

**UNTANGLING SPAGHETTI?
THE COMPLEXITY OF DEVELOPING
INFORMATION LITERACY IN SECONDARY
SCHOOL STUDENTS**

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EXECUTIVE SUMMARY

Aims of the study

This report presents findings from a small study investigating the relationship between mediation and effective development of information literacy in secondary school students. The focus of the study was on the approaches and strategies used to develop information literacy by a Support for Learning teacher and the school librarian. The teacher and librarian worked with a small group of Support for Learning students, with moderate but non-specific learning difficulties, who exemplify the underdeveloped information literacy seen in many students in any mixed ability class. The study was conducted during the first six months of 2006 in a state secondary school in Aberdeenshire and was funded by the Scottish Executive Education Department under the sponsored research scheme.

The study set out to identify:

- The aspects of information-related activities that this particular group of students find challenging.
- How approaches to the delivery of information skills influence the development of information literacy.

Methodology

The study took the form of a case study focusing on how the teacher and librarian deliver information skills through an information activity with a small group of students in their second year at secondary school identified as requiring support for learning. The activity took the form of a series of lessons designed by the teacher and librarian with the aim of developing student skills of gathering, sifting and sorting information, culminating in a presentation of information in the form of a PowerPoint presentation. The teacher and librarian involved played a full and active part in both the development of the project, the data collection and interpretation. Their own experiences of working through this research-based teaching approach were incorporated into the findings. Focusing on a small group of students enabled the teacher and librarian to observe and reflect in greater depth than is often possible with larger classes.

The data was collected through field notes of lessons observed by the researchers and recorded post-lesson reflective discussions with the teacher and librarian. Summaries of these discussions were fed back to the teacher and librarian as a means of checking interpretation, as a reminder of the discussion and ideas considered and as a means of posing further questions for consideration and reflection.

Analysis of the data focused on key points of observation during the lessons, centring on student learning and mediation by teacher and librarian, and key points of reflection during the post-lesson discussions.

Findings

The main contributions of the study focus on the challenges encountered by the students during the information-related activity and the difficulties the teacher and librarian experienced as they helped students develop information skills.

The problems students encountered were less related to a lack of specific skills and abilities than the difficulties encountered in making connections between those skills and information literacy as a means of building a knowledge base of both the subject and its information context.

The major challenge for the teacher and librarian was their realisation of the complex nature of information literacy (described by the teacher as ‘tangled spaghetti’ of skills, decision-making, cognitive and affective elements) and how this detracted from their ability to teach a pre-defined sequence of skills within the time constraints of the activity.

The challenges observed appeared to stem from the teacher/librarian-led, skills-focused approach which was based on an interpretation of information skills as a set sequence of stages and skills within an overall process of finding and using information. This sequence of planning and defining the information need, gathering information from a variety of resources, organising that information and presenting it to a defined audience, is commonly applied through project work in secondary schools. Their approach influenced both the structure of lessons and mediation between teacher or librarian and students:

- The teacher and librarian in this study felt it was important to be sure they were covering the entire information process and skills set in one series of taught lessons, with relatively equal emphasis on each skill: in practice this did not allow sufficient time to explore any one skill in depth.
- By breaking up the process into a sequence of separate pre-defined skills without a consistent emphasis on purpose and enquiry, the students had very little opportunity to follow through and make connections between the information they were finding and the more challenging steps in sifting and selection and processing that information.
- While there was some discussion of students’ prior knowledge of the topic, there was little opportunity for students to demonstrate prior experience of information skills.
- The emphasis in much of the mediation between teacher or librarian and students was on skills and techniques rather than the enquiry and the learner.
- There was little opportunity for students to engage in dialogue to explore and reflect on why the skills taught are needed and what is achieved by using them in terms of knowledge gained and greater achievement.

- This lack of dialogue also restricted the ability to gauge students' understanding of the task and thus the ability to mediate effectively. In part, this stemmed from the teacher's and librarian's reservations about students' ability to engage in meaningful discussion, recalling past experience and knowledge, although there was some spontaneous evidence to the contrary.

The evidence, taken together with evidence from previous studies, suggests that the solution to information literacy development is not just the need for more time to allow greater emphasis on each skill but also the need to consider an approach which is more enquiry-focused:

- An approach to information literacy which is driven by the enquiry and the nature of the required information, would allow information skills and aspects of information literacy to be introduced at the point of need within the enquiry, reflecting the iterative nature of the process rather than adhering to a rigid interpretation of information skills models and frameworks which can restrict this natural rhythm.
- An enquiry-focused approach would emphasise the development of knowledge as well as skills; take account of the learner and his/her prior knowledge; facilitate shared understanding of task and enquiry, and the skills and information needed to fulfil that enquiry; use the dialogue of mediation and reflection to make connections between skills, knowledge and achievement.

Whatever approach is adopted for the development of information literacy in secondary school students, it is likely that a radical shift in teaching approach is necessary to place the enquiry and student information needs at the centre of the teaching focus. This will be challenging for schools. However, it is clear from this research that observation, dialogue and reflection by teachers and librarians is the key to understanding and working with the complexity of information literacy rather than attempting to untangle the strands of the 'spaghetti'.

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1 INTRODUCTION

This report describes a small research project which aimed to examine the types of mediation required to overcome barriers to the effective use of information by secondary school students. The focus of the study was on the approaches and strategies used to develop information literacy by a Support for Learning (SfL) teacher and the school librarian. The teacher and librarian worked with a small group of SfL students, with moderate but non-specific learning difficulties, who exemplify the underdeveloped information literacy seen in many students in any mixed ability class (Williams & Wavell, 2006). The study was conducted during the first six months of 2006 in a state secondary school in Aberdeenshire and was funded by the Scottish Executive Education Department.

The study set out to identify:

- The aspects of information-related activities that this particular group of students find challenging.
- How approaches to the delivery of information skills influence the development of information literacy.

One of the original definitions of information literacy states that:

“To be information literate, a person must be able to recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information ... Ultimately, information literate people are those who have learned how to learn. They know how to learn because they know how knowledge is organized, how to find information, and how to use information in such a way that others can learn from them.” (American Library Association, 1989)

The study reported here contributes to the knowledge base about information literacy by considering some of the deep seated issues that influence the effective development of information literate students. It looks beyond the finding of information, to the challenges students face within the complex process of identifying their information need and making decisions about how to progress through the cognitive processes of interpreting, selecting and applying information within a specific context.

The main focus of the study is on the strategies used in teaching information literacy, i.e. how alternative approaches and mediation can influence the learning experience of students. Previous research by the authors with mixed ability groups highlighted the importance for interaction and mediation at the point of need within the information process and for mediators, whether teachers or librarians, to closely observe the behaviour of students when interacting with information (Williams and Wavell, 2001). In building on that previous research, and by focusing on teacher and librarian strategies for mediation, this research is firmly in line with the current developments in Assessment is for Learning and the value of formative assessment and sharing assessment criteria.

The target research group are key candidates for enhanced inclusion, whereby vulnerable groups not only have access to the information society but can participate in the decision-making processes needed throughout life by enhancing their life skills.

The study provided the opportunity for practitioners, in this case a teacher and a librarian, to become actively involved in the research process by developing their understanding of information literacy which they can then integrate into the learning cycle of their students.

2 BACKGROUND

The purpose of this small study is to examine the types of mediation required to overcome barriers to the effective use of information by secondary school students, who require support for learning and who exemplify the underdeveloped information literacy seen in many students in any mixed ability class (Williams & Wavell, 2006).

One of the recent definitions of information literacy describes it as: “*the ability to identify, locate, evaluate, organize and effectively use information to address issues or problems at hand that face individuals, communities, and nations.*” (Thompson, 2003). Although elements of information *skills* have been incorporated into the educational curriculum in various ways for many years, the emphasis has been on the tools and processes of finding information. However, more recent research suggests that information literate individuals use a complex mix of skills, knowledge and attitudes to help solve personal, job-related and wider issues and problems. Thus to be information literate requires information skills, i.e. awareness of how information is organised in a variety of formats and the ability to access and manipulate information, but also requires cognitive processes to evaluate, synthesise and combine new information with prior knowledge in order to create new knowledge or use knowledge wisely. These more recent studies examine the use of information from the user perspective (Bruce, 1997; Kuhlthau, 2004; Shapiro & Hughes, 1996) and emphasise the cyclical and iterative nature of the process (Becta, undated; Moore, 2002). This is not readily apparent in some of the traditional programmes and linear models and tools adopted to develop information skills at school (e.g. Marland, 1981). Such studies emphasise the need for more effective pedagogies and curricula based on an understanding of the information user perspective and the relationship between information literacy and learning.

The need to be able to find, critically evaluate and apply information in learning and problem solving is not new (Doyle, 1992; Rogers, 1994; Williams, 1986) but the significance has increasingly been recognised in the context of information and communication technology (ICT). The introduction of ICT in workplace, home and school has made information readily accessible but has also highlighted the significance of issues of quality, relevance and reliability of information, as well as the value of being able to deal effectively with the quantity of information and sources available. Thus information literacy can be seen to be directly relevant to learning and achievement both in education and in life, and information access and use is now seen as part of the foundation of lifelong learning.

