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An Evaluation of the Use of the PLUS Model to Develop Pupils' Information Skills in a Secondary School

James E. Herring

Queen Margaret University College, Edinburgh, Scotland

Anne-Marie Tarter, and Simon Naylor

Ripon Grammar School, Ripon, England

Various models of information skills have been developed and applied in schools in North America, Australia, and the United Kingdom in recent years, but there have been few attempts to evaluate the application of the models. This article reports a study of the evaluation of the use of the PLUS model in a secondary school in England. The PLUS model (Herring, 1996; Herring, 1999) categorizes information skills into four interrelated steps: Purpose, Location, Use, and Self-Evaluation. In this study, the PLUS model was used by 112 Year 7 pupils (11-12-year-olds) studying physics. Each pupil completed a questionnaire relating to aspects of information skills and the use of the PLUS model. The views of the school librarian and the physics teacher were gained via semistructured interviews. The main findings of the study were: pupils benefited from using a structured approach to project work; pupils saw the model as a useful tool particularly in helping them to plan, organize, and reflect on their own work; and pupils of this age were able to reflect on both the content and processes of learning.

Introduction

Emphasis has grown in recent years on the development of information skills or information literacy in schools, and this is reflected in the literature of education and of school librarianship where a large number of books and articles have been published on this topic. A number of models of information skills have been developed and applied in schools, although there is a dearth of research studies that attempt systematically to evaluate the application of the models. A number of information skills models have been developed in North America, Australia, and the United Kingdom in recent years; one model developed over the past decade in Scotland is the PLUS model (Herring, 1996, 1999). The research reported in this article relates to an evaluation of the use of the PLUS model in a secondary school in England.

Information Skills Models

A number of models have been proposed for school librarians and teachers to consider when implementing an information skills program in their school: the nine steps approach (Marland, 1981), which identifies a series of

questions that pupils might ask themselves when completing assignments; the Big Six model (Eisenberg & Berkovitz, 1990), which focuses on six broad skills areas necessary for successful information problem-solving; the Information Seeking Model (Kuhlthau, Goodin, & McNally 1996), which identifies how pupils feel during the assignment process as well as what they do; and the EXIT model (Wray & Lewis, 1995), a 10-stage model that focuses on pupils' interaction with the text.

The PLUS model (Herring, 1996, 1999) seeks to incorporate the key aspects of earlier models and categorizes information skills into four interrelated steps: Purpose, Location, Use, and Self-Evaluation. The PLUS model provides a framework for pupils and teachers to work with, but it is not just a linear model with pupils working through each stage when completing an assignment. The PLUS model seeks to encourage pupils to identify purpose (e.g., brainstorming and concept mapping); to locate relevant sources (e.g., using print and electronic information resources); to use the ideas and information found effectively (e.g., reading for information, note-taking); and to reflect on their own information skills through self-evaluation (e.g., evaluation of original plan or range of sources used).

The Wider Educational and Research Context of the Study

Information skills research is related to a number of other areas in educational and library and information studies (LIS) research, and a number of influences on information skills research and on this study, in particular, can be identified. The following section seeks to provide the reader with a wider educational and research context for the study.

Constructivism

The use of research projects in a secondary school can be seen as an example of pupil-centered, resource-based, and active learning. The development of the use of information technology (IT) and the Internet in schools has focused the minds of educators on the need for more attention to be paid to the needs of pupils in secondary schools and, in particular, to the development of their learning skills. This has also led to a renewed interest in constructivist ideas in education that place emphasis on the need for pupils to be more active participants in learning, rather than the passive recipients of information and knowledge from the teacher. The work of cognitive theorists such as Piaget and Gardner has influenced constructivist thinking.

Lebow (1993) states that constructivism can

provide a context for learning that supports both autonomy and relatedness embed the reasons for learning into the learning activity itself... support self-regulation through the promotion of skills and attitudes that enable the learner to assume increasing responsibility for the developmental restructuring process, [and] strengthen the learner's tendency to engage in intentional learning processes, (p. 5)

The Biological Sciences Curriculum Study (1997) argues that using constructivist approaches, students can benefit from what they call the 5 Es: Engage, making connections between past and present learning experiences; Explore, working in teams to share and communicate ideas; Explain, putting experiences into communicable forms such as oral presentations or writing; Elaborate, making connections with other related concepts; and Evaluate, an ongoing process in which the teacher looks for evidence of learning. Matusevich (1995) provides examples from the Montgomery Schools, which adopted the constructivist philosophy, and states that there was increasing evidence of "cooperative learning where students naturally collaborate on projects"; "students as active learners"; "teacher as facilitator"; "authentic activities"; and "higher level thinking skills" and "self evaluation" (p. 3). Alien (1992) argues that in constructivist approaches in schools, the main aim is to enable students to learn in a flexible way, to examine topics from different perspectives, and to discuss topics with other students. In the research study reported in this article, various elements of the constructivist approach to learning are demonstrated—through the pupils' activities in brainstorming and concept-mapping in groups, in evaluating resources, in writing and oral presentations, and in self-evaluation and through the teacher's and school librarian's role as facilitators of learning.

Mental Models

Merrill (1992) argues that learning results from the organization of structures in memory, which might be called mental models, and that in the learning process, if information or knowledge is organized in this way, it can help with subsequent retrieval. Pitts, McGregor, and Stripling (1995) studied how students made decisions when finding and using information and found that "students' mental models related to information were not adequate to provide support for their learning" (p. 182). Pitts et al. also argued that teachers and school librarians should view research-based projects holistically, recognizing that students need to combine elements of different learning strands, such as subject matter, life skills, and information skills. Pitts et al. argue that if students have sophisticated mental models of "information-seeking-and-use systems," they will be able to use their "expert information skills" to "strengthen subject understandings." However, if they have only limited mental models of information skills and "novice subject understandings," students will "have little chance of being able to progress on either strand" (p. 181). In the research study reported in this article, the teacher and the school librarian encouraged the pupils to develop a mental model of information skills, partly by offering pupils a model with which to work, but particularly by including self-evaluation as part of the project.

