University of HUDDERSFIELD

Learner Strategies Using Learning Technologies In Taught Curriculum Time

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1. Introduction

The study was conducted from October 2007 to April 2008 by the University of Huddersfield through a Becta research grant under the capability and capacity strand of the DfES Harnessing Technology strategy.

1.1 Rationale and aims

There appears to be little research evidence on learners' experience of learning with technology in taught curriculum time, how learners are engaged in learning with technology in this learning context, the learning strategies they use and associated learning outcomes.

By focussing on learning with technology in taught sessions and the strategies that learners use in this context, the present study aimed to investigate an important dimension of the concept of e-learning, which is often not associated with taught curriculum time, but more with independent self-directed study time (SDST).

The focus of the project would seem to be of interest at the present time of substantial investment across the educational sectors in technological provision and capability for computer access, Virtual Learning Environments (VLEs) and online communication and information systems.

In order to meet the continuing challenge of delivering greater educational value from technology and realising significant benefits for learners (Crowne, 2007) the project aimed to identify learners' strategies when using technology as a cognitive tool in taught curriculum sessions. The intention was that the findings would inform how we can develop more effective learning strategies using technology in taught sessions.

It was considered important to identify the continuities and discontinuities that currently occur between the Secondary school, FE and HE sectors in students' learning with technology in taught curriculum time. Findings would inform support for increased learner engagement with technology in the three educational sectors and would sustain improvement in learner capability as students transfer from Secondary school to FE and into HE on their educational journey.

1.2 Relevant literature

The study was mindful of recent research findings that have contributed to our current level of understanding about the role of technology in students' learning in different educational sectors. The Harnessing Technology Review (Becta, 2007), for example, places a clear emphasis on the need to progress the use of technology from enhancing and enriching to extending and empowering learning. This represents a shift in focus from teaching provision

to learners' strategies, and particularly to strategies associated with collaborative and constructive learning. This shift in focus is concerned to address the often passive learner role in knowledge creation in formal education settings, the infrequent use of technology for learning together, and the dislocation between learners' experiences using technology in formal and informal learning contexts and outside education.

Important learner perceptions of the impact of ICT on their education were reported in some earlier studies. For example, Jarvis et al (2005), in an important test-bed study, found that Secondary school students wanted more autonomy in the use of computer equipment in lessons. Many students were ambivalent about ICT in teaching and learning, felt impatient when the teacher was showing them what to do, and looked forward to a time when they might have their own individual computer in school and the teacher could just log in and check work (Jarvis et al, 2005: 24). The students reported variable access to ICT, depending on the subject, the teacher, the time-table, and the location of the lesson. Some students felt that the momentum for learning with ICT technology had been lost.

In a comprehensive study of learners' experiences of e-learning across further education, including work-based learning, and higher education, Creanor et al, (2006) identify control and choice as key themes associated with learner strategies and behaviours. Within these themes, the importance of meta-cognition is emphasised, where a learner displays an understanding of how learning occurs and its impact on the learner's identity. However, while the report identifies influencing factors on the learner experience of e-learning in formal learning, the learning strategies and the key themes associated with them are not detailed in the formal learning context.

Conole et al (2006) reported the pervasive and integrated use of technology by HE students and the development of new strategies, including searching, restructuring and validating. Conole et al (2006) suggest that such strategies lead to a shift from passive to interactive learning and from lower to higher levels of cognitive engagement. A role for technology was identified in supporting learning through thinking and reflection, learning through experience and activity, and learning through conversation and interaction (Conole et al, 2006). However, perhaps because the emphasis of the reports by Conole at al (2006) and Creanor et al (2006) was on learner voice and recognised the difficulties in describing one's own learning, learners' strategies using learning technologies were not deconstructed or described in specific terms.

The boundaries in participants' narratives reported in recent research studies are often blurred between learning in formal contexts and independent self-directed study time (SDST). Overall, reports of findings about learner strategies in recent research studies focus on how learners fit e-learning around their traditional learning activities. It is often unclear if and how the e-learning activities learners discussed and the strategies the learners applied operated in

taught curriculum time. The recent study by Deepwell et al (2008) makes an important contribution to investigating and capturing university students' experiences of learning technologies in their self-directed study. The study by Deepwell et al (2008) paves the way for much needed research into students' experiences of learning technologies and the learning strategies they use in taught sessions in different educational sectors.