The New Opportunities Fund (NOF) has done much to ensure all groups within a community have access to the abundance of information available in today’s society through the provision of ICT hardware, and levels of technical skills are acknowledged to be increasing (Condie, Simpson, Payne & Gray, 2002; Harrison, et al., 2003). However, the integration of ICT into the curriculum has reinforced the need to enable users not only to find information but to evaluate and interpret this information in relation to the task in hand. Research into teachers’ conceptions of information literacy indicates that teachers perceive some students to be better equipped than others to develop or apply strategies to seek and make sense of information within a curricular context thus enabling them to reproduce, interpret or transform that information with existing knowledge and understanding to accomplish

specified tasks (Williams & Wavell, 2006). On the other hand in any mixed ability class there are other, less able students, who, according to teachers, appear to be less able to develop and apply strategies effectively and for whom information-related activities pose a particular challenge (Williams & Wavell, 2006). These same teachers, while making suggestions that differences in student approaches may be linked to reading ability, motivation, developmental maturity and ultimately family background, found it difficult to pinpoint which actions, approaches and strategies they might use to minimise the challenges faced by less able students when tackling information-related activities.

Previous research by the applicants examining the impact of the school library on learning within mainstream mixed ability classes suggested that appropriate interaction and mediation were key factors influencing the development of effective use of information skills (Williams & Wavell, 2001). That study raised questions about the challenges teachers clearly felt when invited to interpret learning activities in relation to information handling, as well as the ability of librarians and teachers to diagnose information problems faced by learners and to intervene meaningfully to support them. Librarians viewed information skills as isolated tasks to be tackled in a methodical manner, underestimating the complex inter-relationship between these skills and cognitive processes associated with knowledge building, understanding and decision-making. Teachers on the other hand were more concerned with the end product without looking closely at the process students went through to achieve that curriculum goal. Research by Kuhlthau (2004) examines the importance of appropriate and timely mediation to guide students in their information decision-making and correlates her research with Vygotsky's Zones of Proximal Development (Vygotsky, 1978). Byström & Järvelin (1995), while looking at adults' use of information, found a clear relationship between task complexity and types of information and sources used. Perception of task was the focus of research conducted with able students in Sweden which revealed a correlation between information-seeking behaviour, quality of curriculum-related learning outcome and student understanding of the task in terms of being confused by, accepting, or critically examining bias in information (Limberg, 1999). Several studies have reported on the relationship between perception of task and how students tackle research projects (Burdick, 1996; Many, Fyfe, Lewis & Mitchell, 1996; Merchant & Hepworth, 2002). McKenzie (2003) takes the view that the type of questions asked (how, why and which rather than what) provide the key to successful development of analytical skills required to process information. Thus findings from recent research suggest several key factors as being significant for the development of information literacy:

- Type of task set and questions posed;
- Perceptions and shared understanding by mediators and students of what a task entails;
- The approach used in mediation;
- Prior knowledge, skills and understanding (subject and information-related).

In turn, this suggests, that the use of existing information literacy models and structured information skills programmes alone are not enough to ensure information literate students: the strategies used to mediate with the process of finding and using information will be key to helping learners make the connections between information and learning.

Much of the above research has been conducted with adults or mainstream students who, despite limitations in efficiency and effectiveness of information skills, have sufficient knowledge, understanding, skills and strategies to be able to follow the information process through to a sufficient standard to satisfy, at least in part, the outcome criteria. Students whose academic achievement is below average do not necessarily demonstrate sufficient motivation, prior knowledge, understanding, skills and alternative strategies, or the ability or confidence to transfer these qualities in order to work independently with information when hurdles and challenges are encountered. They exemplify the need for appropriate mediation strategies which take account of the complex inter-relationship between information literacy and learning. The small study reported here focused on a group of students who are identified in school as requiring additional learning support, students who need to develop lifelong learning skills in order to become active and inclusive members of the community. The study analysed typical information-related activities and the associated sub-tasks as perceived by the learner, teacher and librarian to help a) explain student behaviour in those tasks and b) evaluate the effectiveness of mediation and interaction between the teacher or librarian and the learner.

The study continues previous research which examines the relationship between the school library, information and learning (Williams and Wavell, 2001) but shifts the focus onto the strategies and experiences of the teacher and librarian within the classroom context. The research develops a greater understanding of the teacher and librarian perspectives on the day-to-day challenges of developing information literate learners and, together with that previous study, contributes to emerging theories of the nature and impact of appropriate mediation on the learner experience.

3 METHODOLOGY

3.1 The case study

The research took the form of a case study of a collaborative approach by a Support for Learning (SfL) teacher and a school librarian to develop the information literacy of a small group of S2 SfL students in one state secondary school. The research followed the progress and outcomes of a series of lessons using a complementary mix of observation of teacher and librarian strategies and actions within lessons; observation of students within lessons; and a series of in-depth reflective discussions with the teacher and librarian.

The teacher and librarian involved played a full and active part in the development of the project, the data gathering and interpretation, and their own experiences of working through this research-based teaching approach were incorporated into the findings. The project team met with the participating teacher and librarian for initial planning sessions to establish a suitable group of students, arrangements for parental and student consent to be part of the research and the logistics of co-ordinating the timetables of students, teacher and librarian. Consent letters were distributed to the students involved, detailing the aims and objectives and assuring anonymity of reporting at all times. One pupil declined to take part and was given alternative class arrangements and this reduced the participating group to four male students.

It was initially intended that the study would focus on two information-related activities with one group of students under the direction of the SfL team. The first information literacy activity with these students was due to run for six weeks immediately after the Christmas holidays, with a second activity planned to follow. In practice the initial activity was extended and became the sole focus of the data collection, becoming in effect an iterative cycle of practice, reflection and adaptation on the part of teacher and librarian.

Despite assurances that the research team would be kept informed of all meetings and decisions, it became apparent during recorded reflection sessions that the teacher and librarian made use of brief, ad hoc encounters to clarify plans and make decisions. This is recognised as the way in which school communities function and, although not planned for within the study, proved to be an advantage in that the research team observed classes, as did the students, from a position of little prior knowledge of what to expect on a weekly basis, despite a number of possible ideas being presented at the initial planning sessions and subsequent reflection discussions.

3.2 Selection of Sample

Teachers recognise that some students in any mainstream class have less well-developed information literacy than others by the time they reach secondary school and that in most classes information literacy abilities will be very mixed (Williams and Wavell, 2006). SfL students were selected because they exemplify the underdeveloped information literacy seen in many students in any mixed ability class, as well as the need for those abilities if students are to make the most of the opportunities offered within an information society.

The target group comprise four S2 students with moderate but non-specific learning difficulties who require help with reading. The research did not concentrate on the individual learning difficulties but on the challenges these individuals encounter when tackling an information-related activity and the type of strategies teachers and other members of support staff can put in place to help them overcome their difficulties. The teacher considered these students as presenting no specific problems for the research in terms of their particular learning difficulties, other than their common need to develop strategies that will help them use information both at school and later in life. Of equal importance is the need for these, and all students, to understand that information skills are transferable between school subjects and life activities and this leads to information literacy.

Working with a small group enabled teacher, librarian and researchers to gain focus and depth of analysis with a few students without the added constraints and complexities of coping with a larger class, some of whom might have quite well developed information literacy. A small group of this nature are accustomed to and provide scope for unhindered one-to-one mediation. In addition SfL students have greater flexibility in the timetable to allow activities to be adapted without jeopardising the curriculum.

The risks involved in conducting this research were considered to be the challenge of working with a vulnerable group of students who may demonstrate reluctance to cooperate or may have difficulties expressing the challenges they face. This was minimised by the involvement of a teacher who was well-known to the students and direct researcher/student interaction was not established until the group were familiar with the presence of an observer. Students were also informed from the outset of the purpose of the research and the reasons for observation and questions. It was also made clear that it was the teacher and librarian who were the focus of the study, and that the students were not being assessed.

3.3 Data collection

At the beginning of the case study, the teacher and librarian planned the main learning activity as they normally would and the research team gathered data about the overall aims, proposed ideas for student information tasks and expected outcomes during the first of two preliminary meetings. The teacher and librarian were asked to contribute to the data collection during the delivery of the sessions by describing and discussing problems students encountered and closely observing their information seeking and using behaviour. The researchers also gathered data on the interaction and mediation taking place within the class and sought data on the student perceptions of the tasks at each step. Data about teacher and librarian perceptions and experiences was collected from the two preliminary meetings and then during the reflection sessions after each lesson. As already stated some decision-making and planning was conducted on an ad hoc basis and was not recorded but part of that process became apparent during subsequent post-lesson discussions.

The post-lesson reflection discussions became an important part of the data gathering process. During these discussions the teacher and librarian described and discussed what they had observed during the lessons and the problems students had encountered. These sessions provided an opportunity for the teacher and librarian to reflect on possible strategies to help students overcome some of the hurdles they were observed to encounter. The research team provided material from information literacy research in order to stimulate

reflection on alternative approaches. These discussions also revealed some of the ongoing planning and decision-making process that was integral to the lesson delivery. In addition they revealed insights into the challenges encountered by the teacher and librarian and their professional reflection on those challenges. These discussions were recorded and transcribed weekly.

The research assistant took detailed field notes during the lessons. The notes included details of the interaction and mediation taking place within the class and students' information behaviour.

