Harvesting Knowledge: the role of the Internet in helping students to develop independent research skills - a case study

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Abstract

The exponential growth of the web, now the depository of the largest database of information known to humankind, is now posing the potential for new forms of learning (harvested knowledge) through research and independent inquiry.

This paper reports on a case study in which a group of students were actively taught web searching and research skills. The results show not only the potential of the web for independent learning, but also some of the current problems associated with using the medium in this way. The paper points to the future of e-learning and the use of computer mediated communication in conjunction with knowledge management tools and systems.

The study found that whilst there were many advantages to the Internet as a tool for independent research in this field there were also many barriers that prevented the students from using it effectively. These barriers included a lack of access to IT, a lack of knowledge about the Internet and the subject domain, a lack of experience in information seeking strategies and a lack of confidence in using computers and dealing with professionals in the outside world. The attitudes of the learners and the professionals with whom they were trying to communicate were also a factor in whether or not they were successful in their task.

Keywords:

e-learning, Internet, Information seeking, Textiles, Constructivist, search strategies

Rationale For The Study

The motivation for the study arose from the changes that have been occurring in the educational system and in particular the moves towards student-centred and resource-based learning. In the fashion industry, for example, production and sourcing methods have changed dramatically with the introduction of computer based UK technology (Colussy, 2000), and these changes needed to be reflected within the fashion curriculum. The reductions in the time available for contact teaching and an accompanying shift in emphasis from teaching to learning (Barr & Tagg, 1995; Forsyth, 1998) were further drivers for change in the content and delivery of the fashion curriculum. These changes meant that the student body was expected to spend an increasing amount of their time in self-directed study and utilising open access facilities. There has been no systematic research into how effectively fashion students have been dealing with this change in study patterns or which resources are most useful to them. It became evident that there were a substantial number of students who struggled with this new emphasis on independent study. The Internet was identified as a tool that had the potential to assist students with these new more flexible approaches to learning because the learner can choose the time, the place and the pace at which they study (Fayter, 1998). In a sense, then, the function and facilities offered by the web include:

- The transmission of knowledge (e.g., e-Iearning programs)
- Negotiated knowledge (e.g. listservs and discussion forums)
- Harvested knowledge (the web as a large depository of knowledge, data and information).

But the balance between these may be shifting away from the passive transmission of knowledge, to more learner-centred, dynamic and interactive forms of knowledge (see **Figure 1**). In other words, e-learning may be moving away from the transmission of didactic, teacher - centred courseware (learning materials) to the use of computer mediated communication using, for example, discussion forums, listservs and newsgroups (negotiated learning). The exponential growth of the web also allows for (independent) learners to search the vast depositories of web pages, archives and on-line databases (harvested knowledge).

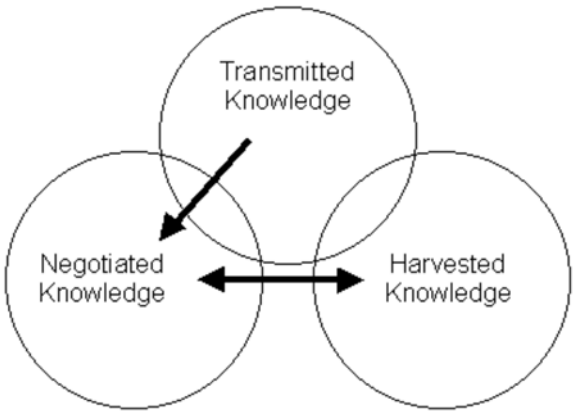

Figure 1: From transmitted to negotiated and harvested knowledge

Certainly, the speed at which the technology is changing also makes it important for learners to be able to "learn to adapt to new technologies without continual intensive training" (Phelps, Ellis, & Hase, 2001, p 482). It is argued (Owston, 1997) that the Web is a useful tool in moving from teaching to learning and broadening access but many students seem not to be taking advantage of, or have been put off using, the technology that we are striving to make more available to them (Jeffries & Hussain, 1998; Selwyn, Marriott, & Marriott, 2000).

This study set out to identify whether the Internet was a useful tool to enable fashion students to engage in independent research with a specific focus upon fabric sourcing - harvesting knowledge (of textiles) using the Internet. Given that the students were given tuition in how to search the web, the study also sought to address the question of whether "harvesting" skills on the Web can be taught to an adequate functional level.

