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Students' and Teachers' Perceptions of Motivation and Learning Through the Use in Schools of Multimedia Encyclopaedias on CD-ROM

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This article is the result of interviews with teachers, students, and school librarians in eight UK secondary schools regarding their use of multimedia encyclopaedias on CD-ROM. It focuses on a content analysis of their comments on how having access to multimedia encyclopaedias changes the way students work and learn in school, how they perceive it enhances their learning, and how it hinders it.

Teachers reported that they used multimedia encyclopaedias as an additional information resource, or because their use was motivating to the students. Some said that having multimedia encyclopaedias had no effect on their teaching. However, they were not so much using multimedia resources within their teaching, but sending students out of their lessons to the library to use them.

The most important factor, by far, in the students' motivation to use multimedia encyclopaedias in school was that they found them quick and easy to use. There was also strong support for motivation through the graphics, video, and sound on the CD-ROM. There was some support for the students being motivated because they were allowed to be in control of their learning.

> To make the most of the potential of multimedia encyclopaedias for enhancing students' learning in schools, it is recommended that a large and early emphasis needs to be placed on the teaching of information handling and research skills. Students prepared in this way will be better equipped to enjoy the more open, independent learning tasks to which multimedia encyclopaedias so readily lend themselves.

In 1992, the Director of the British National Council for Educational Technology (NCET) said that the use of multimedia and CD-ROMs in UK schools was developing rapidly (Steadman, Nash, & Eraut, 1992). By 1997, the writers of the McKinsey Report, which discussed the future of information technology in UK schools (McKinsey & Company, 1997), were able to assume that there were at least 20 multimedia capable computers in every secondary school. Most secondary schools view multimedia computers with CD-ROM drives as information resources. The schools locate these computers in libraries or resource centres, where there is a librarian or another non-teaching staff member to oversee them.

In this article, the study reported attempts to move beyond Hammond's (1995) Stage One Research into multimedia CD-ROM use, characterised by focusing on the program, surveys of computer use, and personal testimonials to address the question, "How do learners (students and teachers) approach CD-ROMs?" The investigation was carried out through content analysis of interviews with secondary school teachers, librarians, and students exploring their perceptions of the changes in teaching and learning in their schools as multimedia encyclopaedias became available.

It has been established (Wishart, 1990; Cox, 1997; Denning, 1997) that the use of personal computers is motivating to students. In fact, Denning (1997) reported almost universal enthusiasm among students for the use of IT to support their work in schools. It is proposed that this is true, perhaps even more so, of CD-ROM use as well.

Theories put forward to explain the nature of the increased motivation seen in students using computers in schools fall into two groups. In the first group are classical behaviourist theories originating from the work of Thorndike (1898) on trial-and-error learning. These describe positive, extrinsic reinforcements generated by, or associated with, the software. If a trial response results in a reward, it will be repeated and learned, whereas ineffectual or wrong responses will be lost. When working at the computer, the ease of error correction and the semi-private environment mean that students are more likely to experiment in their work at a computer than when in class (NCET, 1994).

Also, it is obvious that children find the use of a computer rewarding. They receive nearly immediate feedback on their efforts, often including entertaining sound effects, graphics, and animations. Therefore, they are more likely to take up opportunities to use computers. What is more, as described in Loftus and Loftus (1983), is that these rewards tend to arrive in the variable ratio schedule of reinforcement, after an unpredictable number of responses from the computer user, which Skinner (1938) believes is the most compelling.

Other extrinsic rewards associated with using the computer are increased self-esteem (Cox, 1997) and esteem from peers and teachers, as students can produce better looking, better spelt, often illustrated work. Many are proud of their new IT skills, skills that their parents or even their teachers don't often have. In addition, Cox (1997) found that students are motivated by their view of IT skills as vocationally relevant, and they recognise the need and appreciate the opportunity to acquire the IT skills needed for many jobs.

In the second group are cognitive theories. These focus on internal cognitions rather than observable behaviours, and include controlling the software and intrinsic motivators such as visual complexity and graphical and epistemological curiosity.