Prior to each lesson, a brief analysis of the previous class observation and discussion was emailed back to the teacher and librarian. This provided both a written reminder of the key points discussed and an opportunity for the researchers to pose questions and highlight research and current thinking from information literacy research. This was intended to stimulate further reflection. In this way it was hoped that the teacher and librarian would feel they had developed understanding of a wider range of options to consider when thinking about solutions to the challenges they identified.

A further lengthy meeting between the research team, teacher and librarian was held at the end of the main information activity when all key issues were considered again, and teacher and librarian were asked to reflect on their understanding of the challenges of information literacy development and the relative strengths and weaknesses of the strategies they had adopted within the overall information activity.

3.4 Data analysis

Meetings with the participating teacher and librarian were audio recorded and field notes were taken during the teaching sessions. Student notes and final work was examined during the lessons. Audio recordings were transcribed and verified with field notes and observations from student work. To aid analysis, each lesson (L) and post-lesson discussion (D) was given a number according to the sequence in which that lesson or discussion took place. Each participating student (P) was given a random number (1-4) to ensure anonymity. Thus, for example, P3.L2 would refer to student 3 in lesson 2.

Preliminary analysis of the issues emerging during each lesson and post-lesson discussion was emailed to the librarian and teacher prior to the next lesson. This provided an element of member checking and verification of quality and accuracy of the data interpretation.

The final analysis of the triangulated data sets, as presented in Section 4 below, examined:

- the strategies and approaches used by teacher and librarian and how this related to their understanding of the relationship between information literacy and learning (see 4.1);
- the effectiveness of interactions and mediations involving teacher and/or librarian with one or more students.(see 4.2);
- student responses: the relationship between students' perceptions of the tasks at each step and their information behaviour, particularly at critical learning points (i.e. points at which they could not progress without some form of mediation to help them overcome hurdles) (see 4.3);

- teacher and librarian experiences: the observations made and challenges experienced by teacher and/or librarian in relation to their own strategies and understandings of information literacy (see 4.4).

4 FINDINGS

4.1 Planning the learning activity: overall strategies and aims

Teacher and librarian's aims for the activity

This sub-section considers how the teacher and librarian viewed the learning activity, their aims and lesson plans and the factors that influenced their planning decisions from an information perspective. In doing so it highlights the similarities and differences in emphasis and interpretation of overall goals.

The teacher and librarian were keen to participate in this case study because they wanted to develop more effective means than they felt they currently had to develop information literate students throughout the school. At the initial planning meetings both teacher and librarian interpreted information literacy in terms of research project work that uses library resources but indicated the skills required to carry out such an activity are transferable and valuable beyond school. Their initial plan was to teach a specific sequence of skills using 'insects' as a subject focus, across a series of lessons, during which the students would build a portfolio of evidence of the skills they had learned. The students would then be given the opportunity to practise these skills by undertaking an individual research project, culminating in a presentation on the topic of 'wind power', a subject of relevance elsewhere in the curriculum. During the latter project, the intention was for the students to work independently using their portfolio as a reminder of the skills they had developed and should be using.

The librarian already taught first year classes the skills required to access information from a library (for example, the arrangement of resources within a library and using indexes and the library catalogue) and the skills to plan and conduct an information task (for example, mind mapping and note-taking). However, she indicated that many students were not demonstrating the ability to transfer these skills to other situations within the curriculum and was concerned that they were not information literate when they left school. Drawing on her experience of how students behave when seeking information in the library, the librarian expressed the need for students to understand and practise specifically defined library and information skills and appeared to understand information literacy as the ability to find and use information within a traditional information skills framework (see Section 2 above). The teacher drew on her knowledge of the additional support individual students require for effective learning and again felt the need to identify and teach a number of skills explicitly, to enable students to make connections between their learning and the wider implications of tasks being undertaken. Both teacher and librarian were initially confident that individual skills should be demonstrated or explained before students were given the opportunity to practise them and felt it would be necessary to remind students during the lessons of the immediate task being undertaken. This emphasis on skills stemmed from the teacher's and librarian's belief that students are so keen to finish a set task that youngsters often fail to appreciate the significance of the transferable skills they are learning and using during that process. Thus during the second planning discussion, the teacher and librarian decided to give students explicit guidance on the research process, as the teacher and librarian understood it, without making any assumption of previous experience or understanding. It was felt important for these students to complete the activity successfully and then to be given the chance to repeat the exercise with minimal guidance.

Evaluation of skills development was considered important both for teacher and librarian as mediators and students themselves to understand individual strengths and weaknesses at the end of the activity. At the initial discussion meeting the idea of some form of cross-curricular skills passbook was mentioned and was brought up again during the post-lesson discussion meetings. The lessons began with the intention of students maintaining a portfolio of evidence of the skills they had developed during the course of the activity. The plan was also to encourage the students to reflect on where else in the curriculum or home they had used those skills, and the teacher and librarian were going to use an observation checklist for informal assessment at the end of each session.

When asked directly what their overall aims for the activity had been the teacher and librarian expressed differing emphases. The teacher wanted to engage the students as active thinkers rather than passively completing a task to get it finished and out of the way. She also wanted to teach them skills to enable them to gather information (knowing how and where to start, the use of keywords and note-taking techniques), sift and sort information. The librarian saw information skills and teaching of the information process as her main focus. She wanted to look more closely at how the students were responding to the task because she was aware that her current approaches were not necessarily providing students with effective means to select, sort and sift information, in particular.

Content and sequencing of lessons

This sub-section considers what was actually observed to take place in the sequencing and content delivery of lessons. In practice only one extended research activity took place with teacher and librarian responding to ideas and discussion of the previous week in their delivery of the next session, thus the activity became an iterative cycle of teaching a skill and student practice during a lesson, teacher and librarian reflection on students' information behaviour during post-lesson discussion, and adaptation of teaching strategies in the next lesson.

The first four lessons took place in the classroom with information resources supplied by the library and the last three lessons were held in the study areas of the library. The content and sequencing of the lessons as a whole took a skills-focused approach, as indicated above, and was planned around a classic information literacy framework that often forms the basis for school project work when using library resources. The teacher and librarian saw the activity as being less about students producing an end product that reflected increased subject knowledge and more about developing a set of transferable skills. In this case the librarian and teacher identified skills they thought students needed to complete the research activity and introduced them in the form of three broad categories: gathering information, sorting information and presenting information. In this way the activity generally followed the sort of approach the librarian would normally take with a mixed ability class doing curriculum project work.

Both teacher and librarian expressed the opinion that students experience most difficulties selecting and organising relevant information for their current purpose, that is with the 'sorting' category, while students were thought to experience fewer difficulties when gathering and presenting information. The librarian indicated that students often arrive at the library without adequate preparation for their set information activities and recognised that understanding the purpose at the initial stage was crucial for effective completion of the research activity. While initial planning and the organising of selected information were thought to be particularly important to teach, they recognised that some skills would have to be omitted in the timescale available and some of the ideas originally considered during the

two planning meetings were not included in the lessons. Although the teacher and librarian indicated the need to concentrate on the 'sorting' aspects of the information process, in reality the lessons took the form of a conventional information skills framework, covering: planning, questioning, selection of topic, note-making, collating information, presentations and reflection on skills (see Summary of structure of lessons, Appendix 1).

In addition, each lesson included a number of sub-skills and elements related to decision-making. During the course of the activity evaluation and student reflection on transferable skills was not pursued and ultimately became one of several foci of the last lesson. Throughout the lessons teaching of individual skills was given greater attention than any knowledge gained from seeking information.

During the two initial planning meetings both the teacher and librarian explored a number of different themes around which to base the learning activity. In particular options were considered that placed the information need in situations encountered outside school, for example planning a holiday, in order to encourage students to see the transferability of skills to other contexts. However, in practice the main driving force for selection of a subject focus was the availability of non-fiction book resources in the library and a perceived understanding of how students interact with information. Thus the first lesson began with a subject focus of 'insects' which was then changed to 'spiders' in response to student interest.

The way lessons were approached reflected the librarian's and teacher's theoretical understanding of the nature of information literacy as a process of clearly defined stages involving specific skills. Thus lessons were generally observed to be driven by a skills and resources agenda rather than responses to the information enquiry or the learners' needs. The practical relationship between information literacy and learning was not reflected in the way lessons were planned and organised from the outset but became the subject of post-lesson discussion as the teacher and librarian became more aware of that relationship. The delivery of lesson content evolved in response to these post-lesson discussions and reflections on student behaviour but remained grounded within an overall information skills framework.

Nature of collaboration

The planning and teaching responsibilities for lesson delivery were based on a sound working partnership between the teacher and librarian. From the outset they discussed the importance of their collaborative relationship for sharing ideas and planning lessons and recognised that each brought differing, but complementary, strengths and purpose to the lessons. A partnership like this was thought to require time to develop, and build trust; it was thought to need shared values and an understanding of each others thinking processes. The team teaching that was observed reflected this mutual trust and understanding whereby each could pick up and develop actions and comments made by the other and the lessons moved in a similar direction when spontaneous changes took place.