Theoretical Model

The study looked at both instruction and constructivist approaches to computer based learning. The instructional model draws upon the work of Skinner and Gagné. This model is highly structured and based upon the identification of observable behaviours and appropriate skills that the learner must achieve. Drill and practice are used to enable the learner to master a skill before moving on to a more complex level (Boyle 1997). Gagné (1992) identifies the different skills and conditions required for learning to take place. He advocates the mapping of learning objectives against this taxonomy to ensure that the right strategies are being employed to facilitate learning and for the learner to achieve these objectives. The taxonomy is based upon a hierarchical arrangement of intellectual skills from discriminations at the bottom through to problem solving at the top (see **Figure 2**).

PROBLEM SOLVING
involves the formation of
HIGH-ORDER RULES
which require as prerequisites
RULES and DEFINED CONCEPTS
which require as prerequisites
CONCRETE CONCEPTS
which require as prerequisites
DISCRIMINATIONS

Figure 2: Gagné's Levels of Complexity of Intellectual Skills: Gagné (1992) p.55

The taxonomy is useful in identifying the objectives of learning and ensuring that appropriate tasks are being set for the development of different types of skills. In the context of this study the taxonomy was useful in identifying the types of learning, knowledge and skills the students required to succeed in their task. However observation of the processes they used showed that the activity was not necessarily hierarchical and what was required was a complex interaction of skills and knowledge at a variety of levels. There was more than one route to a successful outcome and the activity was highly complex. The type of activity being undertaken fitted more closely to the type of activities used in Constructivist approaches to e learning. These approaches are more student-centred and are generally considered to be most effective in authentic environments and activities. As this study was simulating an authentic activity, undertaken by professionals in the fashion and textile industry, a constructivist approach was applied to the design of the teaching and learning in the taught sessions emphasising to the student the relevance of the activity to their future careers. Students were provided with the appropriate scaffolding to enable them to move from their existing knowledge in order to develop new skills. This took the form of a series of tutor demonstrations, peer group dialogues and set exercises that introduced them to advanced information seeking skills and strategies. This supported approach is advocated by Vygotsky (1962; 1978) in his theory of the zone of proximal development.

Methodology

A qualitative approach was adopted for the study because such data can provide rich descriptions and explanations (Gray, 2004). It is a valid research approach because it is conducted through intense contact within a field setting, and includes gaining the perceptions of participants (Miles and Huberman, 1994). A case study approach was adopted because this method is appropriate when the researcher is trying to uncover a relationship between a phenonomon and the context within which it is occurring, often using multiple sources of data (Yin, 1994).

Case studies are also valuable when the researcher wants to move beyond the 'what' question to 'how' and 'why'. The participants in the study were a convenience sample (HND fashion students) taught by one of the researchers. The course, however, provided a longitudinal opportunity for studying the students' skills in using the Internet as a resource tool.

As part of the programme the students were introduced to a range of Internet research skills via a series of three practical workshops. Students were shown how to:

- Send and receive email using the college system and the VLE
- Access the external links section of the VLE
- Use bookmarks
- Use the London Institute Library 'I page' as a starting point for an Internet search
- Create folders to organise their bookmarks
- Download a document
- Use a range of search engines, meta search engines and gateways
- Use advanced search options and Boolean terms to refine their searches
- Search for and save images
- Use a URL to identify the source of the information
- Use navigation tools

The students were given selected keywords to search for and the results of the searches on various search engines were discussed as well as the need for selecting appropriate keywords for the search.

The study was in four stages and a variety of research tools were selected to meet the aims of the study and offer multiple means of data collection. This would enable triangulation of the data and increase the reliability and validity of the study. This triangulation was intended to add complexity to the data and to "reveal different facets of the data (Coffey & Atkinson, 1996 p.15). The four stages of the study were:

Stage I Research Methods Activity

Nineteen respondents were asked to identify and put in order of priority the research resources that they usually used when researching for a design project.

Stage 2 Observations

Eleven respondents from the initial group were observed using the Internet to try and source textiles for their assignment.

Stage 3 Interviews

Six respondents who had been observed were interviewed using a semi-structured approach.

Stage 4 Follow up study

- Two years after the initial study a sample of four students at the same stage in their programme were observed undertaking the same sourcing activity. The purpose of this stage of the study was to identify whether, despite the speed of change in the technology, the themes identified in the initial study remained relevant.
- The researcher also used the experience of delivering the sessions to gain an insight into what some of the key issues might be for students using the technology as a research tool. This experience also highlighted some of the issues that lecturers trying to integrate the Internet into their teaching would need to consider. This experience also informed the design of the research tools in stages two and three of the study. **Table 1** illustrates how the tools used related to the aims of the study.

Table 1: The relationship between the aims of the study and the research tools.

