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Chan, L. et al (2002) *Budapest Open Access Initiative*. New York: Open Society Institute. <http://www.soros.org/openaccess/read.shtml> (Retrieved 22 January 2007)

# Integrating information literacy as a habit of learning - assessing the impact of a golden thread of IL in the curriculum

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## Abstract

### Purpose

This paper describes the “golden thread” concept which was used to integrate IL into the environmental sciences curriculum at Newcastle University and presents the preliminary results of research undertaken to assess the impact of the IL interventions between 2005 and 2008.

### Methodology/Approach

A variety of different IL interventions was piloted and assessed. Discussion groups and learning logs were used to draw out student perceptions of their experiences and to investigate the students’ concept of IL as a graduate attribute for life. Student self assessments were considered in the light of independent analysis of their IL abilities.

### Findings

Students’ responses show that embedding the assessment of information literacy can play a crucial role in engaging students with the concepts involved, so that as well as learning specific skills, they have the opportunity to develop a wider awareness of the information environment.

### Originality/Practical Implications

The blended approach offers practical suggestions for integrating IL interventions within the curriculum as well as enabling the evaluation of the impact of the activities. Continuing assessment of the value and effectiveness of the interventions has driven the learning processes for staff involved in the implementation.

## Keywords

learning habits, information literacy impact, information literacy assessment

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## 1. Introduction

Learning for life requires individuals to have developed a personal learning habit which can continually evolve to meet new needs and adapt to new circumstances. Information literacy (IL) is an essential underpinning component of this individualised body of knowledge; it also needs to be built on a foundation of up-to-date skills. It is becoming recognised more widely that IL is essential to today’s workplace; Martin & Williamson (2003) highlight that all information users need to become:

“critical consumers of information in order to avoid overload and to develop new intellectual skills in order to manage information effectively and transform it into usable knowledge”.

These skills are also critical for effective learning while at university and ideally during academic study IL is embedded as a habit of learning which then lasts for life.

The “teaching” and immersion of the student in the scientific method and culture has long been recognised as an important part of education for those entering scientific professions. Separately to IL, but contemporaneously, the term science literacy has become current (Yore et al, 2003) and overlaps with the conception of information literacy are noticeable. Hurd (1998) includes many characteristics, which relate directly to an individual’s ability to evaluate and use information in his definition of a scientifically literate person. An important recurring aspect of scientific research is the critical review of literature to locate your work in the field.

Recently, many authors (Keen, 2007 Brabazon, 2007, Rowlands, 2007) have raised concerns about the information explosion and the ways in which “digital natives” approach their need for information. Keen warns us of

“Digital Darwinism, the survival of the loudest and most opinionated”,

referring to the indiscriminate way people use, contribute to and believe information on the Internet. Brabazon (2007) argues passionately that

“this information fetish” has been profoundly damaging to our learning institutions and to the ambitions of our students and educators”

and champions information literacy as a priority for making the educational system

“productive and provocative in the [post] information age”

However, neither IL nor scientific literacy are effectively taught by exposure to practice, neither can they be absorbed from an academic community by osmosis. To enable students to become information literate, targeted teaching and learning approaches are required, probably given as a result of collaborative effort by subject-specific and library staff. As Johnston & Webber (2003) recognise:

“there is more to information literacy than can be learned in a few afternoons in the library”.

Although it may not be recognised and labelled as such, there is a general agreement amongst academic staff that a student-centred pedagogical approach implicitly involves effective habits of information management and use. Following concerns raised amongst teaching staff about the limited skills of students (BSc Environmental Science) in finding and using scientific literature in assignments, and their weaknesses in more advanced information evaluation and synthesis, close collaboration between academic and library staff has resulted in the development of a whole curriculum perspective which integrates IL into the curriculum more purposely. This paper describes the process of integration and presents the preliminary results of research undertaken to assess the impact of the IL interventions between 2005 and 2008.

## **2. Teaching information literacy**

### **2.1 Which IL model should be used?**

The most frequency cited definition of information literacy is that developed by the American Library Association (1989):

“To be information literate, a person must be able to recognise when information is needed and have the ability to locate, evaluate and use effectively the needed information”.

An individual therefore needs to take on roles as information searcher, technology user, information user and organiser (Rossi & Hinton, 2002); these roles become functional as students develop information literacy skills. Marland (1981) also recognised that there are at least 2 types of skills involved in information literacy i.e.