4.2 Teaching and mediation strategies in practice

The librarian and teacher planned lessons to introduce tasks that they felt students would require in any information activity. They wanted to work from the basis of knowing that these students had all been taught the same skills. The librarian appeared to make most of the decisions relating to the information skills framework, i.e. the skills to be covered and how they were set within the overall purpose, within which the students worked. The teacher

supported the teaching of skills providing clarification and drawing students' attention to the decision-making. During the course of this case study, a number of commonly used teaching and mediation techniques were used, including explaining, asking questions, giving examples, modelling skills, suggesting strategies, sharing criteria, providing worksheets, positive comments, encouraging participation, and helping students make connections. However, in general, lessons were conducted with the librarian and teacher talking to the students about the particular skills they would be focusing on in the lesson and asking specific questions to reinforce awareness of the lesson, and then encouraging active participation in using the particular skill. While the librarian took the lead introducing and demonstrating the information skills, the teacher explained the reasons why the librarian was undertaking it in a particular way to help students make connections between skills, the information process and learning. For example, while drawing a mind-map of ideas when brainstorming 'spiders', the librarian automatically began grouping ideas together and the teacher explained the reason for this and encouraged the students to think about different ways of grouping ideas (L.2)¹. In addition the teacher used her professional experience and knowledge of students requiring support for learning to encourage positive participation, i.e. the motivational, self-esteem issues.

During the first lesson students were given a number of different tasks and concepts to think about with worksheets and printed cards to act as prompts, for example a worksheet to record keywords associated with their topic, a project cover for a skills portfolio, bookmarks identifying three broad information stages, and light bulb cards to hold up when making a decision. The number and variety of different tasks introduced created a lesson that the researchers found disjointed and confusing when trying to establish the intended purpose of individual tasks and their relationship to each other. The main purpose was, in fact, the introduction of the concepts of keywords and questions in information searching. However, in practice, students found it difficult to identify keywords and complete the worksheet provided. The complexity of keyword and question formulation was discussed after the lesson and the librarian admitted to finding worksheets restricting as she began to realise how choice of keywords was more complex than originally envisaged but felt worksheets provided useful evidence of work as part of encouraging students to compile a portfolio of evidence of skills development. As a result of the first post-lesson reflection, the portfolio of skills which had been started in lesson 1 was not pursued and the structure of the lessons shifted to enable skills to be more closely linked to the information purpose.

A further observation from lesson 1 was the interest that had been generated in students when the teacher had posed the question: 'Are spiders insects?' during the discussion on keywords. This resulted in a decision by the teacher and librarian to capitalise on the interest generated and shift the structure of lessons to enable skills to be more closely linked to an information purpose. Thus the original plan of explicitly teaching isolated skills and then letting the students practice those skills by doing a separate research project was adapted to a single series of lessons in which skills were modelled and practised as a class to contribute to an ongoing overall research activity culminating in an individual presentation of selected facts.

Following the interest the question: 'Are spiders insects?' had generated, the teacher invited students to find the answer for the following week. The decision was also made to use

¹ To aid analysis, data from each lesson (L) and post-lesson discussion (D) was given a number according to the sequence in which that lesson or discussion occurred. Each participating student (P) was given a random number (1-4) to ensure anonymity. Thus, for example, P3.L2 would refer to student 3 in lesson 2.

'spiders' as the focus for the information project, rather than 'insects' or 'wind power', a subject for which the librarian was finding difficult to locate resources at a linguistic level suitable for these students. Lesson 2 began with a discussion of whether spiders are insects which initiated a stimulating and interactive brainstorming session of what students already knew about spiders and the questions they would like to answer. In contrast to lesson 1, the focus of this lesson was on spiders, that is, it was subject orientated. The librarian introduced the mind-mapping skills associated with a brainstorming session as a means of organising what they already knew about spiders, with the intention of guiding students to recognise gaps in their knowledge as a focus for questions for further investigation. In practice, while brainstorming, the students became absorbed in the subject and instinctively scanned the resources available in front of them to find information to contribute to the mind-map, thus circumventing the planned sequence of skills being followed by the librarian and teacher. Although the teacher did draw students' attention to how the librarian was grouping ideas together the librarian had not intended to dwell on the intricacies of mind-maps and the reasons for organising ideas for the information enquiry or search was not made explicit. Students were asked to suggest questions they wanted to find answers to and the lesson moved on to explore how questions could be phrased in different ways (e.g. what, why, where, how, etc). So, while the lesson had been subject oriented, there was continued effort to use this as a way of making students aware of the process and skills which were being developed. However, the concept of questions as providing a useful means of furthering the information enquiry and guiding the type of information sought (factual or opinion) lost focus as the teacher, librarian and students became bogged down with identifying question 'words' (such as 'why', 'where', 'how'), without leaving time to explore the subtle implications of those words for the information enquiry.

Lesson 3 focused on the importance of questioning in the information process and also introduced the significance of audience for the final presentation as a factor when selecting information sources. In common with other school project work, the librarian had selected a younger, Primary 7, audience for the presentation of information. While intending to use audience as a means of demonstrating how this has a bearing on the resources used and information selected this was not taken up again at the presentation stage. The librarian's reason for choosing a younger audience as the focus was to enable her to provide resources of a linguistic level suitable for the SfL students. The significance of *types* of questions, and their connection to groups of ideas on the mind-map developed in the previous lesson and potential themes for investigation, were not explored. Instead students were given the task of finding the answer to a specific question, to give them practice in using resources to find specific factual information. The teacher participated in this exercise, modelling information seeking behaviour and commenting on problems she encountered. Thus the teacher was guiding and helping students see strategies and decision-making processes in action. However their own use of these strategies was confined to answering a specific question which had been chosen almost randomly from the list generated previously rather than based on interest. The teacher continued to demonstrate her search for information in lesson 4 using the internet rather than books in order to illustrate potential solutions when answers to a specific question are not forthcoming immediately. Unfortunately technology failure and problems in another classroom interrupted the flow and that became a critical learning point which was not followed through and resolved.

Different note-taking techniques were the focus of lessons 4 and 5 and alongside note-taking skills the teacher asked students to record some of the decisions they made on a separate worksheet. For lesson 4 the librarian had chosen a variety of topics about spiders from the

brainstorming session (food, poison, webs, babies, body parts) and students were invited to use one as the topic for their research. The teacher and librarian then led a discussion on how to identify the most appropriate resource for the topic and audience. The librarian had photocopied a selection of pages from various books and used these to show students how they could select, cut and paste information relevant for their topic from these sheets. In lesson 5, the students continued to select information for their particular topic by highlighting information on different photocopied pages. The lesson then moved on to helping students use books previously selected by the librarian to find and write bullet point notes relevant to their chosen topic on a simple worksheet. There was little discussion about the advantages of different methods and the librarian noted that she did not talk about what to write, the meaning of notes, using full sentences, etc. as she would do with a mainstream class. At the end of the lesson the librarian explained that they would put the information they had found into Power Point presentations the following week.

In lesson 6 the students began the presentation part of the information process. The lesson began with the teacher and librarian asking the students what they had been doing the previous weeks and reminding them that the imaginary audience for their presentation were Primary 7 children. The teacher and librarian then asked for suggestions about what they needed to do next. The students began preparing their Power Point slides, two choosing to concentrate initially on the technical presentation and two focusing more on the information they would include from their three different forms of notes (cut and pasted, highlighted and written bulleted list). The teacher made individual suggestions to students about how they might tackle the task of selecting and rejecting information from their notes, giving them practical techniques, such as deleting notes they would reject, focusing on techniques and processes, rather than the connections between the subject content of their notes, their chosen topic and the most effective means of imparting that as new knowledge for the specified audience. Thus the mediation took account of the learner but was skills-focused rather than enquiry-focused.

Students were given the chance in the last lesson to explain to another teacher what they had been doing during the previous weeks, but appeared to find this difficult. The students were also encouraged to reflect on a checklist of skills they had covered during the previous weeks and evaluate their strengths and weaknesses using a traffic light system introduced as part of formative assessment. Although they appeared to find this task straightforward, the teacher and librarian did not always think responses were a true reflection of students' understanding. However there was no discussion with students of these differing perceptions due to time constraints. During this lesson students were also given the opportunity to finish their Power Point presentations by inserting an illustration and presented the final work to the rest of the class. All the students chose to show their slides with no attempt to explain their findings verbally.

All the skills covered during the seven-week information activity are recognised elements of information literacy. The introduction of too many concepts in each lesson did not allow for exploration of each or its relationship within the overall process of finding and using information. There was growing recognition of the complexity of information literacy and learning; for example the early realisation by teacher and librarian that student motivation and interest had been greatest when they had become interested in a particular question promoted some change of strategy and an attempt to take more account of the learner in their approach to mediation. However the overall strategy remained a skills-focused strategy and

there was no real attempt to help the learner make connections between skills and the enquiry, the development of knowledge or to the importance of information literacy.

4.3 Student responses to mediation at critical learning points

During the lessons the researchers were observing students for critical learning points where students encountered some form of problem or challenge, which might have benefited from appropriate and timely mediation.

The majority of students were actively engaged with most tasks and were particularly animated when the subject matter attracted their attention, for example when the teacher posed the initial question whether spiders are insects and when they found interesting facts about web-making or Black Widow spiders. They were also attentive and enthusiastic when actively participating in the process, for example when encouraged to brainstorm their knowledge of spiders and when they used resources to find information.