	Objectives	RMA	Observations	Interviews
1	To examine the ways in which the students interact with the Internet/WWW.		x	x
2	To determine their levels of confidence and ability in using the media.		x	x
3	To analyse the students' ability to apply appropriate strategies for independent learning using the Internet.	x	x	x
4	To investigate whether Web research skills can be taught.		x	x

Results

The study revealed six main themes, each of which is presented in more detail below. (In order to preserve anonymity, letters of the alphabet replace the names of respondents).

- Knowledge and skills
- Experience
- Strategies
- Confidence
- Attitudes
- Access

Knowledge and skills

Themes that arose from the data showed that there were several areas in which the respondents had knowledge gaps. These were knowledge of:

- Computers and the associated technical knowledge necessary to use them effectively.
- The Internet including, tools for searching and navigation and sites of interest.
- Subject specific knowledge, relating to fabric sourcing and textile terminology.

Knowledge of Computers and associated technical skills

The observations indicated that some of the respondents lacked basic computer skills including in three cases how to control a mouse or use a keyboard. Throughout the observations the computers frequently crashed and Netscape performed "illegal operations". Some of the respondents did not know how to escape from a crash while others did not have basic file management skills or did not understand how to save and retrieve documents.

Internet Knowledge

Coupled with a lack of technical knowledge about computers there was a lack of knowledge about the Internet, how it functioned, and the tools available to help them to find appropriate information. Even though the taught classes covered the use of bookmarks, some of the respondents did not know how to use them. Respondent M struggled with how to get into the computer network and how to send emails.

Q: Having done that [sent an email to a supplier] once would you feel confident to do it again?
A: I don't know. No I don't think so.
Q: And why would that be?
A: Because I wouldn't know how to get into the system.
(Respondent M)

The same respondent (M) also had major problems with navigation and did not know how to use the back button to return to the previous page. Two respondents (S & J) did not understand how to use links to navigate. They also had problems with using Boolean logic to refine their searches and four were unable to identify from the URL what kind of site they were linking to. Although the taught sessions included them, none of the respondents went to a relevant gateway or the London Institute's Library lpage (http://www.linst.ac.uk/ibrary) to start their search. All of the respondents went directly to a search engine that they usually used or one of the search engines demonstrated in the class. Three respondents (Q, G & J) also had problems with creating folders and two (M & F) had difficulties sending an email.

Knowledge Gaps Textiles

The respondents used a very limited range of terminology in their searches.

They were often unaware of trade names or companies that may have been useful keywords to use. They did not seem to be aware of textile trade associations or organisations that might have been good starting points for a search. This lack of awareness of resources was evident in the data from the Research Methods Activity which showed that Trade associations and CD ROMs were not used by 58% of the respondents; wholesale fabric suppliers and trade directories were not used by 44% of respondents. The respondents did not seem to have planned in advance which keywords may be useful and tended to use generic terms such as "fabrics" and "textiles". The use of generic terms usually resulted in a very large number of "hits", many of which were not relevant to the type if information being sought.

This caused difficulties because the learners were uncertain of the terminology to enter as keywords when conducting a search. It also made some of them unconfident about communicating with suppliers and reluctant to send email requests for fabric swatches because they were unsure how to ask for them. Some of the least confident users had knowledge gaps in all three areas. It is perhaps unsurprising that this connection exists for some of the users. Many learning theories accept that learners need to build upon existing knowledge in order to be able to develop higher order problem solving and metacognitive skills. Without this basic level of knowledge, the computer can become a barrier to the learning activity instead of a tool to facilitate it. This is true of both the Instructional and Constructivist approaches to the use of technology in learning and teaching.

Experience

The students with the least experience were also the least confident and the least knowledgeable about computers and the Internet. However, experience in itself did not necessarily lead to either confidence or a more strategic approach to searching. A lack of experience was also closely linked to a lack of access.

The issues relating to experience fell into two categories:

- Experience with computers and the Internet.
- Experience in dealing with wholesale (textile) suppliers.

A lack of experience was often accompanied by a lack of technical knowledge.

The ability of an individual to access the computer and spend time building confidence and gaining knowledge seems to be a key factor in their attitude to the media. The most experienced users with access to their own computers displayed the most positive attitudes, (Respondents H&D).

Strategies

The respondents did not evidence a strategic approach to the way that they searched or to information seeking generally. The interviews supported the themes identified in the observations. There were varieties of strategies that the respondents employed for dealing with different aspects of the task. These have been broken down into strategies relating to searching, technical issues and issues relating to fabric sourcing.