Brainstorming and Concept-Mapping

Much emphasis in educational literature (see, e.g., Kolb, 1984; Whitaker, 1995) is on the need for pupils to reflect on prior learning as a prerequisite to

the acquisition of new knowledge, and the use of brainstorming is one of the methods that is encouraged. Hyerle (2000) examines the use of brainstorming in schools and links brainstorming with concept-mapping. Hyerle states that "brainstorming webs" should not be seen by educators as a first step only, but as "an enduring process that continues and that even extends beyond a final product" (p. 37). Hyerle insists that brainstorming webs or concept maps should not be "perceived as a static visual picture ... that is somewhat disconnected to further creative and analytical work," but should be seen as "a running video of evolving mental models" (p. 38). Hyerle refers to the work of Buzan in the late 1970s and states that "even greater implications for learning exist when students use ... [concept-mapping] ... to concretely draw from their past knowledge everything they know about a topic" (p. 40). In the UK, Kinchin and Hay (2000) studied the use of concept maps in science classes in early secondary school and state that "concept mapping can be a helpful metacognitive tool, promoting understanding in which new material interacts with the students' existing cognitive structure" (p. 44). Kinchin and Hay also state that "a concept map makes a good starting point for constructivist teaching" and that the constructivist approach has "contributed to our knowledge and understanding of difficulties in the learning of science" (p. 45). Kinchin and Hay advocate the analysis of concept maps by teachers as a guide to levels of understanding among pupils. In the research study reported in this article, the pupils used brainstorming and concept-mapping to choose their topic, to explore the facets of the topic that could be studied, and to identify keywords that could be used when seeking information, taking notes, and writing the final project or making the presentation.

The Research Study

The Educational Context of the Study

The study took place in a secondary school in England. The UK educational system requires children to attend primary school (equivalent to elementary school in some countries) from the age of 4-5 years. Children attend primary school for seven years and normally remain in one class (of about 30 pupils) throughout primary school. Emphasis in the primary school is on cross-curricular study, and the pupils have one teacher for each year. At age 11-12, pupils go to secondary school, and they are required by law to attend until they are 16 years of age. Many pupils remain in school after this age. In secondary school, the emphasis is less on cross-curricular study and more on curricular subjects (e.g., geography, history, etc.), and pupils are taught by a number of different teachers each day. Pupils' performance is assessed by a mixture of course work and examinations. National examinations are taken by pupils who progress beyond the fourth year of secondary school, and these examinations determine whether pupils will go on to further (college) or higher (university) education.

Description of the Research Study

The research focused on 112 Year 7 (11-12 years) pupils who were studying physics and completing a project on earth and space. The project was well structured, and pupils were supported by the teacher and the school librarian in a number of ways. The pupils initially worked in groups in the classroom and used brainstorming as a technique to identify what the group knew about an aspect of earth and space. Pupils in each group then chose an individual topic to study, and they completed a spider diagram on a form provided by the teacher. Pupils worked in groups in the library to identify relevant resources for their group topic and then selected the four most relevant resources. They did this by filling in evaluation sheets provided by the school librarian. Pupils were given advice on aids to notetaking, such as using keywords, and on writing up their individual topics. They were given an outline of the PLUS model to allow them to identify the stages of their project, but it was stressed that the model is an iterative one and that they might have to retrace some steps in the process during their project. The assessment for this part of the course is a reflection of both the process and the product. As the pupils progressed through the project, each step was monitored by the physics teachers and the librarians. The completed work sheets and note cards were marked by the librarian, and the final assessment, a written report and a oral presentation, was marked by the teachers.

Research Design and Methodology

The study sought to answer the following research questions.

1. What were the pupils' views on brainstorming as part of the information skills process?
2. What factors influenced pupils in choosing a topic to study?
3. How useful was a concept map (spider diagram) for pupils in identifying research questions related to their topic?
4. What were the pupils' views on selecting and evaluating information resources?
5. What methods did pupils use when taking notes?
6. What strategies did pupils use if they did not understand what they were reading?
7. How did pupils decide on the content of each part of their report?
8. What were the pupils' views of the PLUS model as a useful tool for future project work?

A questionnaire (see Appendix) was used as the main research instrument (Leedy, 1993; Silverman, 1997). Each of the pupils in the study completed the questionnaire relating to aspects of information skills and the use of the PLUS model. The views of the school librarian and the physics teacher were gained via semistructured interviews. The quantitative elements of the questionnaire were analyzed using a spreadsheet; the qualitative elements of the pupils' responses and the teacher's and librarian's responses were

analyzed using a content analysis approach, classifying responses into particular categories.

Findings of the Study

Brainstorming

Positive aspects

Pupils were first asked about the extent to which they could identify positive aspects of brainstorming in a group; the responses were overwhelmingly positive. The pupils concentrated their responses on the process of working in a group and identified three main areas of benefit to them (see Figure I):

- Sharing of ideas (36%);
 - Collecting more ideas/information (26%);
 - Working as a team (20%);
- (number of pupils = 112; total responses = 132).

The pupils' comments about the positive aspects of brainstorming process included:

Sharing of ideas

You could get everyone's ideas instead of just your own.

It brought out all the ideas in the group's head together which was helpful.

It was quite good because people thought of things you hadn't known or had forgot.

We shared ideas and found out what we didn't know from other people.

It gave you all ideas and other people were working with you, so everyone helped each other.

Collecting more ideas and information

We collected more ideas than if we did it individually.

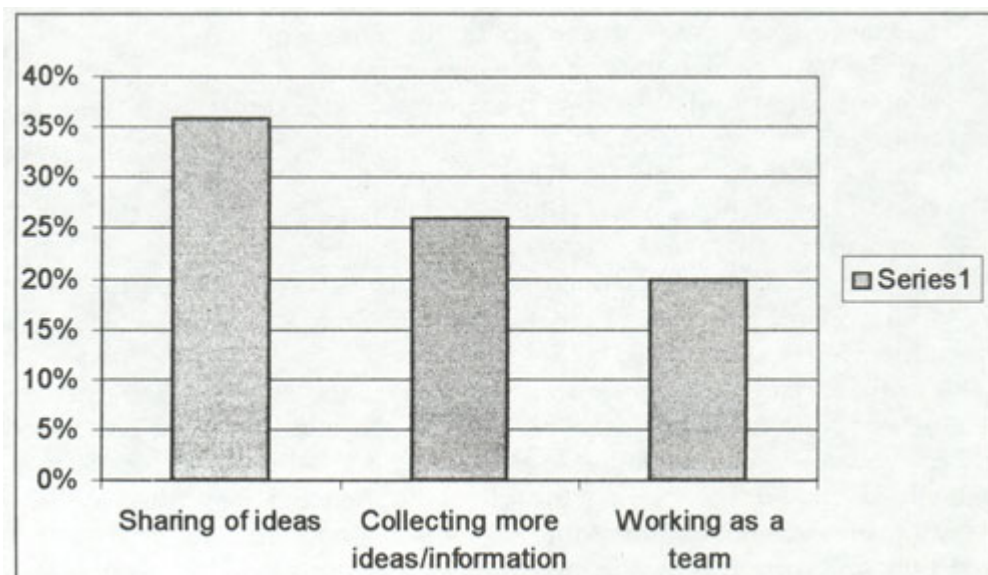


Figure 1. What pupils liked about the brainstorming process.

We collected more answers as some people might know more about one thing and others about other things.

You can get lots more ideas working in a group than on your own.

Working as a team

Asking the questions and working and cooperating like a team.