However, it was also observed that students were inattentive and showed signs of boredom when the librarian explained skills without actively involving the students. This was particularly noticeable during the early lessons when skills relating to the selection and use of books were being covered. There were aspects of information skills which students either found straightforward and grasped quickly or were already familiar with, for example: brainstorming and mind-mapping; contents and basic index usage; skimming and scanning; note-taking; and technical aspects of using Power Point. This suggested that students were already familiar with certain skills and able to apply them naturally when they were thought to be needed, particularly when exploring subject knowledge. However, the librarian and teacher did not attempt to establish students' prior information experiences or their ability to apply information skills before they were taught. This was partly because they had no confidence that these students would be able to transfer any skills covered within the first year library and information skills programme and partly because they considered it would be too difficult to engage the students in reflection on their own skills.

On some occasions students displayed self-awareness of their own skills and strategies and an ability to develop strategies to suit the information task. For example, one youngster showed understanding and initiative by splitting the synthesis of information into smaller tasks to tackle (P2.L6). There were instances whereby students either attempted to defend their information decisions (L3) or recognised inadequacies in their information seeking (L7.P3) and altered their information behaviour in response to their changed perceptions. Thus students were able to demonstrate the ability to use information skills at a basic and routine level as well as to self-assess their own skills. However, the librarian and teacher did not appear to take account of prior information experience which resulted in student boredom on occasions (P2.L2).

On the other hand, three students were observed to adopt inappropriate coping strategies to overcome the frustration they experienced as a result of challenges they encountered. Student 2 wanted to change the question he selected to answer in lesson 3 when he failed to recognise the answer within the text of his selected resource. Student 4 chose a theme that was too narrow to allow him to pursue his interest in the Black Widow spider, stimulated during the brainstorming session, and his presentation demonstrated a mix of facts relating to his chosen topic and information less relevant to the topic but of particular interest to him. Student 3

expressed concern that he had not been able to find enough information from the resources available to fulfil his expectations of his chosen topic and resolved the problem to his satisfaction by changing the title of his presentation. None of these students found a solution to their problems which led them to the most effective response in relation to their information need. Frustration, along with other emotions, is a recognised affective element of working with information (Kuhlthau, 2004): if understood and/or mediated it need not cause insurmountable problems for students and, indeed, can be a driving force for finding solutions. However, as these examples illustrate, lack of appropriate mediation at critical learning points can result in the adoption of inappropriate strategies, which can, in turn, demotivate and/or lead to greater frustration.

Tasks were not always presented with a clear indication of their purpose and connection to the learning experience and on these occasions students also experienced difficulties. In general all students found it difficult to formulate suitable keywords and questions to develop a search strategy difficult (L1&2). The planning that accompanies the definition of an information need requires a number of complex cognitive processes and decisions which were not fully understood and explained to the students, despite the focus on skills and process. Keywords and questions were very explicitly defined in simplistic terms which students then struggled to put into practice because they appeared to constrain the thinking processes. The complexity of these processes began to emerge when the teacher participated in the same information activity with the students in class and reflected on her experience further during the post-lesson discussion.

Cognitive understanding of text was another area that caused one student particular problems (P3.L5) and eventually led to information that was not understood being copied into his presentation (P3.L7). The Power Point presentations produced by the students showed copied information or limited facts which the students had difficulty verbalising to the audience (L7). Illustrations chosen for slides did not necessarily reflect the theme of the presentation and the significance of the presentation and wording of slides in relation to intended audience was not developed. It appeared that the way the activity had been undertaken had not provided students with enough opportunity to fully absorb the subject matter and make the information connections necessary to fulfil the requirements of the task. The teacher and librarian were not always in a position to help students make these connections and follow the development and application of information skills through to an effective finished product adequately demonstrating the learning acquired and contributing to information literate students. Indeed several of the skills taught, for example selecting and rejecting information and transforming information into student's own words, were attempted within such limited time constraints and resource parameters that there was little scope for students to practise the skills by making realistic decisions about their information needs. Although subject knowledge was not a specific outcome intended by the teacher and librarian, it is intrinsically bound up with the information literacy. In addition, the fact that the teacher and librarian made decisions about the way the subject was defined and researched without input and discussion with students limited the opportunities for students to understand the connections between skills and cognitive processes involved in decision making. This also contributed to a lack of ownership or personalising of the activity which contributes to internalisation and deep learning of both skills and the subject under investigation.

Initially students were reluctant to demonstrate their decision-making (L2) and one student appeared to be confused by having to write down both notes on his subject theme as well as

give examples of decision-making (P2.L5). While demonstrating their ability to make decisions about their own information needs and use information skills spontaneously when needed, students were reluctant to discuss and review their previous experiences and application of skills verbally. Similarly, despite some evidence of the ability to reflect on and self-assess their own learning spontaneously, they were not always able or willing to express it. The fact that they were able to reflect on their own skills on a one-to-one basis (see below) suggests their reluctance in class may reflect a lack of understanding of what was being asked of them and why or a lack of familiarity with doing so in a class situation. Appropriate mediation could help them develop the confidence and memory to recall their actions in the context of the overall skills development and activity objectives.

When asked directly by the researcher what they had learned at the end of lesson 6, one student said scanning, highlighting, selecting and why these skills are needed (P3), one selecting information (P1), one thinking (P4) and another indicated information about spiders' webs (P2). Two students thought they had already covered some (P1), if not all (P2), of the skills before, while the others were less sure.

4.4 Teacher and librarian's reflection on their own experiences

The teacher and librarian acknowledged that the lessons for this information activity were adapted on an ad hoc basis in response to student interest and the discussions generated after each lesson. Their intention was to motivate and encourage learners to engage in what they increasingly saw as a complex process. They also realised that they were attempting to introduce a great many different elements into each lesson. The teacher felt that she was sowing seeds that could be developed at a later date although she admitted that many aspects did not appear to be absorbed by students at the time. However, the teacher and librarian did recognise that their ad hoc approach and the high skills content of lessons contributed to a number of tasks being abandoned and to the disjointed nature of some classes. They were also fully aware that their approach was influenced by their own preferred teaching and learning styles and might not be appropriate either for all students or for the delivery of some skills. The librarian felt the need for some form of expert input as the starting point for introducing skills, while the teacher mentioned modelling as a method she liked and both teacher and librarian liked to use illustrative examples to help students grasp abstract concepts. Neither teacher nor librarian were sure that skills could be developed at the point of student need during the information process and were sceptical about students' willingness to engage in two-way dialogue as a means of encouraging them to make connections between their skills development and their value in other parts of the curriculum.

During the course of the lessons and post-lesson discussions there was an emerging understanding of the complexity of information literacy; what the teacher called 'spaghetti'. At the second post-lesson discussion the teacher revealed her growing realisation of the iterative nature of the information cycle, and that each of their three broad categories of gathering, sorting and presenting involved aspects of the other categories. Thus they began to question the ease with which they could take isolated skills and separate them either from each other or from other aspects of learning. For example, after reflection on her own complex decision-making while using books to find the answer to a specific question, the teacher grew aware of the many adaptations she made to accommodate problems she encountered. The librarian indicated that she was no longer convinced that students would

necessarily be in a position to develop suitable questions as the starting point for their investigations as originally envisaged.

Similarly as the teacher and librarian began to explicitly teach individual skills they realised the complexity of even straightforward tasks, such as using an index, and how difficult it is to cover all aspects. Although the librarian already taught some skills to mainstream classes at greater depth than attempted in these lessons, such as using an index for more complex information needs, both teacher and librarian realised that at any point in an information enquiry quite complex cognitive understanding and skills are required which they were not always in a position to support during these lessons. Thus the teacher in particular began to question the extent to which these skills can be explicitly taught and isolated from real information problems.

The complex relationship between information literacy and learning was another focus of post-lesson discussion. Observation and reflection revealed how influential self-esteem and confidence, language development, interaction and inter-personal relationships are on developing successful information skills and ultimately information literacy, in the same way that they are recognised in other learning and teaching contexts. For example, the teacher saw successful experiences in individual tasks as providing the necessary impetus for students to commit to the activity as a whole. Both teacher and librarian commented on how sharing ideas as a teaching and learning group stimulated students' thinking, how modelling provided opportunities to highlight strategies students might employ, and that active participation enhanced motivation. They also realised that students did not always react as expected but the ideas or reasons students put forward could be equally valid as their own predicted answer (D3). However, they also commented that in general students had reacted to the tasks as expected. For example both teacher and librarian felt that students found the gathering and presenting of information easier than selecting and sorting information and that student 4 liked active tasks but struggled with cognitive aspects. The teacher was particularly aware of the dynamic relationship between information literacy and learning and sought ways of helping students 'make connections' between different elements of information literacy. During lesson 6, she began to respond to learner needs by suggesting ways individual students might tackle the task of selecting and rejecting information from their notes. However, both teacher and librarian viewed a shift in emphasis from skills-focused lessons to information enquiry and learner-focused instruction as impractical in mixed ability classes.

In general the teacher and librarian were satisfied that all students had completed each planned task, such as: using contents and index pages; scanning for keywords and thinking of alternative keywords; understanding factual questions; being aware of their own thinking processes; aware of different ways of taking notes. This was reflected in the checklists completed by the teacher after the first three lessons and by students at the end of the activity.