When using a computer, students are actively in control of their immediate environment. This perception of control was found (Wishart, 1990) to be the most important cognitive factor in creating involvement with, and consequent learning from, a computer program. Underwood and Brown (1997) also found that the students surveyed in the investigation of Integrated Learning Systems mentioned the enjoyment of control and being able to work privately at their own pace. Using software to provide an open learning environment that encourages student autonomy and choice is seen as good practice in IT teaching in the United Kingdom (NCET/NAACE, 1994).

Malone (1981a, b) considered that the complexity created by the use of graphics and sound, motivates the user through evoking curiosity to explore the computer environment. Students using a multimedia CD-ROM can be seen to be satisfying this visual or graphical curiosity to see what there is, as well as following up their epistemological curiosity to know more about a topic.

Lepper, Woolverton, Mumme, & Gurtner, (1993) summarise this cognitive approach to motivation in their proposal that an expert tutoring system should provide four major motivational goals: (a) to enhance self-confidence, (b) to produce an appropriate level of challenge, (c) to maintain the learner's sense of personal control, and (d) to elicit a high level of curiosity. To further examine these theories, teachers' and students' views were sought regarding the effects of multimedia CD ROM encyclopaedia use on teaching and learning in UK schools.

Method

IT coordinators in the 62 secondary schools, in partnership with Loughborough University Department of Education, were mailed a survey. It queried the use of multimedia CD-ROMs in their schools. This was followed up by structured interviews with teachers and students in an opportunity sample of the schools. When it became clear that a large proportion of the IT coordinators had passed the survey to school librarians to complete, the librarians were included in the follow-up interviews. Eight schools were selected as the opportunity arose to provide a representative sample of the different types of schools in the area, as shown in Table I.

Table 1
Types of Schools Represented in Sample

Type of School	Age Range	Number in Sample
Local Education Authority	11-18	1
Local Education Authority	11-14	1
Local Education Authority	14-19	2
Grant Maintained	11-16	1
Grant Maintained	11-18	2
Independent	11-18	1

The observations made in these interviews were recorded, and similar comments were grouped together for a thematic content analysis.

Results

More than 85% of the schools located their multimedia computers in the school library, with reference materials such as encyclopaedias and newspapers being the most commonly found CD-ROMs (Figure 1)