We could all help each other in finding our information.

It gave you all ideas and other people were working with you, so everyone helped each other.

It was evident that pupils enjoyed sharing ideas, but it was clear also that they were able to analyze the functioning of the group and identify the benefits of brainstorming. Pupils were conscious of the differences between working on their own and in a group and were able to identify how this might help. The pupils were clearly able to identify the processes involved in cooperative working and were able to identify the benefits that cooperation might bring. Only 5% of pupils stated that they did not like brainstorming. In terms of self-evaluation, the evidence here shows that pupils of this age are certainly capable of reflecting on their learning processes and are able to identify the positive aspects of brainstorming.

Negative aspects

Pupils were then asked to identify any negative aspects of the brainstorming process. The variety of responses to this question was much wider than in relation to the positive aspects of brainstorming. There was also a significant difference in how the pupils analyzed the negative aspects of brainstorming in that they concentrated much more on the behavior and attitude of the group members than on what the group achieved in terms of ideas or information. The main negative aspects of brainstorming identified by pupils were (see Figure 2):

- Arguments/shouting within the group (30%);
- Lack of agreement and cooperation within the group (20%);
- Lack of time/too time-consuming (10%);
- Bossiness of others in the group (15%);
- Not being listened to (10%);
- Members of the group "messaging around" (10%);
(number of pupils = 112; total responses = 114).

Other negative features identified included rejection of ideas, repetition of ideas, difficulties in writing down ideas, and that the work might be better done individually.

The pupils' comments about the negative aspects of brainstorming included:

Arguments/shouting

We got into a couple of arguments as we didn't work well as a group.

People shouting at you and it's hard to get things written down.

We didn't get it done quickly because of arguing.

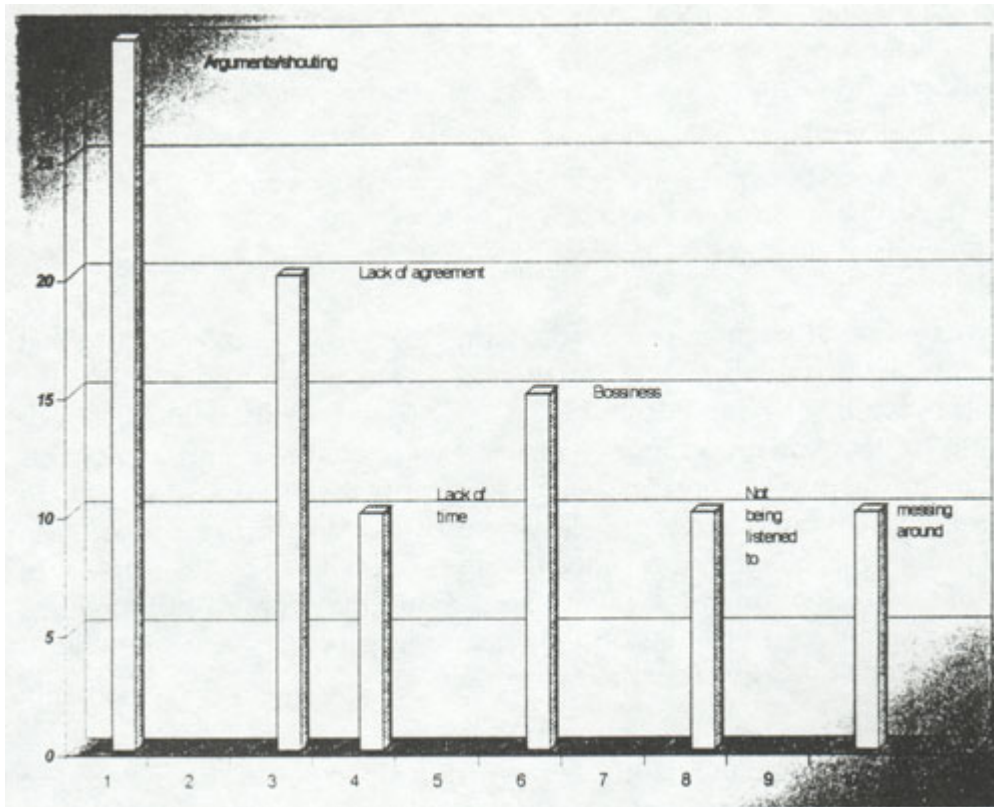


Figure 2. What pupils did not like about brainstorming.

Lack of agreement and cooperation within the group

The selfishness of others. People expect you to agree with them which is hard to do.

Some members of the group left all the work to other members.

It was hard because sometimes the others could not be bothered to join in and you could not sort things out properly.

Lack of time/time-consuming

The way it took long to write up everything.

We got lots of information, so it took forever to sort it out.

Bossiness of others in the group

Our group captain decided on what to write and didn't ask us.

Amy got in a mood. We got bossed about a lot.

Not being listened to

I couldn't say my ideas.

You couldn't get a word in.

Members of the group messing around

People were messing around and fighting over what order in the talk they would say their piece.

Sometimes people just mess about—you don't get anything done.

Other comments

People were getting into a muddle when people were putting down the same things.

Well, we all wanted to write and do something different every time—so it got a bit hectic.

When I said something and people listened—they wouldn't always write it down.

It is easier to work on your own because then you don't have people telling you what to do.

It was clear that pupils were also capable of analyzing the negative aspects of brainstorming and could reflect on their experiences. Despite the negative comments, however, as indicated above, only 5% of the pupils disliked brainstorming.

Benefits of brainstorming in doing research

Pupils were asked whether brainstorming helped them in any way in doing research: 83% of pupils responded positively to this question, with 25% stating "yes" and 9% stating "a little" or "a bit." The main positive benefits identified were (see Figure 3):

- Knowing what information to look for at the next stage (49%);
- New ideas and new information gained from the group (25%);
- Helped to organize ideas and information (13%);
- Ability to reflect back on brainstorming at later stages (13%).

Other benefits were that brainstorming helped to plan the talk and made topics easier to understand (number of pupils = 112; total responses = 123).

The pupils' comments about the benefits of brainstorming in doing research included:

Knowing what to look for at the next stage

It helped me because I knew what to look for.

Because we knew what information we had and what we needed to find out.