Earlier studies, (Oblinger, 2003; Raines, 2003) reported that learners who have grown up in the digital era prefer teamwork, experiential activities, structure and the use of technology. Their strengths, which may indicate learning strategies, include multi-tasking, goal-orientation, positive attitudes, and a collaborative learning style. However, Oblinger (2003) found that many learners between the ages of twelve and seventeen were disappointed with the use of technology in school. Signs of disengagement and dislocation were evident where the learners considered their teachers' use of technology to be uninspiring, and reported seeing better ways than their teachers to use the technology. More recently, Oblinger (2008), van't Hooft, (2008) and de Frietas (2008) argue that formal education risks becoming less relevant if more effective strategies for learning with technology are not supported.

Dyke et al (2007: 84) suggest that e-learning could be improved by being oriented around thinking and reflection, experience and activity and conversation and interaction. It follows that learning strategy development should reflect these three learning orientations. A taxonomy of cognitive activities suggested by Ohlsson (1995) seems to offer useful descriptors of cognitive strategies learners might use with computers as cognitive tools (Lajoie et al, 2000). The taxonomy includes describing, explaining, explicating (clarifying), evaluating, arguing, predicting and defining.

Jucks et al (2003) suggest structure, elaborate, restructure and integrate as a set of learning processes to describe learning with computers, particularly in collaborative contexts. These processes operate on information content to structure information, ideas and concepts, elaborate using other sources, and restructure the information, ideas and concepts into an extended form of understanding. Currently there appears to be little research evidence on the active learning strategies learners use to structure, elaborate and restructure information using learning technology in taught sessions.

Important questions about the role that technology plays in the relationship between taught curriculum time and independent self-directed study time (SDST) are prompted by the research findings by Deepwell et al (2008) of university students' experiences of learning technologies in their self-directed study. In particular, the study suggests that students' use of technology to support their learning in SDST is underdeveloped, and that students require more contextual guidance in taught sessions in using effective learning strategies.

Heppell's (2008) concept of 'inbetweenies' is useful in this context as it places the digital generation of learners between traditional formal learning experiences and e-learning experiences in SDST where learners use their preferred strategies for learning. Such 'inbetweeness' may be disempowering, and the concept highlights the importance of integrating strategies for using technology as a cognitive tool into taught sessions across educational sectors.

Review of the Harnessing Technology Strategy suggested that the use of technology to support effective continuity in learning as at an early stage: 'Understanding what continuity of learning supported by technology looks like for different learner groups and sectors is essential'. The Harnessing Technology Strategy Review identifies, for example, that technology is used less in the Secondary school sector than the Primary school sector for analysing information, problem solving, collaboration and creativity. Similarly, findings by Sheard et al (2007) highlight the learning preferences, mind sets and features of engagement of Secondary school students and the challenges facing Higher Education in engaging future generations of learners. To build on this earlier research it would seem important to investigate students' learning strategies using technology in different educational sectors to inform how continuity of learning in taught curriculum time may be better supported.

The study was further informed by the findings of the Harnessing Technology Strategy review (2007) which reported that while there has been an improvement in levels of e-maturity and increased use of interactive whiteboards in Secondary schools, there continues to be variation in the extent to which use of technology is embedded as a teaching and learning tool. Continued improvement in developing ICT capability in FE is indicated, with the use of ICT as a teaching and learning tool featuring in most colleges. However, in both Secondary school and FE sectors, the review indicates that the possibilities ICT offers for teaching and learning are not fully exploited, particularly for creative and collaborative learning opportunities and for personalised, flexible learning.

Other research indicated a positive impact on Secondary school students' learning outcomes has been associated with the use of technology, and interactive whiteboards in particular, to support learning (ImpaCT2, 2002). However, while, increased engagement in and satisfaction with learning with technology are reported in the FE sector, evidence of the impact on learning outcomes is limited (Harnessing Technology Strategy review, 2007:13).

Somekh (2007:33) argues that until all students have their own personal 'digital learning companions' and access to the Internet wirelessly and when required, the usefulness of technology for learning will inevitably be constrained. Similarly, a new pedagogic understanding of the role of technology for learning needs to emerge if teaching and learning are to be successful. Such an understanding would view technology as a cognitive tool,

providing ideas and a resource for enquiry, and, perhaps most importantly, as a support for creativity in learning (Somekh, 2007:101). This new pedagogic understanding of the role of technology for learning would need to be informed by and seek to develop the strategies learners use with technology as a cognitive tool.