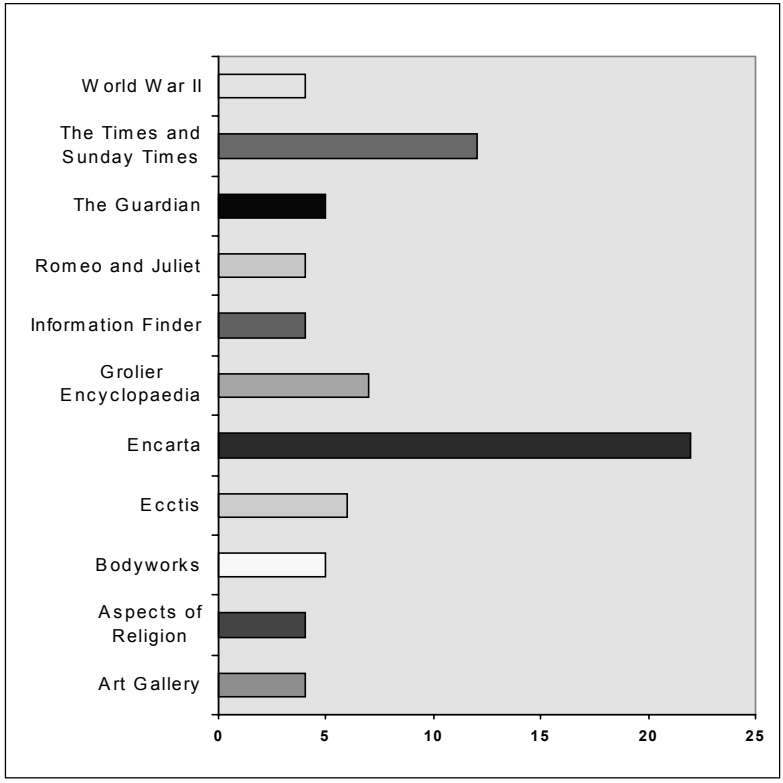


Figure 1. The CD ROMs most commonly found in secondary schools

Sixty-one students, 26 teachers, and seven librarians from the eight schools were interviewed about their schools' use of multimedia CD-ROMs in teaching and learning. The teachers' IT training varied from none (8% of the total) to those with post-graduate qualifications in IT (also 8%). The methods of IT training reported most often by teachers were external INSET courses (42%) and self-teaching (38%). Whereas there were no librarians without IT training of some kind, 57% of them had covered IT within their formal qualifications.

The students were not following specific, formal IT courses. Their ages ranged from 11 to 18 years, 25 students from the 11-14 age group (years 7-9), 16 students from the 14-16 age group (years 10-11), and 20 students from post-16 age group (years 12-13). Overall, 79% had access to a computer at

home, and 52% had access to a computer with a CD-ROM drive. This figure is considerably higher than the slightly more than 40% predicted by McKinsey and Company (1997), on which the Stephenson Report (1997) was based, and the figure found by the British Household Panel Study (1996), which reported that 48% of professional homes had a PC.

The results of the thematic content analysis of the responses given at interview are shown in the following pie charts. Only comments repeated by two or more interviewees are included. Figures 2 and 4 show the analysis of comments made by teachers, whereas Figure 3 shows the librarians' comments. Figures 5 -7 show the students' responses.

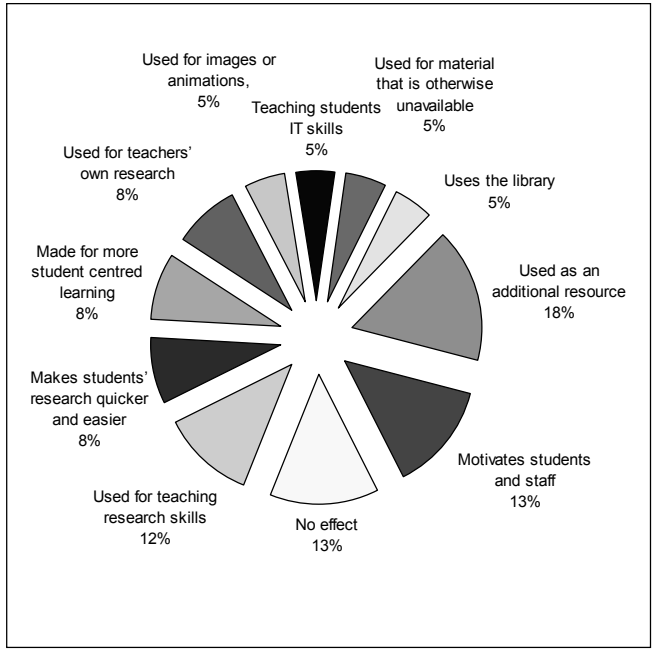


Figure 2. How has having multimedia CD-ROMs affected the way you teach? (n = 64 comments from 26 teachers)

It can be seen that student and staff motivation to use the multimedia CD-ROM encyclopaedias is one of the most repeated observations (13% of comments). However, this data is overshadowed by comments that refer to

the CD-ROMs simply as an additional information resource (18%), and that having access to CD ROMs had no effect on their teaching (also 13%). Based on other comments made by the librarians, many teachers are not so much using CD-ROMs within their teaching as they are sending students out of their lessons to the library to use them.