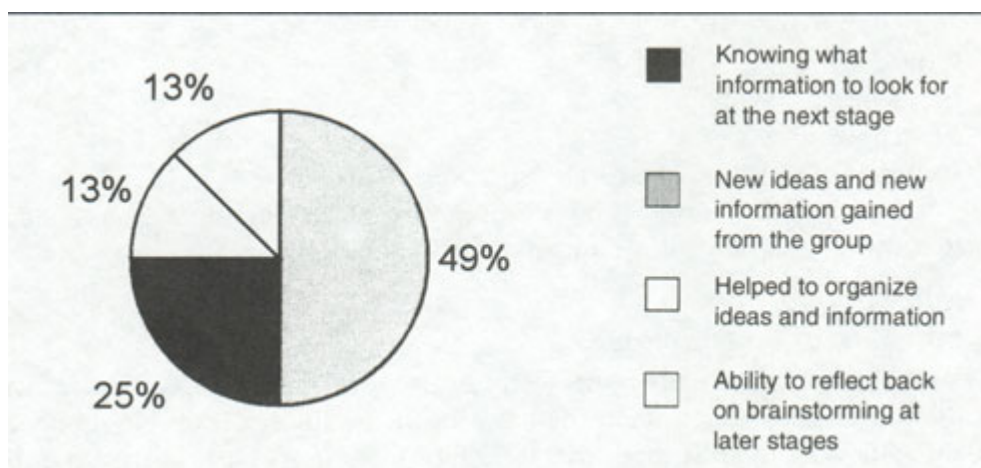


Figure 3. Benefits of brainstorming in doing research.

Because you knew exactly what you were going to research.

New ideas and new information gained from the group

Because people in the group knew stuff that was easy to understand, unlike in books.

Yes, it helped me get more ideas about Copernicus."

Helped to organize ideas and information

By working out specific topics using keywords, research was made easier.

Ability to reflect back on brainstorming

When we divided into our individual topics, we could look back at the brainstorm and find lots of useful information on our topic.

Negative responses

Although 17% of pupils stated "no" or "not really" in response to the question about the effect of brainstorming in doing research, no specific negative reasons were identified by the pupils.

Choosing individual topics

Pupils were asked the reason for choosing their individual topic from a list and the main reasons identified were (see Figure 4):

- Interested in that topic (38%);
- Given the topic/last topic available (28%);
- Knew a lot about that topic (23%).

Other reasons given included: easiest topic (3%); liked the topic (3%); family member knew topic (2%); studied the topic previously (2%); and topic covered in class (1%) (number of pupils = 112; total responses = 114).

Spider diagram

Pupils were asked to design a spider diagram (concept map) that reflected their individual topic and contained keywords that related to what they knew about the topic and about which they still had to find information. The pupils' responses were that the spider diagram was:

- Very helpful (24%);
- Quite helpful (55%);
- Not helpful (19%);
- No response (2%);

(number of pupils = 112; total responses = 110).

For most pupils, using a spider diagram proved to be of value as a stage to go through before locating information in the library.

Locating information

Selecting and evaluating resources

As part of the structure of the project, pupils worked in groups to select and evaluate resources relating to their topics in the library. Pupils were then asked to identify the resources that would be most useful to them. Each pupil selected the three best resources she or he had found, and the group then

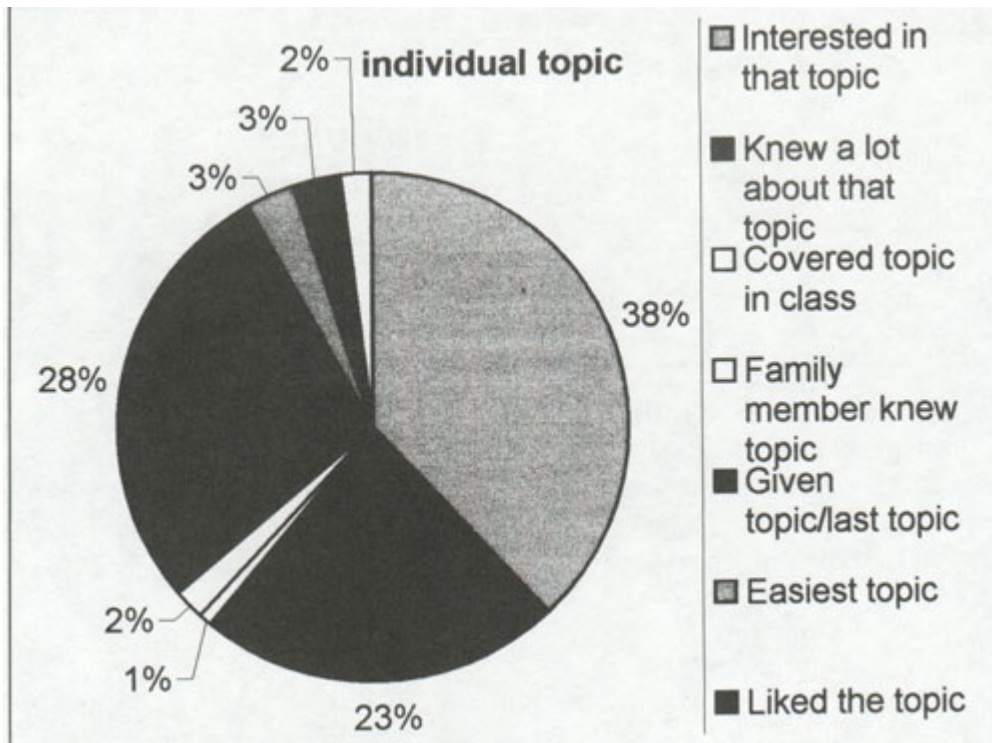


Figure 4. Choosing an individual topic.

selected the four best resources to focus on initially. The responses from pupils indicated that pupils were mainly positive about this stage, although a significant percentage were either negative or uncertain about the value of this stage. The pupils indicated that they (see Figure 5):

- Knew it would help (21%);
 - Thought it might help (40%);
 - Did not think it would help (19%);
 - Were not sure if it would help or not (20%);
- (number of pupils=112; total responses = 112).