2. Research questions

The research questions underpinning the study were: -

1. What strategies for learning with technology do students use in taught curriculum time in the Secondary school, FE and HE sectors? What are the continuities and discontinuities in learners' strategies between the three educational sectors?

2. What learning outcomes are associated with students' learning strategies using technology in taught curriculum time?

3. How can we develop more effective learning strategies?

Underpinning the main research questions is how learner strategies are supported by technology in the Secondary school, FE and HE sectors (in reference to cognitive learning strategies (CLS) and active learning strategies (ALS)) and what are the continuities and discontinuities between the Secondary school, FE and HE sectors.

3. Methodology

3.1 How the study was undertaken

The study incorporates the emphasis placed on learner voice in recent important research projects with a cognitive-empirical approach to investigating learner strategies. Online surveys were completed and fieldwork in the Secondary school, FE and HE sectors including lesson observations, interviews and students logs, were conducted from December 2007 to April 2008.

3.2 Participants and learning contexts

3.2.1 Participants

The participants were 9 Year 11 students from 3 Secondary schools, 9 A level or Diploma students from 3 FE institutions, and 7 undergraduate students from 5 university schools and departments (Law, Youth and Community Work, International Business Studies, Pharmaceutical Science, and Advertising with Media and Design Management) in one post-92 University in the North of England.

Ethical guidelines for educational research were followed (BERA, 2004), ethical approval was obtained from the University, access to participants was through consenting institutions, and a contract of ethical practice was undertaken with each participant to ensure voluntary informed consent. The principle guiding participant access and participation the research was the individual's interest, willingness and enthusiasm for taking part in the project. The subject areas and anticipated use of learning technology were not the main deciding factors (see Section 3.2.4).

3.2.2 Students completing online surveys

To gain a wider picture of students' perceptions of how learning technology supports their learning and the strategies learners use, and to contextualise and triangulate findings from the participants observed in the study, online surveys were completed by FE students (N=81) from partner institutions and HE students (N=72) registered on a range of undergraduate courses at the University. Secondary school students in Year 11 (N=109) and in Year 10 (N=97) completed online or paper-based surveys.

3.2.3 Taught sessions in which observations were made of learner strategies using learning technologies

The subject focus of the taught sessions was a chance factor and depended on the days negotiated for the observations. Some subject and discipline matches occurred across the educational sectors, as Table 3.1 shows.

Table 3.1: Subject focus of taught sessions where learner strategies using learning technologies were observed

Secondary school sector	FE sector	HE sector
History GCSE PE Technology (Graphics) Sociology English Applied Science Science Physics Mathematics Key Skills DIDA Geography French Food Technology	History Music Business studies Psychology Health and Social Care Applied Science Diploma in Child Care and Education Computer studies BTEC IT Key Skills IT BTEC Intermediate Travel and Tourism Spanish Photography	Law International Business Studies (Statistics) Youth and Community Work Pharmaceutical Science Advertising with Media and Design Management

Taught sessions in which learning technology was not used to support learning during the data collection period are shown in Table 3.2.

Table 3.2: Taught sessions in which learning technology was not used to support learning in taught sessions

Secondary school sector	FE sector	HE sector
Chemistry Media RE Drama Art	English Maths	International Business Studies Law (some modules) Advertising with Media and Design Management

3.3 Methods and instruments used

3.3.1 Shadowing participants

To track learning with technology, students were shadowed for one day or relevant part of a day in their educational setting in taught curriculum time. This involved observing, timing and recording aspects of the student's interactions with learning technology, their learning strategies and learning outcomes. In this context, learning was defined as an increase in knowledge, skill or understanding or as a change in how something is perceived or interpreted. An observation form was developed to record learning with technology, and included information on the times, duration, activity, learning strategy and learning outcomes of student engagement with/use of technology as a learning tool in taught curriculum time.

3.3.2 Student log

A student log was completed after each taught session that featured learning with technology (computers or interactive whiteboards). The student log identified the subject focus, the focus of the session, the technology used, what it was used for, how the technology supported learning, and the student's perceived learning outcomes, or what the student knew, understood or could do as a result of the technology used in the lesson.