- i) Instrumental skills – being able to find and use the library effectively, using search engines and different types of searches (What and how skills).
- ii) Cognitive skills – analysis of information needs to meet particular demands, analysis and synthesis of information collated (How and what for skills).

In the UK, a distinct model “The seven pillars of information literacy” (Task Force on Information Skills, 1999) was developed by the Standing Conference of National and University Libraries (SCONUL) and focuses on defining personal characteristics and a progression of skills that are associated with the development of information literacy for an individual (Johnston & Webster, 2003).

A contrasting phenomenological conception of information literacy was developed by Bruce in Australia (Bruce, 1997) following a study of how information literacy was conceived and

experienced by those who used information. Consequently this leads to a process rather than skills-focused description of aspects of information literacy. The applicability of Bruce's model was confirmed in a UK study of student perceptions of information literacy by Smith & Oliver (2005). Smith & Oliver (2005) noted, however, that students took different roles at different times, so that the model did not provide a typology of student approaches. This highlights the fact that information literacy may be better conceived as a recursive learning process rather than a simple ladder of skills to be attained.

Bent et al (2007) therefore describe IL as

“an individual's attitude to their learning and research such that they are explicitly thinking about how they “use, manage, synthesise and create information, in a wise and ethical manner, to the benefit of society”, as part of their learning life. In this view, information literacy is central to learning and research and is about changing people's learning attitudes and habits so that they understand how information fits into their learning lives.”

The differences in conception and definition of information literacy described above are not inconsequential for pedagogical approaches (Smith & Oliver, 2005). If information literacy consists of a set of skills then the emphasis should be on training; in contrast if information literacy is a personal and individualised corpus of knowledge and an attitude to learning, then it is education that is needed (Town, 2003). Of course, it is likely that information literacy will require both approaches if the aim is to allow the development of a continually evolving personal learning process underpinned by up-to-date skills.

## **2.2 Integration or stand-alone courses?**

A SCONUL study (Peters et al. 2003) concluded that information skills are an intrinsic element of the academic curriculum and should be integrated with the teaching of the subject disciplines, but with no preference for teaching by librarians or subject-related academics. Godwin (2003) expressed concern that separation of learning about information literacy from subject-related learning results in either overload (with too much covered in too short a time) or lack of relevance, where modularisation leads to separation not integration of the skills learned into the whole pattern of study. In contrast, Johnston & Webber (2003) argue that this does not imply that the best approach to information literacy is to integrate its teaching into that of another discipline. Instead a better response would be a credit bearing module specifically focussed on information literacy as a stand-alone subject but which requires subject-specific integration of the skills learned (Johnston & Webber, 2003). Both approaches stress the importance of contextualisation and practice of information literacy skills as part of the teaching and learning process.

McGuinness (2003) confirms the well known fact that:

“students are disinclined to engage in learning tasks that are not mandated by their lecturers and not credit bearing”.

Students are assessment motivated and hence gain skills best when they need them most, i.e. to facilitate an assignment (Godwin, 2003). Therefore whichever approach to the inclusion of information literacy is used, it is essential that marks are directly associated with the demonstration of information literacy i.e. the direct assessment of information literacy skills is needed.

It is therefore likely to be necessary to take a whole curriculum perspective. Lupton (2008) sees IL as a learning activity situated within a topic, course and discipline and concludes that course context can significantly influence students' IL experiences and allow them to transcend generic dimensions of IL. Some aspects of information literacy may well be able to be taught to all students, no matter what their disciplinary specialism, in the same way, thereby allowing the development of generic supporting resources e.g. a self-guided library tour; web-based instruction on the use of bibliographic databases. Other aspects may be better learned in a specific disciplinary context e.g. some evaluation criteria for information quality. Considering the development of information literacy throughout a degree programme may well result in a blend of integrated and stand-alone teaching and learning approaches, but it is clear that both need to be valued through direct credit-bearing assessment.

### **3. Integration of IL into the Environmental Science curriculum**

#### **3.1 Background – IL teaching in 2004**

The programme specification for BSc Environmental Science (Version September 2003) mentioned information skills as a cognitive skill: “critically appraise data, information and viewpoints and produce a reasoned argument” and as key (transferable) skills: “summarise and communicate in writing and orally in a manner appropriate to the target audience; use information sources effectively”. However, the linked description of the teaching strategy merely commented: “library workshops develop information searching skills”. As implemented in 2003/04, Stage 1 students had an introductory library tour in induction week, as provided to all students. Stage 2 students had an advanced skills library workshop planned as part of a compulsory module. In 2004 this was organised through collaboration with the Science Liaison Librarian, but this was in no way integrated into the content of the module.

