews also explored the benefits of the site over traditional learning methods. Five senior construction professionals were also shown the site and asked to give feedback.

RESULTS AND DISCUSSION

Students were asked a number of general and specific questions about the site. The following discussion and response give examples of the range of feedback received. General interest from all of the students surveyed was positive. In response to the question, "Do you think the resources on Virtual Site and the Low Carbon Housing Learning Zone have, or would have benefited your study?" the comments showed that the information available on the site is considered to be useful for introducing construction to students with limited experience. The interactive panoramic images of construction were believed to offer an improved insight into construction sites, there processes and operations. One student commented that the "Panoramic images of construction sites give a better idea of what they look like and how they work".

The environmental information was also considered to be important and to some extent, students alluded to the fundamental nature of the information, underpinning the delivery of other topics.

"I was impressed by the Virtual Site tool… it highlights some of the main activities for students who have never been on site before, it puts a visual picture to some instruments they have only heard of in class. I'm a sponsored student, a tool like that could easily be used for training".

"If we [the students] had an initial concept of the main concerns to do with environmental impact and thermal losses before we started doing the modules, that would have been useful"

"It would benefit first year students, to give a clear idea of construction methods to students with no building background."

When the benefits of the web technology were explored it was interesting that some of the less expensive multimedia applications were identified as being important as well as the more interactive and expensive web environments. Video and photographic information were seen as important to understand the practical elements being discussed. Students felt that such sites were effective in getting information across as relevant information could be grouped and linked together. Students were also interested in how current information was and the effectiveness with which some applications may be able to capture relevant information. The following question was posed "What benefits do the interactive online resources have over traditional paper based research material?" responses included:

"Videos are easier to update and keep relevant to today's processes".

"Having many elements [photographs, images and text] together in one page or application speeds up the process of learning".

"Interactive online resources are more hands-on, allowing students to go through a process, rather than having a paper to read".

The learning zone was not seen as a replacement of research, but to supplement it; however, the team developing the site were unsure how the web material would be used. The following statement and question was posed: "Much of the material on the Low Carbon Housing Learning Zone has been taken from research and consultancy work undertaken by Leeds Metropolitan University. Would you use the Learning Zone, or access the original research papers, or use both?" The following responses suggest that the site would be used as additional resource rather than replace use of academic papers.

"I would use the papers first and then use the Learning Zone if still unsure, for backup and further reading." "I would use both, to get a detailed view of the issues".

"I would probably use both. Research papers alone are useful but are sometimes long and contain irrelevant information".

While there were some very positive comments, both about the site and its features, the students were also concerned that they had not been made aware of recent developments. Through follow up questions, it was revealed that most students had been aware of the site when it was first used as a repository for storing photographs, but had not been aware of the development of the interactive virtual environments. It is difficult to know when to release web material into the learning environment. Although considerable information exists on the site, it is still in the early stages of development and is still being populated. However, the new material is seen as an important resource for students and lecturers, and sufficient material now exists for it to be used as a learning resource.

A lecturer who has started to use the site as a teaching and learning resource for an Environmental Science module, identified the key benefits of the site as:

- Teaching and learning materials can be accessed at any time of the day.
- No Health and Safety or logistical implications that would be found when visiting real working environments.
- The material is visual and practical; it is much better to see a number of photographs or a 360 degree panorama of what is being discussed than a sectional drawing or diagram.

- There is considerable potential for the future, especially as we move to 2016 and the requirement for zero carbon dwellings.
- Student response has been very positive. They like the fact that it is visually appealing and contains real examples. Students, also seem to like the mix of different types of visual stimuli.

All of the practitioner who were shown the web site gave positive feedback, they all supported the development and many were keen to get involved with developing new material. The interest from industry in getting involved with education is clearly useful. The feedback has shown that the site is moving in the right direction, helping to bring the real world into the classroom and potentially improve the link between industry and education. Responses from practitioners suggest that the momentum and interest both in sustainable construction and multimedia learning is growing.

Some of the final year students were concerned that they had not been made aware of recent developments. Some publicity has gone out in the form of posters and presentations. Until recently, the new material on sustainable construction has not been available. To achieve greater student impact the new web material could be embedded and tested within modules. The features used within the site have captured the initial interests of students and practitioners. Further work needs to be done to determine whether the site becomes useful as a key educational resource and whether it finds its way into practice. Considering the Byron approach to keeping people involved, it would also be worth informing the wider community of such teaching and learning web developments. News letters or distributions through Facebook, Twitter and other social network sites could prove useful in engaging a wide audience.

While it is suggested that the facilities and capabilities offered by e-technology are considerable and engrained in student life they do need to be evaluated and developed. Although "… today's students think of the internet the way their parents and their grandparents… viewed electricity: ubiquitous and only noticeable when not available" (Bruce, 2003 p 24), today when the students flick on the switch millions of lights come on - some work, some don't and all vary in function, purpose and quality. The next generation's media for teaching, learning and training has arrived, but further research is needed to determine how to capture interest and expose learners to good practice. While the results show that academic papers are still important there is considerable interest in multimedia applications. The more graphical and dynamic images seem to capture the interest of students and practitioners, this is consistent with previous (Gorse 2009). Research is necessary to both guide and evaluate the use of on-line teaching and the success of the materials in training, educating and informing.

CONCLUSIONS

The web has provided a platform for resources that can help access and also guide learning by grouping resources together. The key benefits to such sites included improved link to real world, greater access to materials, ability to link and group relevant materials and use of multimedia formats that ensure current information can be easily uploaded and accessed. The multimedia applications shown to the students were of interest. Such web sites can provide a wealth of information that can benefit study and practice. The research has shown that some resources such as photographs and technical documents are relatively easy to upload and do get used by students. Other resources such as 360 degree panoramic images and streaming video are more expensive to produce and take time to prepare for on-line use, yet capture student interest. Interactive environments, although getting easier to produce, are relatively

expensive and time consuming, yet it is suggested that these environments are what will be demanded in the future. While there are some very tangible benefits to such web sites, further investigation is required to determine how e-learning resources are effectively disseminated.

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