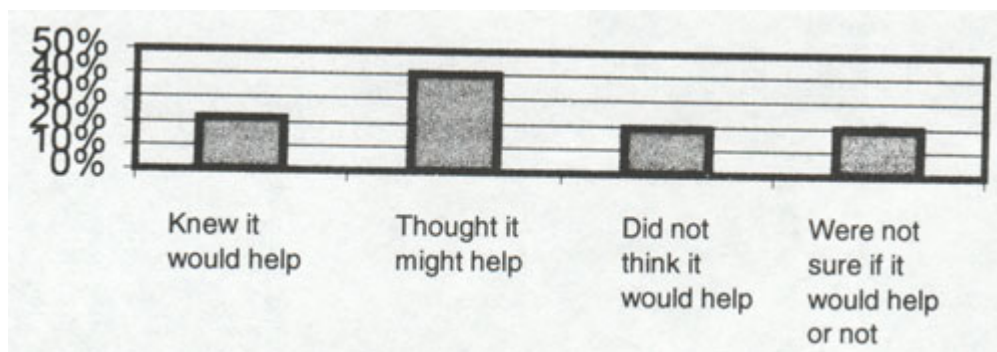


Figure 5. Selecting and evaluating resources

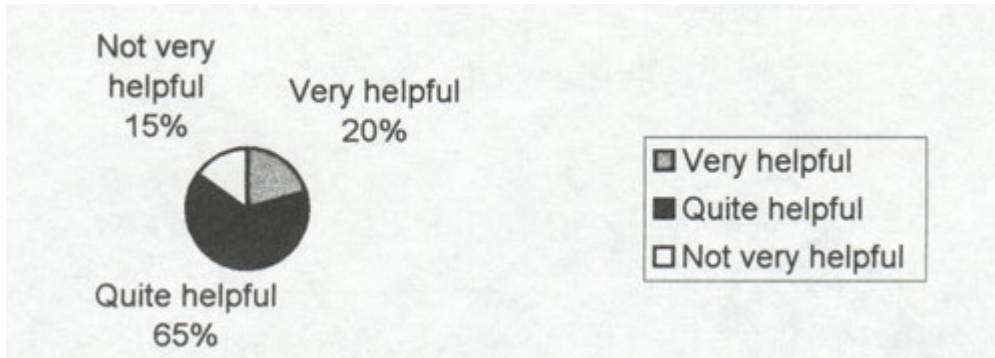


Figure 6. Finding the four best resources.

Choosing the four best resources

Pupils were asked how they felt about having to choose the four best resources from those they identified as being relevant. They were mainly positive or positive about this stage of the process. The pupils indicated that they thought that this stage was (see Figure 6):

- Very helpful (20%);
 - Quite helpful (65%);
 - Not very helpful (15%);
- (number of pupils = 112; total responses = 108).

Using information

Methods used to take notes

Pupils were asked about the methods they chose to use when taking notes. They were given guidance on suitable methods by the teacher and the school librarian. The pupils indicated that they chose the following methods (see Figure 7):

- A4 paper (24%);
- Spider diagram (18%);

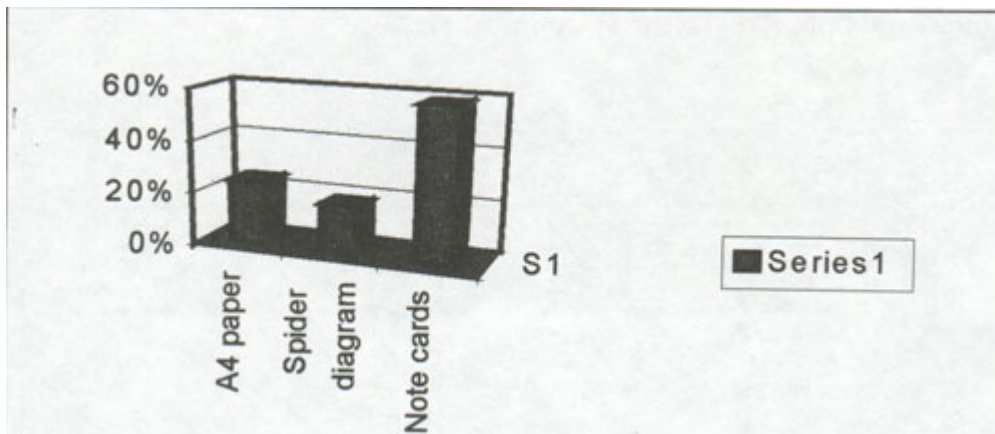


Figure 7. Methods of taking notes.

- Note cards (58%);
(number of pupils = 112; total responses = 111).

Although all three suggested methods were used, most pupils preferred to use note cards, which is perhaps the most traditional method.

Choosing what to take notes on

This question sought to find out the pupils' views on what influenced them when they were using resources of different kinds and taking notes. Pupils gave a variety of responses to this question, with most indicating that they took notes on the information they found to be most relevant to their topic. Encouragingly (from the teacher's and school librarian's viewpoint), pupils also indicated that they used keywords as a guide and used skimming as a technique to identify the key information and ideas. Other methods included taking notes on previously unknown information and on information that was easy to understand and that related back to the spider diagram. We noted limitations to this question in that pupils might use a range of techniques but only write one technique down. Also, a number of pupils misinterpreted this question and either indicated the types of materials they preferred to take notes from or the methods used (see above). The pupils identified the following reasons for choosing what to take notes on (see Figure 8):

- " Most relevant/useful/interesting/best information (43%);
- Information related to keywords (21%);
- Skim read and choose relevant information (11%);

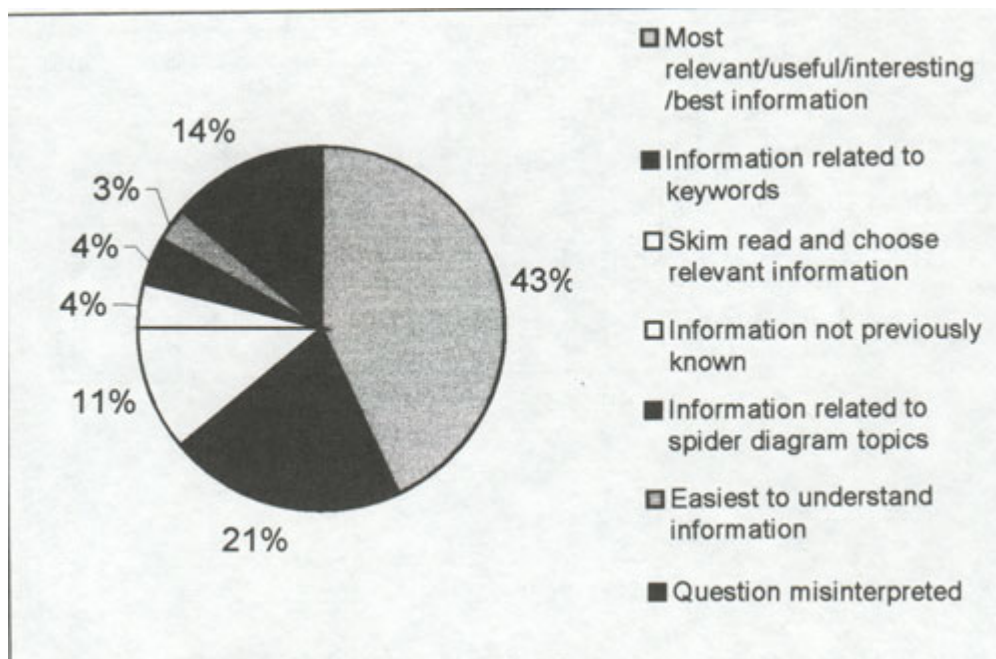


Figure 8. Choosing what to take notes on.

- Information not previously known (4%);
- Information related to spider diagram topics (4%);
- Easiest to understand information (3%);
- Question misinterpreted (14%);
(number of pupils = 112; total responses = 118).

In relation to how they chose what to take notes on, comments from pupils included:

Most relevant/interesting/useful information

I take notes on things when I know they will be useful for my topic.
Just look for the information that is relevant for your project.
I chose the information I think will be most effective.