During the programme review in 2004, the Environmental Science teaching group expressed concern about the weak skills of students in finding and using scientific literature in assignments, more advanced information evaluation and synthesis and the potential ability of the students to effectively undertake their Stage 3 Environmental Science Project

“Even in Stage 2 assignments you still mostly get websites quoted as references.”

“I think that we have probably failed to encourage the students to find and make sense of scientific, rather than popular literature.”

“I do think that most of the intake are woefully trained in dealing with writing reports and undertaking original work. This spans the full gamut from design (which one might expect to be a little naive) through to execution and write up. ... The students are not given any time to learn really useful skills for the outside world (like thinking, for one)”.

#### **3.2 Integration and evaluation of IL in the curriculum 2005-2008**

Reviewing the previous library workshops, we noted that a coincidence of timing had led to a particularly effective workshop. The students had just been set the task of finding information about the possible impacts of airport expansion for an assessment when they attended the workshop. As a result the students had been keen and obviously interested.

“It was nice to run a workshop where it felt integrated into the real study of the students, rather than an optional add-on where even those who turn up aren't that interested”.

Review of the curriculum and module structure of the programme allowed us to identify three compulsory modules, one per stage, where information skills were mentioned explicitly as Intended Skills Outcomes. The development of students awareness of IL and its associated skills was planned to flow through these modules integrating information literacy learning objectives into the Environmental Science programme. Each module was then developed to include the introduction, consolidation and explicit assessment of information skills but within a subject-specific frame (more details are given in Table 1). The Environmental Science programme specification was amended so that the teaching strategy for key skills (Version September 2004) stated:

“Information literacy is developed with the support of the library and information centre support staff with a golden thread running from Environmental Science Issues through Environmental Practice to the Environmental Science Research Project. ... Varied requirements for literature searches and production of word-processed documents reinforce this and give the opportunity to practice information literacy skills in a range of contexts”.

Preliminary evaluation took place between 2005 and 2008. Learning logs and search strategies submitted as part of assessments provided relevant information on both the use of the skills introduced and students' perceptions of the processes. Additional questions were included in end of Module questionnaires. Informal review of the approaches was also made through conversations with staff and students. From 2007, Stage 1 students were also asked to self-assess their information literacy skills using a simple framework [Fig 1] developed from the

SCONUL 7 pillars model as part of the paperchase exercise in the Library. More detailed review was carried out with students from 2007 including comparisons between students' assessments of their own IL compared to an independent evaluation of their work, using criteria devised to assess evidence of IL in assessed work at different stages [Fig 2]. Discussion groups were also used to draw out student perceptions of their experiences and to investigate the students' concept of IL as a graduate attribute for life.

**Table 1: Environmental Science Information literacy strategy.**

|             | Stage 1 – Environmental Issues  | Stage 2 – Environmental Practice  | Stage 3 – Research Project   |
|-------------|---|---|--|
| Aim:        | To develop students' study and communication skills to enable independent learning at HE level and to develop confidence in debate.   | To give students an enhanced understanding of environmental science in a work context.  | To give students the opportunity to undertake a research investigation, analyse data, critically review the literature, and prepare a report of the investigation.   |
| Structure:  | Lectures or visits to introduce topical environmental issues followed by small group tutorials for which students need to prepare discussion material.  | Presentations from current environmental practitioners linked with skills development workshops, CV writing, project management etc.  | Mainly self-directed research support by individual supervisor. Tutorials held in Semester 1 to consolidate writing and project management skills.   |
| Assessment: | Group presentations (2) drawing together observations and literature to discuss an environmental issue.<br><br>Individual research topic submitted as i) a search strategy and mind map.<br>ii) an essay outline with full bibliography.  | A job description and person specification for a post suited to an Environmental Science graduate.<br><br>A briefing document on a current topic (e.g. airport expansion) including a record of the search strategy used and an assessment of strengths and weaknesses of the information sources.                                  | Literature search strategy; précis of key literature in the form of an introduction to a scientific paper.<br><br>Main report in extended journal paper format and supervisor's assessment of process.   |
| IL aspects: | First session highlights importance of making use of library resources; students complete library paperchase and IL self assessment exercise.<br><br>Main library workshop in Week 5 after assessment of paper chase results and targeted to weak areas. Focusing on how to find known information sources and how to search for resources on any topic – development of an appropriate search strategy. Correct citation skills and awareness of copyright and plagiarism. Mind mapping. | Importance of understanding priorities and interests of a range of stakeholders highlighted throughout.<br><br>Main library workshop in Week 3 refreshing on search strategy techniques and introducing a wider variety of information sources as well as routes to access them, methods to support critical evaluation of sources. | Tutorials include tips and hints on managing information from sources and the key elements of literature review.<br><br>Main library workshop in Week 2 – overview of key sources of academic information especially databases and introduction to EndNote. Reminder of key ethical issues – plagiarism and need for correct citation. |