Although the teacher and librarian recognised that the lessons tried to cover too much ground, they were reluctant to take anything out and in fact ended the study feeling students would benefit from much more skills tuition, particularly as each step in their information process was understood to be more complex than originally envisaged. Many of the explanations the teacher and librarian gave for why student learning was limited, focused on expectations of the students' perceived abilities and *assumed* responses in particular information contexts rather than looking critically at the delivery of tasks and students' *actual* responses to that approach.

The teacher expressed the need to share with colleagues the importance for teachers themselves to be clear about what they are asking students to do during information-related activities and why, otherwise students have difficulty interpreting the teacher's requirements into the tasks they perform. However she also reflected that there was probably no simple way to develop information literacy and teachers needed to be aware of the complex relationship between information literacy and learning. She appreciated the opportunity this study had provided to discuss and reflect on these issues and was keen to share her experiences with other teaching colleagues.

5 DISCUSSION

Previous research in Scottish secondary schools highlighted problems for teachers and librarians in understanding the relationship between information literacy and learning (Williams & Wavell, 2001). In turn this limited their ability to help students make the connections between prior and new skills and knowledge, to make the information activities both more meaningful and more effective in terms of developing information literacy, greater subject understanding, and better grades. More recent research also confirmed that secondary school teachers, while recognising the need for students to develop information literacy, are often unsure what approaches they can realistically take to develop information literacy in their students (Williams & Wavell, 2006). The study reported here enabled a teacher and librarian to observe students working in greater detail than is often possible with larger classes and to reflect in some depth with the researchers on their observations during the post-lesson discussions. In doing so the aim was to gain greater insight into the information handling difficulties teachers already observe in many learners (Williams & Wavell, 2006) as well as focusing on the effectiveness of mediation strategies.

In fact many of the challenges encountered by the teacher, librarian and students in this learning activity appeared to stem from the skills-focused approach which influenced both the structure of lessons and mediation between teacher or librarian and students. The emphasis was on an information process with a pre-defined sequence of skills, albeit linked to a research topic and task, rather than an enquiry process of developing new knowledge through finding and using information. Thus, at the start of the research the teacher and librarian planned to teach students a series of information skills which they felt were important for these youngsters to develop in order to undertake information-related activities in a number of curriculum disciplines. Their initial strategy had been to focus explicitly on the specific skills required to gather, sort and present information, introducing and modelling the skills in a planned sequence, and reinforcing by student practice of the skills in relation to a project on insects. As their own observation and reflection proceeded, the teacher and librarian became aware of the cyclical and iterative nature of the information skills process; the complexity of each skill; the cognitive demands they require; their inter-relatedness; and their relationship with other aspects of student learning. By the end of the study they were aware that they had raised more questions than answers and felt that there was probably no easy solution; ‘untangling the spaghetti’ of information literacy appeared as an insurmountable challenge.

Some of that challenge was related to the need, as they saw it, for more time if information skills were to be covered more successfully within the curriculum. Having become more aware of the complex nature of information literacy, the teacher and librarian admitted that they had attempted to tackle too many skills in the time available and that none had been covered in the depth they would have liked. They were also aware that the ad hoc nature of their approach, again stemming from their recognition that the process was more complex than expected, had resulted in several tasks being abandoned along the way or not finished satisfactorily. They saw the ultimate solution as building more time into the curriculum for information skills development. This would require understanding and commitment across the school but would also enable a more cohesive approach to information skills development across all ages and subject areas. Lack of sufficient time and commitment to teach skills

across the curriculum, has often been seen as the major challenge (e.g. Williams & Wavell, 2006)

However, the findings suggest that time alone may not be the answer to effective development of information literacy and that the solution will require a strategy that focuses more on the enquiry and information need. Through the course of the study it became clear that a number of the problems students encountered were less related to a lack of specific skills and abilities, and more to do with the difficulties encountered in making connections between those skills and information literacy as a means of building a knowledge base of both the subject and its information context. The overt focus on a wide range of skills, introduced and practiced in a pre-defined sequence, tended to detract from the purpose for applying those skills, i.e. the information enquiry. In fact it was apparent that the students themselves had already acquired a number of the skills that were being explicitly introduced by the teacher and librarian and when given the opportunity to follow up on a spontaneously generated question related to the research topic, they were able to use the resources available to locate information up to a point. However, by breaking up the process into a sequence of separate skills without a consistent emphasis on purpose and enquiry, the students had very little opportunity to follow through and make connections between the information they were finding and the more challenging steps in sifting and selection and processing that information. Making decisions and value judgements about the quality and relevance of information can only be done in relation to a meaningful enquiry.

Similarly the emphasis in much of the mediation between teacher or librarian and students was on skills and techniques rather than the enquiry and the learner. The teacher/librarian-led and skills-focused structure of the lessons did not allow for the kinds of decision-making and critical thinking which was not only part of the goal for the course but is also an essential component of working with information. Moreover, while the teacher described the information process as 'dynamic' and requiring students to make connections between skills, subject knowledge, prior experiences and their information needs, the links students were helped to make were more about what the teacher and librarian themselves were demonstrating rather than helping students draw on their own prior knowledge, experiences and perceived information need. The teacher encouraged students to consider their thinking processes and provided individual strategies at the point of need, but there was little recognition of how much experience students were already bringing to the information activity and little opportunity for students to demonstrate prior experience of skills rather than subject knowledge. Thus, despite the fact that both teacher and librarian initially agreed that students particularly struggle with selecting, organising and synthesising information, they took students through all the steps of a traditional information skills model without differentiating between those aspects that needed to be taught from a basic level and those aspects that students were already confident to apply and which could have been built on.

This lack of emphasis on the learner's existing knowledge and skills base, coupled with lack of emphasis on the enquiry, resulted in some cases in students becoming bored or demotivated. In other cases they developed coping strategies which enabled them to feel they were doing something to meet the immediate goals of the activity but which did little to contribute to the overall development of information literacy.

In this and previous research it is quite clear that students' responses to their information enquiry and their ability to make appropriate information decisions is closely related to their interest, prior knowledge and understanding of the subject under investigation. For example,

teachers when considering their conceptions of information literacy (Williams & Wavell, 2006) also began to appreciate the need for mediation when students read unfamiliar words even within simple texts and how significant general knowledge is for placing information in context. During a study examining the Impact of the School Library Resource Centre on Learning (Williams & Wavell, 2001) one group of students conducted investigations for a French project. The students investigating French sporting events progressed quicker than those researching food and wine with its unfamiliar terminology, revealing the significance of their prior understanding of the topic in their ability to begin their research. This is also reflected in the work of Todd (1999) and Limberg (1997). McKenzie (2003) and Loertscher (2003 & 2005) suggest that the way questions are posed influences the information need and thus the information-seeking process. However, the present study reinforces earlier findings (Moore, 2002; Williams & Wavell, 2001 & 2006) which indicate that the relationship between understanding of task and mediation to help students build on existing knowledge is not always recognised within the planning of information activities in schools, even amongst experienced practitioners. In this case, while the teacher and librarian appreciated the need to brainstorm what students already knew about spiders from the start, it was only after reflection they became more aware of how significant vocabulary, language, and the understanding of fairly simple organisational concepts become for effective execution of the information process.

There was understanding at the beginning of the study of the importance of students reflecting on their own skills and knowledge, and ideas were instigated to encourage the sort of reflection that the teacher and librarian themselves valued so much after each lesson. In this activity the students evaluated their ability to undertake individual skills using a checklist prepared by the teacher and librarian. The teacher also encouraged students to identify the decisions they made when finding and selecting information. However, the relationship between this thinking process, decisions made, further action taken and skills used was not fully explored with students. Traditional information skills frameworks incorporate an evaluation step at the end of the information process to encourage reflection on what worked and why. The need for constant reflection and revisiting each step is well documented even in the early information skills models (Marland, 1981; Williams, 1986) and has been given greater emphasis recently (Becta, undated; McKenzie, 2003; Moore, 2002), stressing the need to repeat actions as required in order to fulfil each information need within the overall whole. The McKenzie (2003) and Moore (2002) models place student reflection at the centre of the cycle while the Becta model (undated) puts the teacher and mediation in this central position. This study reinforces the need for both student reflection on their own actions and mediation to help highlight the connections with other activities. Other frameworks take a rubric approach whereby students are encouraged to view individual skills and their progressive complexity within information literacy as a whole (AASL & AECT, 1998; Barrett & Danks, 2005). Kuhlthau's work suggests that, while providing students with a framework in which to place their understanding of information skills, it might also be worth exploring with students the affective elements of anxiety, frustration, confidence, etc. which accompany the various stages of the information process (Kuhlthau, 2004).