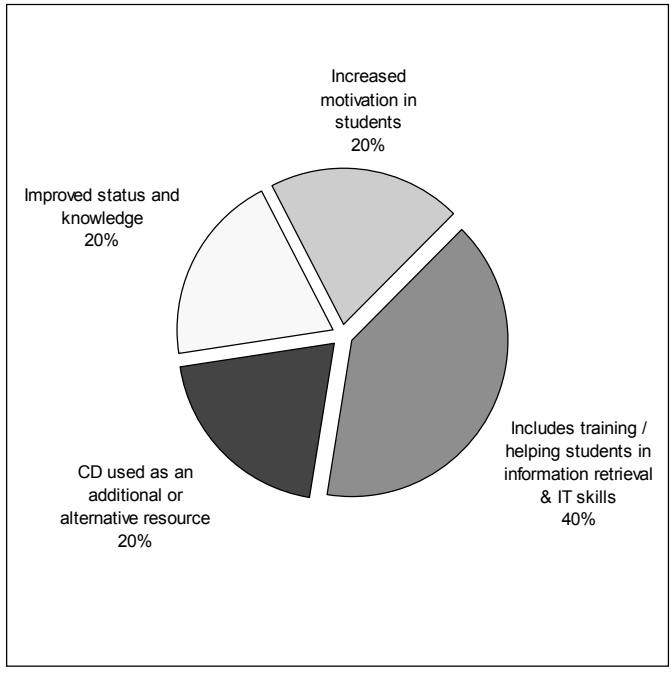


Figure 3. How has having multimedia CD-ROMs affected the way you work in the library? *(n* = 15 comments from 7 librarians)

More than one-third of the librarians' comments (40%) reported that their job is changing to include supporting the use of CD-ROMs within the school and training in other IT skills. This change has led to enhanced status for the school librarians. Both teachers and the librarians, themselves, report this. One comment is that librarians are the "recognised experts in information handling." Another is that "having the CD-ROMs had enhanced the role of the librarian in the eyes of the other staff."

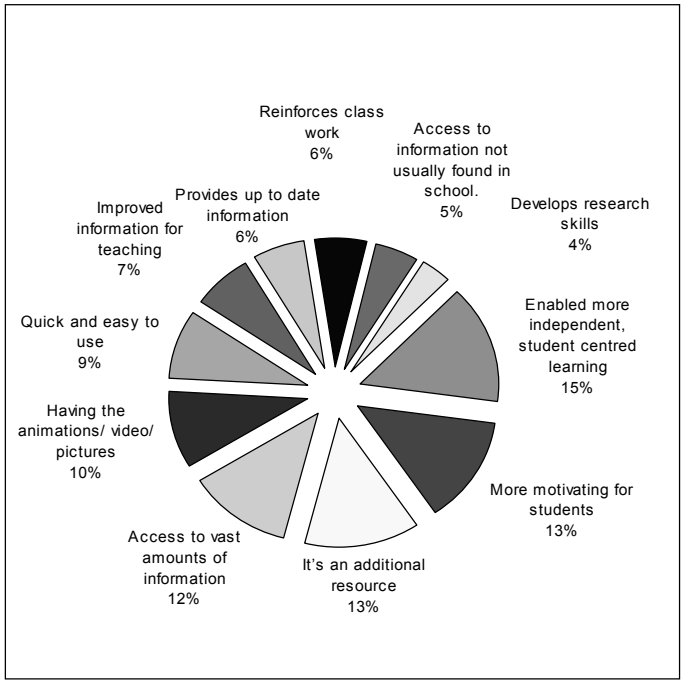


Figure 4. What is it about multimedia CD-ROMs that enhances your teaching? (n = 82 comments from 26 teachers)

Figure 4 depicts that the teachers' most common comment, enabling more independent, student-centred learning (15% of comments), can be immediately associated with their second-most common response (13% of comments) and that the CD-ROM encyclopaedias are more motivating for students. Other commonly reported benefits to teaching were having access to large amounts of information (12% of comments), and having the graphics, animation, and video (10% of the comments).

The four key factors that make students want to use multimedia CD-ROMs, shown in Figure 5, are (a) ease of use (23% of comments), (b) speed of use (14%), (c) the availability of graphics, sound and video (15%), and (d) the quantity and range of the information (14%).