**Fig 1 : IL Self Assessment Activity**

**How Information Literate are you?**

Read the behaviour and associated example and then give yourself an honest rating between 1 and 5.

Score : 1= Poor    2= Fair    3= Good    4= Very Good    5= Excellent

| <b>Behaviour</b>  | <b>Example</b>  | <b>Rating</b> |
|---|---|---------------|
| I analyse my information needs before I start looking for information             | Defining keywords and phrases, using mind mapping techniques, talking to friends, finding background information              |               |
| I choose sources appropriately  | Don't just use Google, but try different types of information such as books, newspapers, government reports, people, websites |               |
| I can search for information effectively and efficiently                          | Using advanced features of search engines, combining words, limiting searches   |               |
| I know how to ask questions to help me get information                            | Using appropriate language, saying things in a different way, listening skills  |               |
| I can gather brand new data when required   | Designing and creating surveys, gathering data, carrying out interviews   |               |
| I know how to keep up to date with new information                                | Knowledge of the main information sources for your job/subject area   |               |
| I understand how to interpret information retrieved from different sources        | Understand how search engines rank results, being able to sort results sensibly   |               |
| I evaluate the quality of the information I find                                  | Using appropriate criteria such as currency, bias, authority to assess information  |               |
| I can understand the information I find, analysing and synthesising appropriately | Able to summarise, reword information, collate material from several sources. Know not to cut and paste!                      |               |
| I recognise the legal and ethical implications of using other people's work       | Understanding of copyright and plagiarism. Able to reference material correctly   |               |
| I think about what I am doing and make changes as a result                        | Reflect on what works and change habits as a result   |               |

Adapted (with permission) from an idea by Helen Conroy, Netskills, Newcastle University.

## Fig 2 IL Assessment Criteria

Student:

Module:

### Information Literacy Assessment

Score 1 (low) – 5 (high)

| Criteria                         | Description  | Score | Comments |
|----------------------------------|--|-------|----------|
| C1: Independent Research         | The work shows evidence of some independent research<br>i.e. sources other than course textbook/ lecture notes have been used            |       |          |
| C2: Relevance                    | The sources used are appropriate to the <b>topic</b> and <b>level</b> of study<br>i.e. the kind of sources you would expect              |       |          |
| C3: Validity                     | The sources used have <b>academic credibility</b><br>i.e. books, journals, quality websites  |       |          |
| C4: Critical thinking            | The student has incorporated the information into the essay in a way which demonstrates understanding of the topic and critical thinking |       |          |
| C5: Citation                     | a. References are cited correctly<br><br>b. All sources are cited in the text and bibliography   |       |          |
| C6: Plagiarism                   | There is no evidence that any material has been plagiarised  |       |          |
| C7: Information literacy ability | Total score, indicating the general information literacy of the student (35=100%)  |       |          |

### **3.3 Concurrent Information Literacy activities**

The development of the Environmental Sciences programme was taking place within the context of other information literacy work initiated by library staff. The Newcastle Information Literacy Project (Bent, 2006) has developed a toolkit of learning objects, links and ideas which can be repurposed by teachers to integrate into the curriculum and this provided a rich source of accessible material for both teaching and library staff. Materials developed for the Environmental Sciences programme, such as the self assessment activity, have also been deposited into the Toolkit so that they can be used by others. The impact assessment criteria are being piloted in a University Teaching Fellowship project aimed at integrating IL into Chemistry and this has allowed refinement of the criteria to the benefit of the Environmental Sciences course. The student self assessment activity was adapted from work on perceptions of IL by secondary school pupils and teachers (Bent, 2008); this study also influenced the design of the focus group discussions and informed some of the approaches taken in the individual IL interventions.