Keywords

Use words/phrases that link with your topic or are about your topic.
I look for keywords.

Skim read

I skim read and pick out the keywords for my topic.
I skim read to find new information.

Strategies used if the pupil did not understand what was being read

Because pupils who are reading for information will often come across ideas or information that they do not understand, one question was designed to identify what strategies pupils employed when faced with this problem. Identifying these strategies can help to provide feedback to pupils who may adopt unhelpful strategies, such as ignoring the text, and to allow the teacher

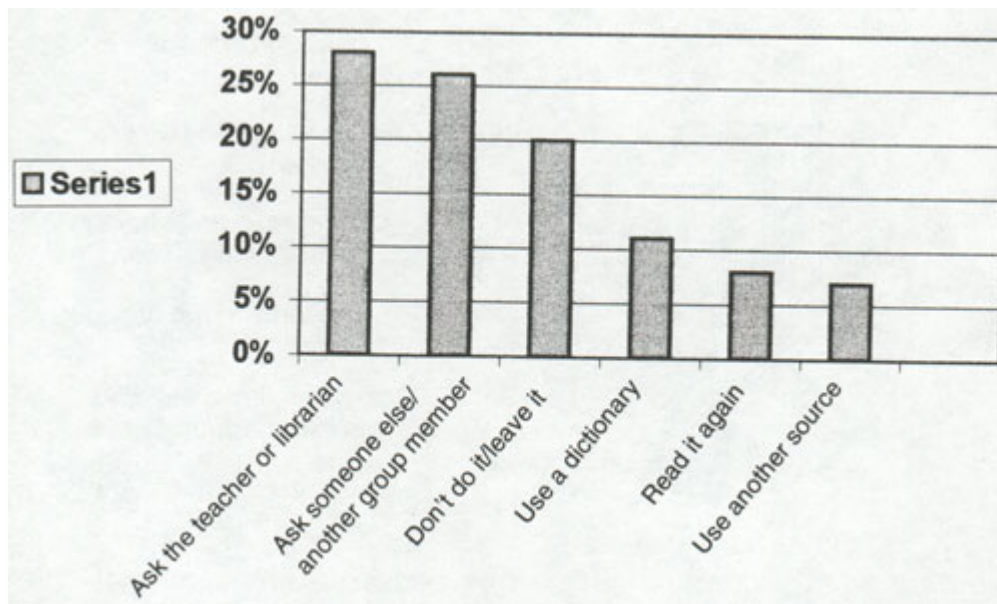


Figure 9. Strategies pupils adopted if they did not understand what they read.

or school librarian to suggest alternative strategies. The pupils identified the following strategies to use if they did not understand what was being read (see Figure 9):

- Ask the teacher or librarian (28%);
- Ask someone else/another group member (26%);
- Don't do it/leave it (20%);
- Use a dictionary (11%);
- Read it again (8%);
- Use another source (7%);

(number of pupils = 112; total responses = 147).

The results were encouraging from an information-skills perspective in that only 20% of pupils decided that they would ignore what they read and not employ an alternative strategy. There is also clear evidence here that pupils consult each other regularly if they do not understand something they read. The strategy most frequently adopted was to ask the teacher or librarian. In one way, this may appear encouraging in that pupils feel that they can ask for help; on the other hand, it may be that this reliance on the teacher or school librarian will make the pupils less independent in their learning.

In relation to the strategies adopted by pupils, comments included:

Ask the teacher or librarian or someone in the group

Ask someone in the group and if they don't know, ask the teacher.

I either asked my group or Mr. Rouse/Mrs. Tarter.

Put the book back or ask the teacher.

Don't do it/leave it

Miss it out because if you can't understand it, others won't.

I leave it out and find another book on the subject.

Use a dictionary

I'd look it up in the glossary/index or in a physics dictionary or ask the teacher.

Read it again

Read it again to see if you understand it.

Use another source

I usually look in another book for simpler information or ask the teacher.

Deciding what would be written in the group's outline

Once the pupils had gathered relevant information from a range of sources, the group met to write an outline for the written report. The pupils were asked how they decided what would constitute the contents of the report and what methods they had employed. They were encouraged to view writing the report as part of the information-skills process and part of the Use element of the PLUS model. The pupils appeared to respond well to this advice, and a significant majority used their original brainstorming sheets or keywords they had identified as guides to selecting the contents of the

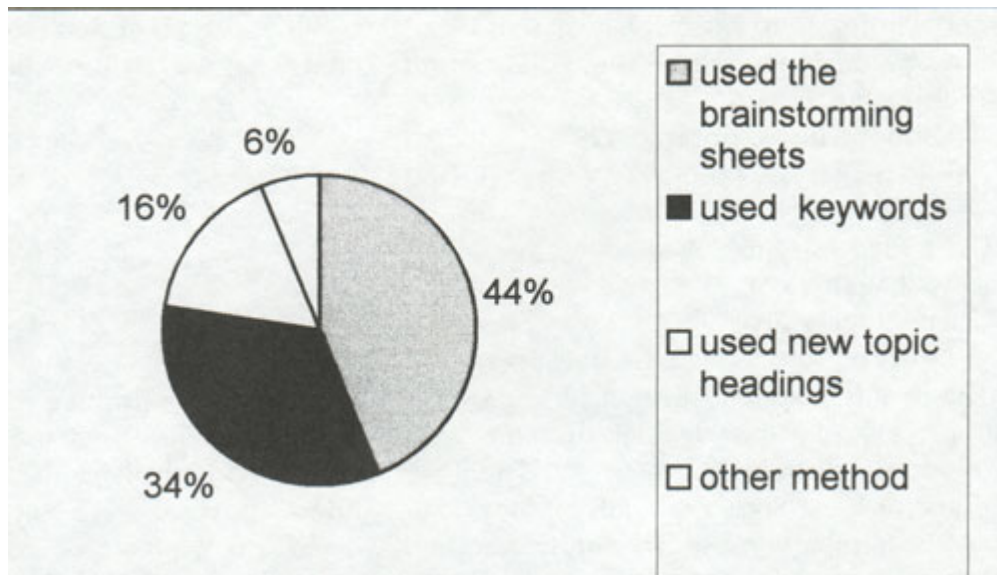


Figure 10. Deciding on the contents of the report.

report. The results showed that the pupils used the following methods (see Figure 10):

- used the brainstorming sheets prepared at the start of the project (44%);
- used previously identified keywords as topics (34%);
- used new topic headings (16%);
- other method (6%).

In the *other* category, it was clear that some of the groups had used the note cards previously used at the planning stage, and other pupils stated that they worked on their individual topics at this stage, suggesting that the group had already decided on the structure of the report *before* the location stage or that they saw no reason to change the outline structure *after* the location stage (number of pupils = 112; total responses = 119).