Thus the concept of information literacy and its relationship with learning can be explored and explained with students, in line with the principles of assessment for learning and formative assessment and reflection on understanding, skills and knowledge. This kind of reflection, however, is dependent on a more enquiry-focused approach to learning. The librarian and teacher in this study, in common with many other practitioners, appeared to have interpreted information literacy models as a step by step sequence of skills. In contrast

with real world information activities which are far from orderly and straightforward, the teacher/librarian-led skills agenda leads to a pigeon-holing of activities and disaggregates the skills from the enquiry and the learning. Understanding is restricted to the 'doing' of skills rather than appreciating and learning the reason for the skills in terms of increased subject knowledge, better results in the finished product, and more satisfaction with the answers. In fact it appears to be common when teaching skills to lose sight of the fact that information literacy is a means for building a knowledge base and creating new ideas and it is just this knowledge which is often the motivating factor for students (Williams & Wavell, 2001 & 2006). The present study reveals how difficult it is for a teacher or librarian to integrate student self-reflection within a more teacher-led, skills-focused agenda, where the emphasis is on covering a rigid sequence of skills. As the above literature suggests, 'reflection' cannot itself be simply treated as another 'skill' to be introduced through the use of techniques such as checklists, without this being part of a different overall approach of reflecting on the whole information process. This reflection is as much about 'why' the skills are needed and what is achieved by using them in terms of knowledge gained, i.e. it is about the relationship between information literacy and learning. While some discussion focused on the subject of spiders during the brainstorming session, there was little time left at the end of this activity for students, teacher and librarian to discuss the subject content of presentations in relation to the information process; for example how skills contributed to subject content of presentations or how the subject content could have been improved in relation to purpose through further development of skills or using alternative strategies.

The evidence would suggest that the solution to information literacy development is not just the need for more time to allow greater emphasis on each skill, helpful though that may be, but also the need to consider an approach which is more enquiry-focused. An approach to information literacy which is driven by the enquiry and the nature of the required information, would allow information skills and aspects of information literacy to be introduced at the point of need within the enquiry, reflecting the iterative nature of the process rather than adhering to models and frameworks which restrict this natural rhythm. As already suggested, this approach also needs to take account of students, the information users, and what they bring with them in terms of skills, subject knowledge and cognitive understanding. However, the option of such a radical shift in approach appeared to be one that the teacher and librarian in this study felt unable to fully adopt. Much of the frustration and many of the challenges they experienced appeared to be due to contradictions between their belief about the best way of 'teaching skills' and their actual experience in trying to do so. They were keen to help students move beyond the basic 'doing' of information skills and, as a result of reflection on the need to take a more learner-focused approach, the teacher did begin to mediate with individual students in order to provide them with alternative strategies. However, the focus of this mediation remained on the skills and techniques rather than the enquiry and information need making it difficult for students to make connections between the skills and the bigger picture which encompasses the enquiry, information literacy and their own achievement. Despite the fact that this skill-focused approach was not working as successfully as expected they were unable to let the student or the enquiry and information need control their approach to teaching.

Some of their concerns appeared to relate to ways of engaging students in a process which requires self-reflection. One of the major restrictions to being able to gauge critical learning points or students' understanding of the task (one of the librarian's main goals), and thus the ability to mediate effectively, was a lack of genuine two-way dialogue in lessons. The reasons for this are undoubtedly varied. However it appeared to stem in part from the

teacher's and librarian's firm belief that they needed a common baseline and thus needed to 'teach' information skills explicitly regardless of prior experiences of the students, i.e. their need to be in control of what is taught and how it is taught. Thus the opportunities for meaningful reflection through dialogue were limited. They also expressed reservations about students' ability to engage in meaningful discussion, recalling past experience and knowledge and how this could be applied to the task in hand, although there was evidence within the study that the students could do so provided they understood the task. Conversely, this and previous research suggests that students do find it difficult to express their information needs in situations where there is a lack of clear understanding of the task, as seen in this study, exacerbated by the teacher and librarian themselves not having a clear understanding of what they are trying to achieve. A shared understanding of the overall goals of the learning activity as well as the aims for each individual task are important as research indicates that students approach information activities with differing perceptions of what the task entails. For example, some students approach tasks with the aim of gathering information, others with an understanding that different points of view are needed (Limberg, 1997; Many, Fyfe, Lewis & Mitchell, 1996) and this will depend on the way a task is perceived and set by the teachers. Dialogue is one way of clarifying aims and misconceptions and helping students develop an awareness of the bigger picture, how their immediate task fits in with the development of their own information literacy and the relationship between information literacy and learning.

A further barrier to change for the teacher and librarian in this study was their need to be sure that they were covering the entire information process and skills set in one series of taught lessons. This approach may be encouraged by the way information skills are portrayed as part of the whole process of finding and using information, a framework which lends itself to a focus on project work in the curriculum. While ultimately it is likely that all skills and the whole process should be experienced by students during their school career in order to develop information literate individuals, it is not necessarily the case that information literacy is relevant only within project work. In fact the skills of evaluating, sifting, selecting, synthesising and presenting information are equally applicable to situations where information is provided rather than sought by the learner, e.g. reading for meaning in a given text or looking critically at the messages in a visual source. These are equally valid forms of enquiry around which information literacy can be developed. For example, during the reflection stage of a recent study into teachers' conceptions of information literacy (Williams & Wavell, 2006), two teachers decided to concentrate on developing their students' ability to read for meaning and select relevant information for the immediate need: in both cases normal curriculum worksheet questions were used as the basis of their information activity. One of those teachers explained that she saw no point in sending students to search for information if they were unable to select from a piece of text. Moore (2002), working with primary teachers in New Zealand, also advocated concentrating on one aspect of information literacy with an understanding of the whole process in the back of the mediator's mind. In fact it is likely that while focusing on one particular part of the information process a number of other skills will be required which students can either demonstrate their knowledge of or be encouraged to develop through considered mediation based upon sound knowledge of information literacy as a whole.

Whatever approach is adopted for the development of information literacy in secondary school students, it is likely that a radical shift in teaching approach is necessary to place the enquiry and student information needs at the centre of the teaching focus. As suggested in this project this requires an interpretation of information literacy which encompasses the

knowledge and cognitive processes as well as the skills and equally important is a fundamental shift in classroom practice for many teachers and school librarians. In order to facilitate this change in understanding, practitioners could explore some of the current research into information literacy and some of the practical application of research that has been implemented in the United States, Canada and Australasia (AASL & AECT, 1998; Alberta Learning, 2004; Loertscher, 2005; McKenzie, 2003; Moore, 2002). However, as is clear from this research, observation, dialogue and reflection by teachers and librarians is the key to understanding and working with the complexity of information literacy rather than attempting to untangle the strands of the ‘tangled spaghetti’.

6 CONCLUSION

The study set out to examine the challenges of developing information literacy in secondary schools, by close observation and critical reflection of a teacher and librarian working with a small group of students who require support for learning. Observation of lessons provided data on the way these students tackled information-related activities and data on the approach taken and mediation strategies used by teacher and librarian to develop information skills.

This section begins by setting out the conclusions which the teacher and librarian drew from their observation, reflection and discussion and finishes by examining the conclusions drawn by the researchers as a result of their analysis of the data.

Being involved in the study provided the teacher and librarian with the opportunity to observe students handling information, reflect on and discuss their own approaches to mediating the information process and to adapt their mediation strategies in response to their renewed understanding. The teacher in particular expressed her appreciation of the chance to discuss student learning in a way that she normally has little time for and was keen to communicate her experiences and undertake further investigation and reflection with colleagues. However, at the end of the study both teacher and librarian felt the experience had left them with more questions than answers. Their observation and reflection had revealed a greater complexity than they had expected, described by the teacher as the 'spaghetti' of information literacy, i.e. the inter-related strands of skills, decision-making, cognitive and affective elements.

While it was clear that they had begun to develop a different understanding of the challenges of developing information literacy, they also felt they needed to take further steps to investigate information literacy in other groups of students in an attempt to 'untangle the spaghetti'. Their approach to developing information literacy had been based on a teacher/librarian-led, skills-focused delivery which, in turn, was based on an interpretation of information skills frameworks as a set sequence of stages and skills within an overall process of finding and using information. This sequence of planning and defining the information need, gathering information from a variety of resources, organising that information and presenting it to a defined audience, is commonly applied through project work in secondary schools. By the end of the study the teacher and librarian had concluded that it is more difficult to teach isolated skills than they had originally appreciated. Moreover they felt that this approach did not address the complex nature of information literacy and was unlikely to succeed as a strategy for developing information literacy as part of lifelong learning. They concluded that there is unlikely to be one simple approach that will suit all students in all situations but that by continuing to observe and reflect on students' information behaviour and adapt their own practice accordingly they would be in a better position to mediate effectively.

They also concluded that there was a need to devote more time to the development of information literacy within and across the curriculum. While they realised this would require understanding and commitment across the school, they also felt this was

necessary in order to provide scope to cover skills adequately and to enable a more cohesive approach to information skills development across all ages and subject areas.

The analysis of data collected from both the post-lesson discussions and observation of lessons by the research team suggested that time was not the only factor involved. While the research did not reveal neat solutions to the challenges of developing information literate learners, it did reveal the problems inherent in the kinds of skills-focused strategy adopted in many UK secondary schools within their library and information skills programmes. A rigid interpretation of the information skills frameworks as a sequence of skills within an overall process of finding and using information can mask the complexity of information literacy and detract from its development, in particular from an understanding of the connections between information literacy, learning and achievement.