### **4. Assessment of the impact of the IL interventions**

In the past, in spite of the huge investment of time and effort expended by library staff in delivering information literacy related activities at Newcastle, there has been little hard evidence to demonstrate how effective the activities have been in the real development of students as information literate learners. Competency based tests assess specific skills, such as citation and can indicate whether students can use specific resources effectively and can describe their search strategy, but on the whole there is little evidence that the intervention has permanently changed the students' attitudes and habits with respect to information. Noe and Bishop (2004) comment that

“little direct research has been conducted on whether these information literacy programs are effective”

and this is true of the bulk of IL related workshops and tutorials.

Given that IL encapsulates both a skill (training) element and an attitude (education) element, the assessment of the success of the Environmental Sciences programme has included both qualitative and quantitative techniques.

#### **4.1 Methodology**

A range of different IL interventions and evaluations was piloted across the Environmental Science programme, so a range of techniques had to be employed to capture a sense of their impact. At this stage, emphasis was mainly on testing and refining the activities and evaluations, rather than a providing a full structured assessment of their impact, so although all students participated in the activities themselves as part of their environmental science curriculum, only volunteers joined in the self assessment and discussion group exercises. As volunteers tend to be motivated, higher achieving students, this will inevitably lend some bias to any conclusions. However, the work has served as a basis for a more structured evaluative framework which is currently being implemented.

#### **4.2 Self assessment results 2007**

Students rating of their own IL ability at the start of the programme indicated both their individual perceptions of their past experience and current information literacy level. Overall, mean scores were mainly between 2.4 and 3.6, with students rating their ability to “interpret information retrieved from different sources” the highest and ability to “gather brand new data” the lowest. Interestingly, the broadest range of ratings, including several rated at the lowest [1] and the highest [5], was “recognizing the legal and ethical implications of using other people’s work”, some indication perhaps of the variable prior learning experiences of the students.

#### **4.3 Student learning logs**

The learning logs submitted by the Stage 1 students ahead of the library workshop highlighted the range of starting points for the students and a range in student willingness to engage effectively with self-directed learning approaches.

“My first experience of the library was on the Wednesday on the induction week. This was a self-guided tour of the library facilities using a guided tour from a marked route and an information booklet. This wasn’t overly successful and perhaps important facts were overlooked. This could have been due to lack of concentration due to lack of sleep or the lack of the tour’s relevance to my course (or so I believed). .... On the paperchase exercise I severely struggled, eventually asking for help. After receiving help the library system became far clearer and I was able to complete the paperchase. On a visit to the library on the search for information on climate change due to the relaxed nature of the visit I managed to get more familiar with the library system and I’m now far more comfortable with the system.”

“I first visited the library during my first week at University when I had the library induction. I used this time to familiarise myself with where the Environmental Science books were in the library as I thought I would be using them a lot! I found the books relatively easy to find using the maps as a guide and feel that I could now locate them with ease. Although this initial information was useful I didn’t find as much information on how to use the library as I did with the paperchase exercise”

Later learning logs submitted in review of their group work to find information on a range of topics and present it back to the whole class showed that some had got it, and were using a range of sources with some clear strategy and planning, and others not.

“The majority of the research I carried out was at home on the internet”

“I did search for relevant information myself, mostly using the internet as this was more convenient for me. This is because the library is quite a distance from my halls and this presents quite a difficulty at the weekend”

“I learnt successful ways to gather specific information from the internet by refining my words when using search engines within websites. I also realised how important it was to look at the information carefully and relate its relevance back to the question”

“I felt that I have achieved quite a lot. I actively used journals in my research for the first time in a project, and indeed used a range of journals. I also reduced my dependence on books quite a lot. Many of the statistics in the presentation were taken from websites – government departments and agencies. The use of these websites means that my information and figures were reliable and more current. I also used portals and gateways on the Internet following the library exercise and a very good book on sources of information on sources of information in environmental science in the library reference section”.

“Reviewing my learning logs through the course, I can see that I have begun to use journals and the internet to find different kinds of information more effectively and I have used the library much more. I achieved my learning aims for handling information quite well.”

The search strategy used for the essay outline also confirmed that students used a range of approaches, not always very successfully:

“I went onto the Internet where I used a variety of search engines and key words to find information that may have been of some use to me. The main search engine I used was Google. The key words I used were hedgerow, removal, farm, agriculture, amalgamation, environment(al) impacts. Each time I searched I came across many of the same web sites, which I had already used or had already found were no use to me. So I tried putting inverted commas around some words and different combinations of the key words I had already thought of. This often came up with the same websites again, however, it did sometimes come up with new sites which were useful. This was often a long process as each search would come up with hundreds and sometimes thousand of links to web sites that the search engine thought were relevant (which as I have said above, was often not the case).