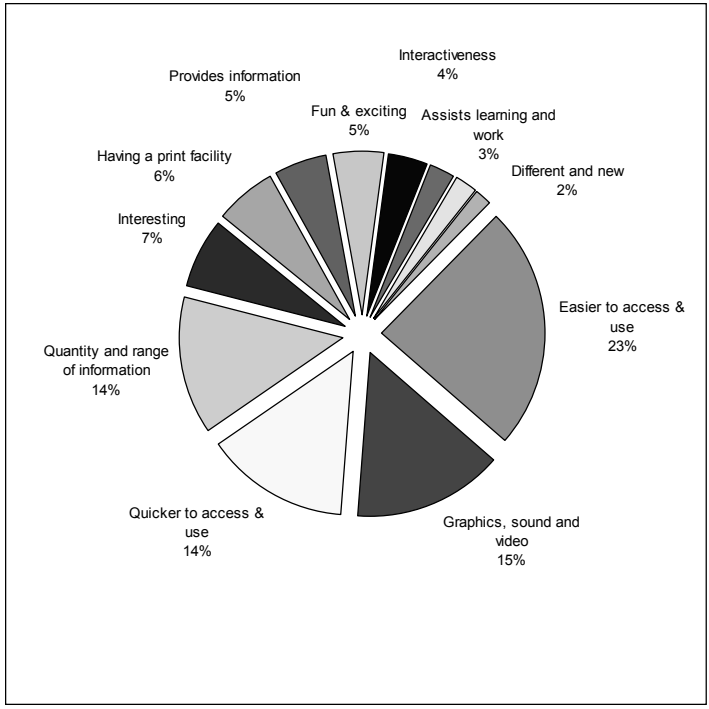


Figure 5. What is it about multimedia CD-ROMs that makes you want to use them? (n = 61 students, 198 comments)

When asked particularly about the benefits of learning from multimedia CD-ROM encyclopaedias (Figure 6), the most popular response was the presence of graphics, video, and sound (22%). Ease of use (17%), enjoyable and fun (11%), quicker to use (9%), and being able to print off from the CD-ROM (8%) were also mentioned.

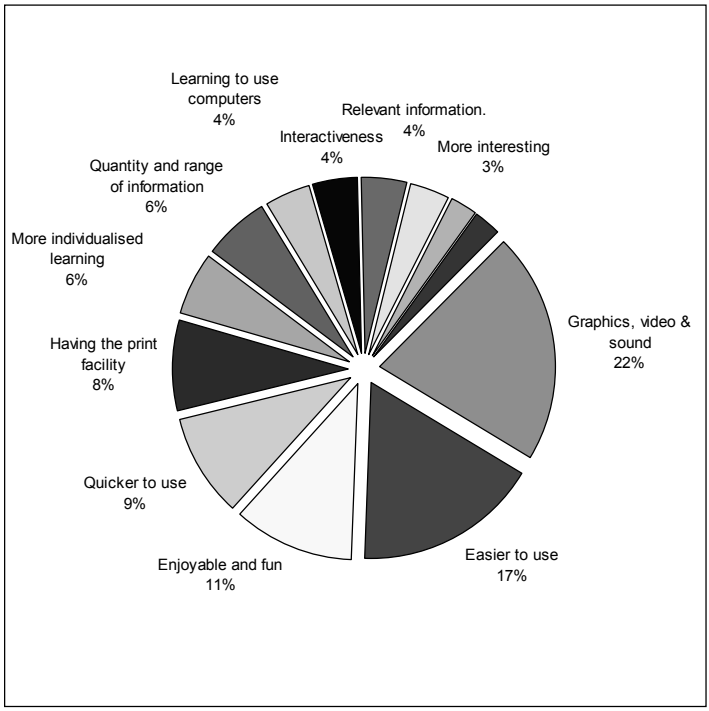


Figure 6. What is it about multimedia CD-ROMs that makes it better to learn from them? (n = 61 students, 137 comments)

However, when the differences between responses from the different age groups are taken into consideration, the presence of graphics, video, and sound was the most common response for only the oldest (years 12-13, 18% of comments) and youngest (years 10-11, 23% of comments) age groups. Only 7% of comments from years 10-11 cited the presence of graphics, video, and sound. For this group, the convenience of using CD-ROM encyclopaedias was the most common response (13% of comments). Freedom to explore was the second-most common point (9%) made by the youngest age group (years 7-9), but not by the other age groups.