Searching Strategies

Respondents employed a range of strategies to search the Internet and make choices about the sites to go to. These strategies varied in their effectiveness and in some cases the complete lack of knowledge about how the Internet works (for example, server/client relationships, domain names, address protocols, etc.) led students to employ ineffective strategies. This could be why they felt so overwhelmed with the amount of content on the Internet. The most confident and experienced respondents employed the most effective strategies.

Respondents tended to stick to between one and three search engines with which they were familiar. Four of the respondents cited Yahoo, which was the most popular search engine at the time. Reasons given were: friends recommended it, they knew the address, it was easy to use, and that they were familiar with it.

There was overall a lack of strategy in the respondents' approach to searching and to their selection of tools for searching. This lack of a strategic approach was partly due to a lack of knowledge about gateways, directories, advanced search techniques, image searches and fashion and textile related sites on the Internet. One of the respondents (D) was very experienced and confident but still did not demonstrate a strategic approach or an extended knowledge of search engines, advanced search techniques or sites that may be useful. This indicates that experience with the Internet in itself does not necessarily lead to the use of effective search strategies.

The majority of the respondents had experienced some problems of a technical nature. The strategies they employed to deal with this seem to be instinctive rather than based upon an understanding of the nature of the problem. Respondent H was familiar with some technical terminology and seemed to be aware that running several applications or having many windows open may be part of the problem. Generally, they felt ill equipped to deal with technical issues. One of the strategies they employed to deal with this was to consult a friend or relative who was more knowledgeable. This collaborative approach to problem solving was also apparent in the taught sessions. Some of them felt that they needed more training or more IT classes to help them feel confident in their use of computers.

Fabric sourcing strategies

The Research Methods Activity showed that the range of resources that students were using for textile sourcing was limited and that they did not tend to use wholesale suppliers or trade directories and associations. The observations verified this, however by the interview stage (after the taught sessions) the majority of the respondents had tried to contact wholesale suppliers to order textiles for their final major project. This was not always easy nor did it necessarily led to a successful outcome.

Even though they did not all use the Internet to source their textiles they saw the value of being introduced to wholesale suppliers and had found the sessions useful in helping them to develop their Internet skills although they felt that the number of sessions was not sufficient.

Confidence

Respondents' levels of confidence when using the technology varied from extreme confidence to extreme anxiety. The data from the observations and interviews indicated that the least confident users were often those with little experience of using the Internet and limited access to it. Many factors seemed to have an impact upon levels of confidence. These included problems with spelling and severe dyslexia. A lack of confidence in their literacy skills made students nervous, and sometimes extremely anxious, about using the web. Literacy issues affected some of the students for whom English was not a first language. The level to which it affected them seemed to depend upon their level of ability in English and their ability to employ other resources to help them (dictionaries, English friends).

Students for whom English was a first language also faced difficulties caused either by a lack of confidence in their use of spelling and grammar or in the case of respondent M, because of her dyslexia.

The problem is I'm not very good with anything that's written down. I don't take in what I read. I think that's because I'm dyslexic, so I don't do a search by reading things. (Respondent M)

The respondents recognised the role that computers and the Internet could play in research as well as in their future professional lives. However, they had reservations about the time it took to learn the appropriate skills and to find the information that they were looking for. Some of the respondents felt overwhelmed by the volume of information offered on the Internet and felt ill equipped to analyse and evaluate it.

Access

Access to the technology and the resources to use it effectively had a clear impact upon the level of experience of the user. Generally, the students who had no access outside of college were the least experienced users and were often the least confident. They also had the most limited knowledge of computers, the Internet and search tools.

Some of the respondents clearly felt that not having access at home to a computer with an Internet connection was a disadvantage. They were not always able to access a computer at college at a time that was convenient to them.

It's mainly in the evening when the college is closed, when you are at home. That's why you're restricted. (Respondent F)

I don't have access to email at home- I don't like coming into college, into the library to do it. Someone's always on it. (Respondent M)

External factors

In addition to these skills and areas of knowledge there are certain external factors relating to the media that need to addressing in order for the student to be successful. These external factors include access to a stable network and the appropriate software and hardware, the level of technical support that is available and the accessibility of the equipment at times that are convenient for the learners. The location of the facilities and the arrangement of the rooms to allow collaborative learning also need consideration. One of the biggest external barriers was the attitude of suppliers toward students. The Internet provides an excellent medium for students to engage with experts and professionals but this opportunity for the textile industry to engage with and encourage the next generation of designers will be lost if they do not develop a more supportive response.