As we had suspected before the course, the students’ first port of call in search for information was usually the internet. The students had also mastered the use of the library catalogue to find books.

Hence the final tutorial session on the course was focused explicitly on journal papers and, in particular, the skills needed to read them and extract relevant information, using a recent journal article on a topic of general environmental interest. Module questionnaires indicate that all students found the module was very helpful in supporting them to learn to use the library facilities. All the students indicated that their information search skills – even where they had considered them good initially – had been improved through the Module. Overall the Module was judged to have helped lots in developing the skills needed to assess information and use it to evaluate environmental issues.

The information search and evaluation strategy submitted as part of the assessment at Stage 2 shows that students were using a wider range of sources and making some attempt to distinguish them in terms of reliability and bias, though not always very systematically. For the assignment students had more difficulty in presenting the information they had collected appropriately. Few of them considered the best structure and method of presentation for the audience; in contrast all were able to find a wide range of relevant information. The better assignments assessed and applied the information they had collated well taking into account the practical purpose for which it was to be used (i.e. rapid briefing on key issues).

“There is a large amount of information available on this subject, but a lot of it is very subjective to the views of the campaign groups and not all is based on actual fact. For example the facts I found on the Environment Agency’s website were quite different to the information that I found on the website for the local campaign groups. ... Although there is a lot of information available on the negative impacts of incinerators I have tried not to get carried away with them because they are very subjective. I started by looking on the internet but found that the vast amount of information was too much to look through, so I started using books and journals for relevant information. I also feel better about using them as they are more reliable.”

“The two main sources of information used were scientific journals and the internet. These sources provide the most recent information including the latest facts and figures, as well as providing a range of public opinion (internet in particular). ... To refine the articles produced by a general search I performed a search within the search results using more specific terms. This enabled me to rapidly locate the most relevant publications.

Journal articles were very specific, so I primarily read the abstracts first to determine whether the paper was relevant, only if this was true did I read the whole article and note the key points. Usefulness was decided by the degree of relevance to the topic, avoiding highly opinionated or biased articles. Papers written to inform rather than persuade were used.

Internet searching was much less efficient as the number of irrelevant hits was much greater than the scientific article database. The reliability of websites was judged by the organisation.”

“My first search was a broad search on the CSA database through the library. A search using the words “waste incinerator” threw up papers on the technical aspects. A scan of the abstracts showed reference to municipal waste as the correct terminology. A search using the words “municipal waste incineration produced a number of papers which also covered environmental impacts. I also visited a site for the Parliamentary Office for Science and Technology this is intended not to be politically biased and simply provide information. The Office for National Statistics was also felt to be reliable and unbiased site.

The sites from the pressure groups were often a selective reworking of the information provided from other sources.

I used LexusNexus to find newspaper stories about incinerators and chose the Guardian as a suitable source. Given more time it would have been interesting to see how papers with different readership bases covered the stories”

Stage 3 students were much more focused on the academic use of information and the conventions associated with correct citation in their tutorial sessions as part of the research project module.

“I found the workshops with Moira very helpful. Before attending the workshops I had no idea about the vast information that we could get from databases and electronic journals. It's handy to know that we can get information from lots of different sources, as it is sometimes so easy just to rely on the internet, and usually most relevant books are out on loan.

The workshops also helped with explaining how references should be set out for different sources of information, as I was always confused about how we should cite a web resource.”

Almost all of the Stage 3 students were able to demonstrate the use of a broad range of sources to support the introduction (context setting) and literature review in their final submitted projects. However, it was interesting to note that if a journal was not available electronically then it may as well not have existed. Several inter-library loan requests were received for journals which were held as hard-copy in the library. The students found the integration of information skills sessions as part of modules of benefit, as well as finding the sessions themselves directly relevant to tasks that they were engaged in

“It was good having the sessions integrated into Modules throughout the year, we paid much more attention and they seemed much more relevant. The sessions this year really set us on the right track. After them we were better equipped to search for the most appropriate journals, to identify other sources of information and to reference the range of sources of material we have found. Without those sessions I would have really struggled with my research project.”