The problems arising from this approach, as illustrated in this case study, affect students, teachers and librarians. By placing emphasis on the explicit teaching of a sequence of skills, and trying to give equal emphasis to the full range of skills of finding and using information in one extended activity, there are dangers of not being able to explore any fully, and not being able to help learners make connections between those skills and the task in hand. In this and previous studies information activities appear to have been driven by a preconceived notion of what skills can be taken for granted (in this case, very few) and those that should be developed and also an unrealistic and simplistic approach to a complex interplay of skills and cognitive decision-making from the learner perspective. As illustrated in this case study, this can result in confusion, boredom or the development of coping strategies by students.

Previous research has already demonstrated the importance of appropriate mediation at critical learning points within the process of finding and/or using information. By focusing on a pre-defined sequence of skills teachers and librarians are less likely to recognise the individual hurdles students encounter when handling information and are not necessarily in a position to mediate to help students make the connections necessary between knowledge building and skills development or to assist with appropriate strategies. This case study has indicated how the skills-focused approach can limit the scope for the kind of mediation which helps learners make connections between skills and learning, or develop a sense of information literacy as it relates to lifelong learning and the ability to find and use information within context. In particular the study has illustrated the difficulties in a skills-focused approach of embedding meaningful reflection by the learner, i.e. reflection not only on the skills being developed, but also on the connection with the enquiry and information need, and with the development of knowledge and achievement.

In illustrating the nature of the challenges the study has also pointed to some solutions. It has reinforced preliminary theories about mediation emerging from previous studies within Scottish (Williams & Wavell, 2001) and UK (Williams & Wavell, 2006) schools, by confirming the importance not only of taking account of the educational goals of the teacher and librarian (in this case the development of skills) but also the prior skills, knowledge and information experience of the learner. In addition this study has highlighted the role and importance of the enquiry and information need as the third element in mediation. The findings point to the potential advantages of an enquiry-focused approach in which the enquiry and the

need for information form the context for developing and applying skills and knowledge. The importance of developing information skills in context has long been recognised: however this study illustrates that context is about more than working within a curriculum-related topic. The context for finding and using information includes the subject and nature of the task, the enquiry and information need associated with fulfilling that task, and knowledge of the kinds of skills and techniques the learner may already have as well as those they may need to develop. It is within this context that there is scope for making decisions about the relevance and quality of information or the best ways of reworking it; how the information has contributed to the development of new knowledge or understanding or achievement; whether there are things that could be done with information to improve the outcomes – i.e. information literacy.

Task and purpose is critical to this approach. All learners approach a new task with their own unique knowledge of both the subject under investigation and experience of the skills needed to pursue that investigation. In order to encourage students to make the most effective use of this prior knowledge and experience teachers and librarians need to consider this in relation to the tasks they set, incorporating the ability to build new knowledge by using existing skills and knowledge as well as developing new skills where relevant. The information enquiry and the learner become the focus for mediation and reflection. There also needs to be a *shared* understanding of what the enquiry requires in terms of skills and knowledge. In contrast to mediation which focuses on practice of skills and techniques, an enquiry-focused approach where mediation takes account of the enquiry and the learner is more likely to facilitate the kind of reflection and dialogue needed to achieve this level of shared understanding.

Overall, this study has contributed to understanding of the problems that can arise with a skills-focused approach to information literacy and the need for a more enquiry-focused approach which emphasises the development of knowledge as well as skills; which takes account of the learner and his/her prior knowledge; which facilitates shared understanding of task and enquiry, and the skills and information needed to fulfil that enquiry; and where the dialogue of mediation and reflection are used to make connections between skills, knowledge and achievement. The skills-focused approach taken by the librarian and teacher in this study is not atypical of the approach taken in many schools, particularly when accommodating new ICT developments, which tends to place the emphasis on the skills of using information tools and techniques. However this study suggests that it is important for teachers and librarians, not to assume that a skills-based curriculum can be delivered in isolation from other aspects of the learning context. Rather than ‘untangling the spaghetti’ the findings suggest there is a need to learn to work within the complexity of information literacy, focusing on helping learners make connections, rather than isolating the individual strands of skills and decision-making. For professional librarians there are parallels here with the reference enquiry in which they are expected to be able not only to tease out and understand the nature of a client’s enquiry but also, through this, to help the client to understand and make connections between the purpose of their enquiry and the associated information needs. It is also important to move away from the notion that information literacy in schools is best tackled as a pre-defined sequence of tasks within a project: it is equally valid to consider ways of developing information literacy within any information-based activity in the curriculum, such as seeking meaning from a given text, identifying main themes from an audio-visual

presentation, or revising for an exam. The relative emphases on different aspects of information literacy may vary across these activities but reinforcement across a range of existing learning contexts may do much to resolve concerns about lack of transfer of skills (e.g. Williams and Wavell, 2006).

The debate about the development of information literacy is an ongoing one and an international one: while countries such as Australia and the USA have already gone further than UK schools to define information literacy attributes and standards, there is still a need for further research into the most appropriate ways of developing information literacy as part of preparing students for lifelong learning. This study will make a small contribution to that wider debate. It is also important that these issues continue to be explored within schools and within the initial professional education of teachers as well as librarians, if they are to avoid the pitfalls of over-reliance on simplistic interpretation of information skills frameworks.

This study was deliberately focused on one specific group of students, and one teacher and librarian. While it has been valuable in adding to understanding of the role of an enquiry-focused approach to information literacy, there is a need to examine the value of this approach in other school contexts. By the end of the study the teacher and librarian had moved part of the way towards understanding the complexity of information literacy but were not yet at the stage of being able to test a new approach with other groups of learners. They themselves voiced a need to begin to share their experiences with colleagues as a way of further exploring the challenges and implications for the school as a whole. The approach suggested here is undoubtedly challenging for secondary schools. However the teacher and librarian in this study have shown the value of observation, reflection and dialogue in helping them understand the challenges as a first step in moving towards greater success in developing information literate learners.

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APPENDIX 1

The summary below briefly describes the format of each lesson taking account of the teaching approach and the main task focus.

- 1 Introduction to the information activity
 - a. Explanation of three different stages: gathering, sorting, presenting.
 - b. Introduction of project folder to maintain skills record. Task – mind-mapping ideas related to information handling for front cover.
 - c. Reminder of how thinking process are constant. Task – thinking about thinking using light bulb cards.
 - d. Introduction of key ideas and keywords when using books. Task – completing keyword grid and class brainstorming session.
 - e. Reminder of contents pages and how they work. Competitive task – practising using photocopied contents pages.
 - f. Teacher spontaneously raised question about classification of spiders. Set task for homework to find out whether spiders are insects.
 - g. Return to front cover of project folder.

- 2 Introduction to project on spiders - planning
 - a. Discussion about results of homework.
 - b. Began task of brainstorming ‘spiders’ and librarian developed mind-map. Highlighting techniques when naturally incorporated and encouraging practice of their use.
 - c. Introduction of questions that might be answered. Task of identifying questions.
 - d. Reminder of thinking processes.

- 3 Questioning
 - a. Teacher recaps previous lesson and brief outline of next lessons.
 - b. Introduction of importance of questions for thinking and decision-making and opinion questions mentioned.
 - c. Introduction of audience.
 - d. Group task practising making decisions on choice of books to use for P7 audience and justifying that choice.
 - e. Individual task of choosing question from those identified in previous lesson to try and answer using books. Teacher tackled task and shared her progress.
 - f. Reminder of need for keywords.

- 4 Selection of topic, introduction to note-taking
 - a. Reminder of previous lesson, plans for next lessons.
 - b. Introduction of sheet to record thinking, decisions.
 - c. Brief explanation of differing requirements for tasks: developing skills, answering a question, exploring subject.
 - d. Teacher began sharing experience of finding answer to last week’s question on internet – aborted due to network failure.
 - e. Task of regrouping questions to topics selected by librarian.
 - f. Selection of topic by students.
 - g. Group task of selecting books appropriate for information on spiders.

- h. Introduction to note-taking. Task to practise cut & paste method. Task to record decisions.
- 5 Note-taking practice in library
- a. Students questioned about last lesson.
 - b. Introduction highlighting technique for note-taking. Group task practising highlighting for their topics from photocopies sheets. Techniques incorporated when required (use of colours).
 - c. Mention of skimming and scanning for information within text and reminder of keywords.
 - d. Reminder of decision-making and need to complete 'think bubbles'.
 - e. Introduction of note-taking using paper and pencil, reminder of bullet points. Individual task of selecting books, using index & contents pages to identify relevant information, selection of notes appropriate to topic on simple record sheet.
- 6 Collating information for presentation
- a. Students questioned about note-taking skills.
 - b. Introduction of plagiarism, need to write in own words.
 - c. Reminder about decision-making.
 - d. Reminder to think about task and audience.
 - e. Explanation of guidelines for presentation. Individual task of selecting information from their notes and construction of Power Point slides.
 - f. Introduction of skills sheet for students to complete.
- 7 Presentations and skills reflection
- a. Students asked to recall previous lessons to another teacher.
 - b. Students finished their Power Point slides, notes and insertion of picture.
 - c. Teacher explained importance of learning about skills as well as learning about spiders.
 - d. Introduction of traffic-lighting system to check skills development. Task to self-assess skills level.
 - e. Brief discussion on students' enjoyment of the activity.
 - f. Students showed their slides to whole group.