The necessity of learning to use a multimedia CD-ROM was mentioned most often (22%) as its most difficult aspect, as shown in Figure 7. There was less agreement on other difficulties, with 12% of responses mentioning their being too complex, yet 11% who had no difficulty. Lack of availability of the CD-ROM computer to the students was also an issue (10%), and worryingly, eyestrain was mentioned in 8% of comments.

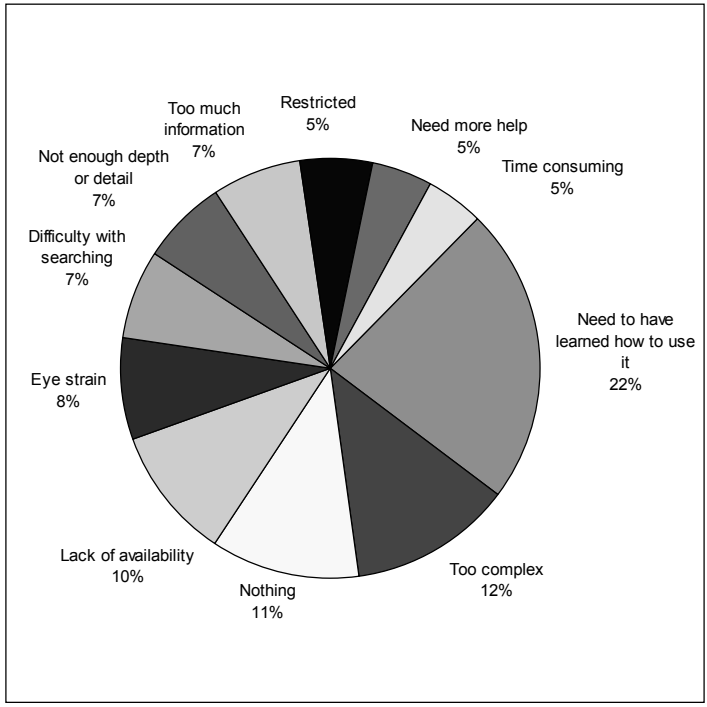


Figure 7. What is it about multimedia CD-ROMs that makes it more difficult to learn from them? (n = 61 students, 108 comments)

Learning to use a CD-ROM was the most popular comment for only the oldest and youngest age groups (18% for years 12-13; 25% for years 7-9). However, for the middle age group (years 10-11), no difficulty was the most common reply (17%) for learning from a CD-ROM. Also, the proportion of pupils mentioning eyestrain falls from 10% by years 12-13, to 6% by years 10-11, to 3% by years 7-9.

Discussion

The introduction of multimedia CD-ROMs into schools appears to have had most impact upon the library, with 85% of schools locating their multimedia PCs in the library or resource centre and CD-ROM encyclopaedias being the most popular purchase (Figure 1). While the third most common comment from teachers was having multimedia CD-ROMs had no effect on their teaching (13% of comments shown in Figure 2), all librarians were affected by CD ROM use.

Figure 3 shows that the librarian's job is changing to include IT skills teaching. Many of the librarians' (40%) reported that they are supporting the use of CD-ROM encyclopaedias within the school. This often involves training students in IT skills such as cutting and pasting information between applications.

Herring (1992) said it is possible that the changes in the information technology that are available in schools will result in the merging of teachers' and school librarians' roles. Librarians will assume more of a teaching role, and teachers will increasingly become facilitators in providing information access. The results discussed here appear to support at least the first half of his prediction.