#### **4.4 Focus Groups 2007-8**

Only a small number of students volunteered for the focus groups and, as has already been stated, they tended to be the more successful and more highly motivated students. As with their comments in the learning logs, the students demonstrated a mixed range of IL abilities. It was apparent that while some had definitely moved on in their approach to dealing with information, others had still not fully engaged with the concepts.

“On the web information has to be simple and easy to follow, ease of use is a big factor in me deciding what to read. If it doesn't “look good” I don't use it”

“I think it's more difficult to know if a book's useful until you've got it and you have to read quite a lot before you know if it's useful but you can get a feel for the whole website quickly”

“When we were in a group we discussed what to do and decided how to do it and so that was easier when we started looking because we had already thought about what we wanted and it helped me to think about where I should look”

When reflecting on their personal IL journey over their first year the students were able to identify ways in which they felt they had progressed

“Learning how to reference properly has influenced every piece of work we're going to do, because of plagiarism and all that and it's become second nature to write it down when you look at a source. That was something I didn't used to do and I spent ages going back and sometimes I couldn't find things again”

“just using a library properly, I never really used one before so finding things is new”.

“Last year we didn't use it as much but now I use it every day....I learned about EJs when I came here.... and I think more about how I use web sites”

There was also evidence that whilst several students had absorbed some of the messages relating to choice of sources, in the main they only applied this thought process to their academic information activities and did not carry over the concepts into their everyday life.

“I think everyone’s initial approach is Google, but there are obviously other places to find information (chuckle) for like essays and stuff”

“It depends if you want academic information or just general information like about how much it would cost to buy something”

Thinking back to their original self assessment of their information literacy, all the students felt that they were now more information literate, basing their assessment, it seemed, on the fact that they knew about more sources of information.

## 5. Discussion

Bridgland & Whitehead (2005) highlighted the importance of an explicit endorsement of informational literacy within the institutional teaching and learning strategy; this provides a framework allowing approaches to IL to be taken at a programme level, rather than simply as response to the needs of individual academics. However, even where there is an institutional policy with regard to the integration of IL, Bridgland & Whitehead (2005) found that success continues to be dependent on “working directly from the ground up with academics”. McGuinness (2003) and Peters et al (2003) also highlight the critical importance of lecturers in both deciding the value given to information in their teaching and influencing students’ use of information sources. McGuinness (2003) however suggests that to date the evidence suggests that there are only occasional pro-library individuals who have really taken IL integration into the curriculum on board. There are few well documented examples of IL teaching in the context of a programme or module; in contrast library websites often hold a wide variety of materials on IL skills including access to self-taught training packages (e. g. [http://www.ncl.ac.uk/library/info\\_skills.php](http://www.ncl.ac.uk/library/info_skills.php)). This work suggests that finding links – here with the concept of scientific literacy – to the specific method and culture of the academic discipline can provide the bridge needed to bring even library-neutral academics into active engagement with IL concepts.

Surveys of students as information users tend to confirm the initial feelings of staff with regard to the environmental science students and the descriptions student make of their own search behaviours described above.

“Student use is focused upon the web, email and library catalogues, and they use search engines and sites they are familiar with as the starting point for most academic as well as personal queries” (Martin & Williamson 2003).

“Students tend to search in unsophisticated ways, often not really understanding what to look for, nor how to go about a search”. (Peters et al. 2003)

“It was evident that the students were collecting information in a random, non-discerning fashion, which was reflected in the quality and type of information contained within their assignments”. (Rossi & Hinton 2002)

Smith and Oliver (2005) also highlight the relative unpreparedness of students for finding, accessing and organising information sources. In most subjects students were expected to become independent learners and critical thinkers, but the way that this was to be achieved was usually only expressed in very general terms (Peters et al, 2003). Most academics assume that students are somehow, albeit haphazardly, developing information skills (McGuinness, 2003). However, students apply the strategies for learning which they have developed in order to be successful in their previous educational institution (Ryan 2000). However, in terms of their understanding of the concept of IL, Bent (2008) discovered that many students have a much more sophisticated understanding than their teachers perceive, which indicates that they would be receptive to more explicit discussion on how they can develop as information literate learners. In carrying out the assessment of information literacy and the preliminary evaluation reported above it is clear that students have rarely previously been challenged to consider how they are finding and using information and hence they can find reflection on these aspects difficult.