Pupils' view of the PLUS model as a guide for future project work

We wished to discover what the pupils thought of the PLUS model as a method or structure that they might use with other projects in the school. A significant percentage gave a favorable response, indicating that they thought the PLUS model was a suitable support tool for them to use when completing projects. The pupils' responses indicate a clear intention to use the PLUS model in future assignment or project work. It was not part of this research to discover whether pupils did, in fact, transfer the skills learned and apply them in other school projects. The pupils also commented on the model in general and identified key benefits to them in relation to planning, the provision of stages in a project, and organizational skills. In a number of medium responses, pupils stated that the model was "quite good" or "OK," but these responses also included favorable comments about future use of the model. Some made negative comments that related either to the fact that

the process was too time-consuming or that they preferred their own methods. The results showed that the pupils' responses could be seen as (see Figure II):

- Favorable response (68%);
- Medium response (22%);
- Negative response (10%)

(number of pupils = 112; total responses = 96).

The results show first that, as with the other elements of the research, pupils of this age are well able to reflect on the process and analyze the impact of using the model on their own learning approach. Some pupils stated that PLUS helped them to reflect on the work done in the project. Second, it is encouraging from an educational point of view to see that pupils saw benefits in having a structure, in being able to plan their work, and in being organized, as these are the benefits that teachers and librarians would hope to identify in using an information-skills model such as PLUS. The comments made by pupils' included:

Favorable response

I think it's a very good way to do a project.

Medium response

It was quite good and I will use it in any future project work.

Negative response

I did not think it was very good as I prefer my own ways.

Planning

It is extremely helpful and it is a good way of planning what you're going to do because it would be quite difficult if you didn't do much planning.

Because it helps you plan your work.

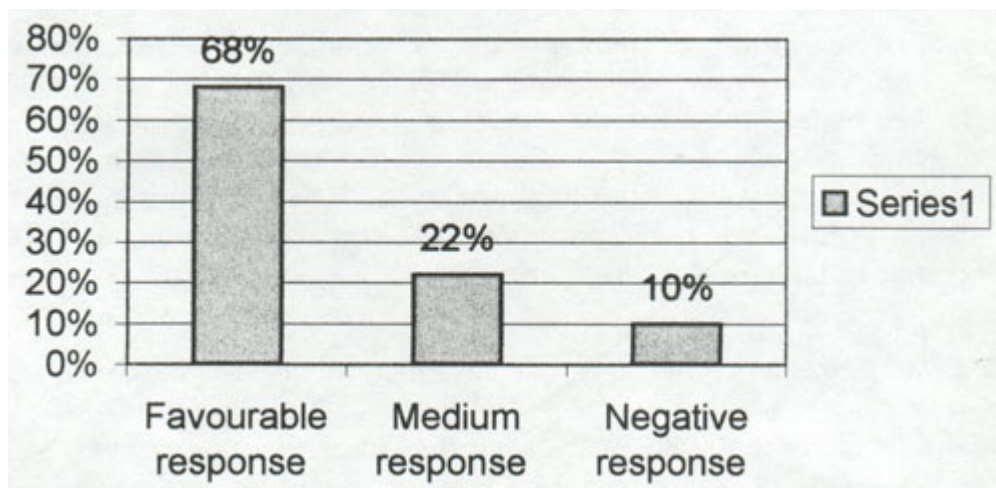


Figure 11. Pupils' views on the PLUS model.

Stages

I think PLUS works well and you don't miss out an stages in researching the information.

Because it makes the stages of studying lots easier. It is good to use stages.

Being organized

I thought it helped as it kept us organized.

It is helpful and keeps me organized.

Reflection

It makes you think and look at the information you have. It makes you make lots of decisions and then look back on your decisions once you have finished. I think it is a very useful and a good system.

It is very useful as it is very easy to do but important to the success of the finished piece as well.

Transfer of skills/future use

PLUS is very helpful because you remember it and you do the same method every time you do project work.

It was really good because it gets you into a system of doing PLUS all the time

It's easier..

The teacher's view

The physics teacher viewed the PLUS model as a tool that pupils could use that was simple and flexible and definitely helped in allowing pupils to achieve successful learning outcomes and to develop as independent learners even at this early stage in secondary school. Pupils were all efficient at finding information, but not necessarily good at differentiating between what was relevant and what was not. The PLUS model gave pupils a structure to work within, and one result was that more of them remained on task during the project than in previous years.

The teacher also noted a significant improvement in the content of projects in that pupils were less likely merely to copy from resources or to cut and paste from CD-ROMs. There was also a greater degree of understanding among pupils than previously about the topic being researched.

The key benefits of using the model, according to the physics teacher, were that pupils were more confident in working independently or in groups; that the quality of the final assignments had improved; and that pupils now understood the importance of the process of learning as well as the content and the product.

The school librarian's perspective

The school librarian recognized that the PLUS model contained the same general elements as other models (Marland, 1981), but that pupils saw the model as being easy to understand, and they liked the acronym PLUS as a guide to their studying. The librarian was confident that pupils would use the model with other school projects.

According to the school librarian, pupils are often unsure about doing their own research, particularly when working in groups. The school librarian stated that the PLUS method's simplicity demystified the process of research and that it provided "a manageable roadmap which in our experience even the least confident pupil find accessible." The basic PLUS model has been adapted to match ability or age groups and has been used successfully in this school from Year 7 pupils (age 11) to Sixth Formers (age 17).

For the school librarian, the PLUS method suited pupils who were working under time constraints to finish projects, and using PLUS provided both pupils and staff with measurable targets that encouraged efficient use of time and resources. Using the model in the classroom and the library encouraged pupils to view their project work holistically and not simply as the use of "library skills." Like the teacher, the school librarian noted a real improvement in the ability of pupils to produce their own work, rather than merely copying facts with little or no understanding, and she stated,

Since we have incorporated the PLUS method into the project work done in the library what we have found is that the work produced is often less complex than previously produced but is based more firmly on the youngsters' own understanding of the material.

The librarian saw this as evidence of enhanced learning, which should be seen as the key beneficial result of using PLUS.