When teachers were asked how having multimedia CD ROM encyclopaedias in the school enhanced their teaching (Figure 4), their most common comment (15%) was that CD ROMs enabled more independent, student-centred learning. This can be linked to their second most common comment (13%): CD-ROMs are more motivating for students through applying Lepper, et al.'s (1993) recommendations and Wishart's (1990) theory of intrinsic motivation through students being allowed to be in control of the software and the learning environment.

Thus, it appears that some teachers are prepared to relinquish aspects of their didactic role and open up their students' learning environment by getting them to use CD-ROM encyclopaedias for independent research as recommended by Collins, Hammond, and Wellington (1997).

However, the students' responses do not immediately bear out the theories of motivation put forward in the introduction. As shown in Figure 5, two of most popular factors in wanting to use CD-ROM encyclopaedias are ease of use (18%) and speed of use (13%). It appears that students are most keen to save themselves effort and time. This appears to be especially true of the older students, with the proportion of comments mentioning ease of use and access rising from 12% of years 7-9, to 19% of years 10-11, to 24% of years 12-13.

Only the motivation of having graphics, sound, and video (14% of comments) appeared to be particularly important in making students want to use multimedia CD-ROM encyclopaedias. This can be understood through reference to both Loftus and Loftus' (1983) behaviourist theories of extrinsic motivation and Malone's (1981a, b) cognitive theory of intrinsic motivation through visual complexity. It also appeared to be important to the students when asked about the benefits of learning from multimedia CD-ROM encyclopaedia. The presence of graphics, sound, and video formed 18% of their comments (Figure 6).

When looking at differences between responses from the different age groups, it can be seen that the presence of graphics, sound, and video was the most common response for only the oldest (18%) and youngest (23%) age groups. It formed only 7% of comments from years 10-11, for whom the convenience of using the CD-ROMs was the most important (13%).

The sense of being in control, proposed by Wishart (1990) as motivating students to use IT, was the second most common response made by the youngest age group when they were asked about the benefits of learning from CD-ROMs. Freedom to explore was mentioned in 9% of comments from years 7-9.

There was less agreement about the difficulties of learning from multimedia CD-ROM encyclopaedias, with the older and younger age groups referring to the necessity of having first learned how to use a CD-ROM (18% and 25%, respectively). In contrast, for the middle age group (years 10-11), no difficulty was the most common reply (17%). Overall, the necessity of having first learned how to use a CD-ROM encyclopaedia was mentioned in 19% of students' comments (Figure 7). Lack of availability of multimedia computers to the students was also a common issue (8%).

The proportion of students mentioning eyestrain, which falls from 10% of comments made by years 12-13, to 6% made by years 10-11, to 3% of comments from years 7-9, is likely to be linked to the length of time that students have the computer available to them. Older students are given priority on school computers and have more free time for research.

CONCLUSION

It is concluded that both teachers and students find the use of multimedia CD-ROM encyclopaedias are beneficial to learning. Also, the most important factors, by far, in motivating students to use multimedia CD-ROM encyclopaedias in their work are that they are easy and quick to use.

There was also strong support from students that what motivated them to use multimedia CD-ROM encyclopaedias was the use of graphics, sound, and video. However, further research would be needed to ascertain whether they act as an intrinsic or extrinsic motivator, or both. There was not enough information provided in the students' comments in this study.

There was also support, especially amongst the teachers' responses, for the concept of students being motivated by being put in control of their learning by using the multimedia CD ROM encyclopaedia. Thus, the students' perception of ease and convenience of use, together with the motivation engendered by being in control and the graphics and sound, has led to multimedia encyclopaedias becoming an extremely popular school library resource in the UK.

It is recommended that in order to make the most of the potential of multimedia CD ROM encyclopaedias to enhance students' learning, a large and early emphasis needs to be placed on the teaching of information handling and research skills. Students prepared in this way will be better equipped to enjoy the more open, independent learning tasks to which the multimedia encyclopaedias so readily lend themselves.

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