Best practice guidance for student learning therefore recognises that it is essential that if students are to develop new or altered strategies for learning these must be fostered, supported and encouraged through the structure of the teaching and learning environment (Crosling & Webb, 2002). The preliminary evaluation of this “golden thread” approach confirms that if information skills are recognised as key skills within the subject benchmarks, and hence in programme specifications, a planned and recursive approach to teaching and learning information literacy is required.

Initial approaches to integrating information skills teaching have meant that information specialists or librarians lead sessions to teach information skills as part of modules (Bridgland and Whitehead, 2005). Peters et al (2003) showed that most information skills teaching to date has been focussed on how to search for, locate and retrieve information and present a properly formatted bibliography. Martin & Williamson (2003) give evidence that even after preliminary information skills training, students make poor use of the wide range of subscription and other higher-education funded electronic information sources and gateways. The preliminary evaluation of these students also indicates that they are very difficult to wean off a “Google habit”. Yore et al (1993) cite a number of examples which show that many students are uncritical readers, and do not apply their previous understanding of a topic to the information they are reading; often students apply a higher degree of certainty to the information provided than was actually expressed by the authors. Students often find difficulty in separating an evaluation of the quality of the science from the quality of the reporting. No courses currently “teach students to recognise their information need nor how to synthesise information to create new knowledge” (Peters et al 2003). Godwin (2003) concluded that evaluation of information was the most vital skill needed by students and one that has featured least strongly in past development of information skills courses. Embedded teaching and a requirement for reflection on some of these skills seems from the preliminary evaluation reported to have supported student learning and integration of them as habits of learning. However, more evaluation is needed in this area.

Johnston & Webber (2003) developed a stand-alone module to develop a range of information literacy skills. Their work found that students began with concept of information literacy as concerned with finding and using information sources, as they became more experienced they also began to value information evaluation and management aspects. Rossi & Hinton (2002) integrated information literacy development into an introductory module:

”The assessment tasks used the subject content of the course as a medium through which students were able to demonstrate their acquired information literacy skills, apply them to situations that reflected their personal backgrounds and consider their application to situations other than their own” (Rossi & Hinton, 2002).

Rossi and Hinton (2002) however concluded that their expectations with regard to the development of students’ ability to critically analyse and evaluate, then apply were over-ambitious for a one semester course, which also had a range of other objectives; hence the more advanced information literacy skills were hatched, rather than fully-fledged by the end of the course. While the work of Rossi & Hinton (2002) and Johnston & Webber (2003) sit at opposite ends of the integrated versus stand-alone debate, both studies support the finding of Smith and Oliver (2005) that information literacy is a highly individual and situated practice. The preliminary evaluations carried out to date confirm this and suggest that assessment of IL should be focused on both supporting student reflection on processes and the final outcomes.

For academic and library staff, one of the benefits of drawing a thread of information literacy through the whole environmental sciences programme is the ability to map the IL development of students from the very start of their university experience right through to graduation. Once the programme integration is fully established, this will enable evidence of the potential contribution the programme has made to IL as a graduate attribute to be more easily recognised. The interventions, techniques and methodology used in the programme to date will be extended and developed during academic years 2008-9 and 2009-10, resulting, we hope, in more comprehensive evidence of the value of the approaches taken. For the students, the articulation of the concepts surrounding IL very early in their university experience allows them the opportunity to recognise the value of the IL activities as part of their wider learning experience within the context

of their subject and beyond. Piloting the IL activities alongside the evaluation and reflective feedback activities in the programme enabled us to refine and adapt both on an ongoing basis, so that lessons learned from Stage 2 students, for example, could quickly be reflected in the work done with Stage 1 students. Building this kind of flexibility into the programme is essential if it is to continue to be relevant and to enable it to adapt to the changing needs of the students.

## 6. Conclusions

Some aspects of IL can clearly be taught to all students in the same way, thereby allowing the development of generic supporting resources. Other aspects may be better learned in a specific disciplinary context. Considering the development of IL throughout the degree programme has led to a blend of integrated and stand-alone teaching and learning approaches, but it is clear that both need to be valued through direct credit-bearing assessment whenever possible. If “marks” or even self assessed rankings are attributed to IL abilities, this serves to challenge and motivate students towards improving their ranking in a later assessment exercise. It is evident that embedding the assessment of IL ability can play a crucial role in engaging students with the concepts involved, so that as well as learning specific skills, they have the opportunity to develop a wider awareness of the information environment. Any impact evaluation also needs to be embedded alongside the activity.

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