Conclusions

This study demonstrated that the pupils in this school who undertook this project looked favorably on using the PLUS model. It is clear that most of them found using the model generally beneficial, as it helped them to plan their work, to be more organized, and to reflect on the different stages of the information-skills process. Most pupils also stated that they would like to use the model in the future with other school projects. In relation to the different elements in the PLUS model, the findings show that pupils saw definite benefits in brainstorming in relation to the generation of new ideas, to the sharing of ideas and information, and to working together. The negative aspects of brainstorming related mainly to the behavior of group members as opposed to the discussion and analysis of ideas and existing knowledge. Pupils also saw brainstorming as a useful planning tool and a helpful prerequisite to the location of information. Pupils also saw benefits in using spider diagrams to identify keywords related to their individual topic. In relation to locating information, pupils mainly found that going through the process of selecting and evaluating resources in the library and then choosing the key resources was helpful to them in locating information relevant to their topic. Pupils used different methods to take notes and adopted different strategies when choosing what to take notes on, which included taking notes on the most relevant and useful information, using keywords as a guide to taking notes, and skimming the resource to identify

relevant information. These strategies reflect the guidance given to the pupils by the teacher and the school librarian, and pupils clearly acted on this advice. Pupils used different strategies if they did not understand what they read, including asking members of the group or asking the teacher or school librarian. Some pupils used other sources such as dictionaries, but others decided to ignore what they did not understand. The findings show that these pupils needed more guidance on reading for information.

This study clearly has limitations in that only one school was used, and only pupils from one year of the school's population were surveyed. It is, therefore, not possible to make generalizations about whether the use of the PLUS model would be as successful in other schools. Also, pupils in this school were made aware only of this particular information-skills model, so it is not possible to compare the use of the PLUS model with other information-skills models. A further limitation relates to the methodology in that only a questionnaire was used to study pupils' responses. The use of a semistructured interview with a sample of pupils might have provided more depth to the study.

Despite these limitations, it is clear that the pupils benefited from using the PLUS model, and both the teacher and the school librarian noted improvements in the pupils' approach to their project and in the work produced. It is also clear that pupils benefited from being taught a structured approach to the project process. This study sought to make a contribution to research in this area in that it concentrated on the pupils' views of the information skills process and sought to find out how the pupils felt about certain aspects of the process. It also covered areas such as brainstorming, which have been given little coverage in the literature on information skills and information literacy.

Implications

As stated above, this study was restricted to one school and one year of pupils. However, the study should be useful to educators who seek to improve the learning skills and experiences of pupils in their schools. Both teachers and school librarians can learn from this study about the value of cooperation between teachers and the school librarian. Pitts et al. (1995) stated that "The collaborative approach to teaching represents a new paradigm for most educators" (p. 183), and although this statement may be less true in the year 2002, the extent of collaboration between the professionals in this study demonstrates what can be gained from such collaboration. There are benefits for both teachers and for school librarians, including the sharing of professional knowledge: the teachers gained more insight into information skills and the use of resources, and the school librarian gained more insight into the subject and the teaching approach used.

It is clear that the pupils benefited, not only from improved grades for their final products but also from the process of learning, which involved a

variety of activities (e.g., brainstorming), skills (e.g., evaluation of resources), and intellectual rigor (e.g., self-evaluation). A key implication for teachers and school librarians is that pupils of this age are capable of reflection and of focusing on their own learning and that the teachers and school librarians should not underestimate the abilities of pupils of this age, but encourage them to be reflective learners.

Teachers and school librarians can also learn from this study that the use of a structured model such as PLUS can allow pupils to be active and reflective learners but, at the same time, to feel that there is a support structure that underpins this approach to learning. Pupils were not merely given a topic and asked to research it and write a report (as still too often happens in schools), but were encouraged to express themselves freely in sharing ideas in brainstorming and to use their evaluative skills in selecting information, notetaking, and writing. The pupils in this study accepted self-evaluation as part of their learning process, and although the use of self-evaluation can be seen as part of the constructivist approach, teachers and school librarians should not fear that the adoption of such an approach necessarily means denying pupils adequate support for their learning.

For school librarians, in particular, the implications of this study are: that teachers will respond positively to the suggested use of a structured model of information skills such as PLUS; that collaborative assignment planning and development increase the curricular role of the school librarian; that school librarians can actively improve pupils' learning by using their own professional knowledge (e.g., of information skills) to support learning; and that involvement in subject-based research projects is a positive way of increasing the use of resources in the school.

Further Research

Further research could review the use of information-skills models (all of which have a structured approach) in different schools, with different levels of pupils and in different subjects. The objective of that research would not be to prove the efficacy or otherwise of individual models, but to further explore the benefits of providing pupils with a structure in which to work actively and reflectively. Research could also be conducted to study the extent to which pupils do, in fact, transfer the skills across project work in different subjects in the school and, if not, what methods can be developed to encourage the transfer of skills. The school librarian is uniquely placed to take a whole-school view of skills development and transfer in the school, and a profitable area of research would be to examine the potential role of the school librarian in this area. Also, little empirical research has been done on developing methodologies for auditing information-skills teaching in schools or on the development of whole-school policies on information skills. Such research could provide school managers, teachers, and school

librarians insights into how to increase collaboration in teaching and into the development of pupils' learning skills.

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Author Notes

James Herring is Head of the Department of Information Management at Queen Margaret University College, Edinburgh, Scotland. He is a former school librarian who has taught in university LIS departments for over 20 years. He is the author of a number of books on school librarianship, information skills, and the Internet in schools. He is currently researching information-skills audits in schools and the impact of Intranets on school libraries.

Anne-Marie Tarter is the School Librarian at Ripon Grammar School.

Simon Naylor is a physics teacher the same school, which is located in Ripon, England.

Appendix: Questionnaire Used in the Study

Self-Evaluation

This form gives you a chance to think back over the work you have just completed. As you answer, try to think about what was useful and you would use gain when you do project work. Also, think about what didn't work so well and ways you might use to improve your work next time.

Brainstorming as a group

What did you like about brainstorming together about your topic?

What did you not like about it?

Did the brainstorming help in an way in doing your research?

Choosing your individual topics

Why did you choose your topic?

- a) I was interested in that topic
- b) I knew a lot about that topic
- c) We'd already done work on that topic in class
- d) Someone in my family knows about that topic
- e) Any other reason? (please list it here)

Did it help making a spider diagram of our ideas you already knew and the questions you had before you started your research?

- a) very helpful
- b) quite helpful
- c) not very helpful

Locating information

How did you feel about having to select and evaluate resources before collecting the information?

- a) I knew it would help
- b) I thought it might help
- c) I didn't think it would help
- d) I wasn't sure if it would help or not

After you had selected the resources to use, how did you feel about having to select and evaluate the larger group of resources to find the best four?

- a) It was helpful
- b) It was quite helpful
- c) It wasn't very helpful

Using information

What method did you use when taking notes?

- a) A4 paper
- b) spider diagram
- c) note cards

How do you choose what to take notes on when you are reading about your topic in books or CD-ROMs?

What do you do if you don't understand something when you are reading about your topic?

When your group wrote up your outline, how did you decide what you would write in each part of the report?

- a) Our group used the brainstorming sheets we prepared at the start of the project
- b) We used our keywords as topics
- c) Our group came up with new topic headings
- d) Other (please list here)

Overall

Overall, what do you think of PLUS as a guide to help you with any future project work?