Summary

The data from the main study reveal that the respondents were not using a strategic approach to their searching. They generally lacked confidence and experience in the use of computers and were not making use of functions that could speed up or simplify the search process for them. Most were not transferring or consulting information that had already been covered in the taught sessions or in other parts of the course. This meant that the majority of the respondents were not working effectively and were taking much longer than necessary to find relevant information. These results are consistent with results from other studies that have examined the information seeking strategies of novice users of electronic information systems (Marchionini 1995).

Results: Follow Up Study

The follow up study identified that all of the themes in the initial study were still valid. The most significant change was not in the skills and abilities of the students but in the ways in which the Internet had developed. One of the most interesting aspects of the follow up study was that it indicated that the designers of search engines were constantly modifying the services on offer in order to help users to overcome some of the more common problems that they encountered. These include improvements in spell checking services, phrase matching and the development and expansion of translation services (Sullivan, 2001a, Google,2002b). The size of search engine indexes is also constantly growing. For example in June 2000 Google indexed 250 million pages, but by December 2001 it had indexed a record 1.5 billion documents (Sullivan, 2001b). This has potential advantages and disadvantages. On one hand a search engine with a large index is more likely to include the information that a user is looking for, especially when they are searching for an obscure term. On the other hand, when a user is using a broad or popular term it may generate more hits resulting in information overload (Sullivan, 2001 b).

One significant change in the respondents was the level to which those who had their own computers and

access to the Internet had become almost totally reliant upon this for their research. They used the Internet even when it may not have been the most appropriate source of the information that they were seeking and it took them much longer to find the information this way than it would have done using traditional resources. There is a danger that these "Internet Dependent" students will be narrowing rather than expanding their range of references through their use of the medium.

Discussion

The study has highlighted the wide range of problems the students faced whilst trying to use the medium. Some of these problems were of a technical nature; the instability of the network was a particular issue and led to some students becoming very frustrated with the technology. This was a small-scale study and therefore one has to be cautious about generalising from the results. However there are other studies in which these findings are reflected using other groups of learners. These include Williams (2002), who found that students complained about networking problems which restricted their access to their website. Hara and Kling (1999) and Felix (2001) also cited technical problems as a barrier to learning using technology.

Although these technical problems clearly affected some of the respondents the majority of the problems that they faced were due to gaps in their knowledge or a lack of effective information seeking and evaluation strategies. The sheer volume of information available on the WWW was seen as both an advantage and disadvantage and some of the respondents were clearly overwhelmed by the amount of data available.

There were very few instances observed where the respondents made use of other tools that could have assisted them - for example; the history button, book marking facilities or advance search options. Even when they were aware of these facilities they had rarely considered using them, preferring instead to wander deeper into a trail of links or keep returning to a list of hits from a search. Their knowledge of sites and organisations on the WWW that were specific to fashion and textiles was extremely limited and reflected their use of physical resources in the college library. This lack of familiarity with the WWW was often linked to a lack of experience and access particularly for those students who had very limited prior experience and did not have their own computer. However, it has to be noted that not even the most experienced users were using these functions to their full advantage. Experience with computers in itself it seems, does not necessarily lead to effective information seeking, (Lazonder ,2000).

If we are expecting students to engage in more self-directed study and resource based learning then we have a duty to ensure that they have the appropriate skills in place to enable them to adapt to this mode of learning. In order to be able to function effectively as independent learners they will need to develop confidence and expertise in information seeking and evaluation and to be able to transfer and apply these skills in an increasingly complex environment. Clearly for many students a basic IT induction is insufficient for their needs. A structured introduction to information seeking that covers all the basic skills and drawing upon the instructional approach would give the students a grounding upon which they could then develop higher-level skills in independent research. The instructional approach on its own, however, would not be sufficient to enable the students to adapt to the continuing changes in software. This requires capability with computers as opposed to competence in a specific programme or environment (Phelps et al 2001)

Phelps et al (2001) indentify that this capability is achieved through hands-on experience, regular practice and reflection on the part of the learner. They claim that computer capability is "much more to do with an approach to learning and working than simply a set of technological skills." (Phelps et al., 2001 p.483). In order to facilitate the acquisition of this capability learners will require access to the appropriate facilities at a time and location that meets their needs. Providing this level of access is one of the biggest challenges for higher education providers. This cannot be ignored if we are really committed to developing effective independent learners who are able to take advantage of all the resources available to them and especially the harvesting capabilities of the World Wide Web. The special needs of dyslexic and other students with literacy problems also need further investigation. There are many guidelines for the production of web-based resources to make information more accessible to these students as well as software tools that can assist them. Mainstream software developers are also having to take these issues on board as government legislation in the USA (code**) and the UK (SENDA) is having an impact on e-learning.

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