3.3.3 Structured interviews

Students reflected on and evaluated their learning with technology through an interview schedule that asks questions on the role technology plays in the student's learning; whether and why the participating day was usual or unusual in the way technology supports learning; which technologies support learning in the students' particular settings; differences between experiences of learning with technology in the present and previous educational sectors; the features of learner-focused engagement with technology and possible missed opportunities for such engagement.

3.3.4 Student survey (Case study and wider population survey)

Questions were asked around the role technology plays in the student's learning, the technologies used, and the types of learning activity that technology supports.

3.4 How the data was analysed

The data was analysed quantitatively and qualitatively. Quantitative analysis was carried out on survey data on students' perceptions of technology for learning and on observational data from shadowing students in taught sessions. Quantitative analysis from observations focussed on the following:

the amount and percentage of taught curriculum time learning technology is used as a tool for learning, and differences within and across educational sectors;

and

the amount and percentage of taught curriculum time students spend using different learning technologies, and differences within and across educational sectors.

Qualitative analysis drew on the work of Ohlsson (1995) on cognitive epistemic activity, Jucks et al (2003) on learning processes and Pianta et al (2006) on engaging learners.

4. Results

4.1 Quantitative results: Surveys

Quantitative analysis was carried out on survey data on students' perceptions of how they use technology for learning in taught sessions in the Secondary school, FE and HE sectors. Statistical comparisons were made between the participating students and the wider populations surveyed. The section aims to provide a context for the learning strategies and learning outcomes identified in subsequent sections of the report. Quantitative analysis was also applied to observational data of learner strategies from shadowing students in taught sessions.

4.1.1 How Secondary School students perceive the usefulness of technology for learning

This section provides information about the views of the participating students regarding the usefulness of technology for learning and the focus of such learning in taught sessions in the Secondary school, FE and HE sectors. In this way, the section aims to provide a context for the learning strategies and learning moves identified in the qualitative analysis (See Section 4.2). It should be noted that percentage values for the participant group should be interpreted with caution due to the small sample size.

Reasons for participants' use of technology

As Figure 4.1 shows, Secondary school students considered the main reason for using technology was to get the work done.

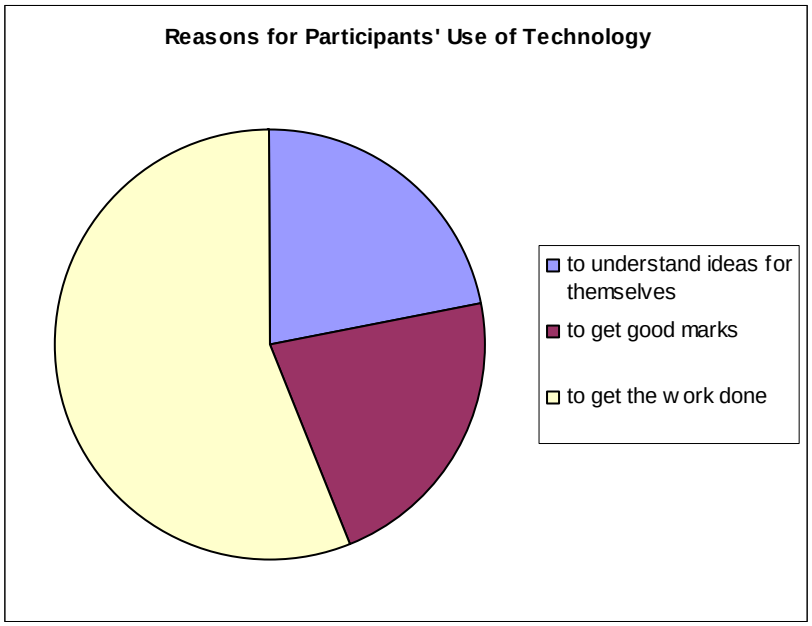

Figure 4.1: Reasons for Participants' use of Technology

2 students (22%) use technology in lessons to understand ideas for themselves

2 students (22%) use technology in lessons to help to get good marks
5 students (56%) use technology in lessons to get the work done

The level of support for learning provided by technology

As Figure 4.2 shows, Secondary school students mainly consider that technology supports their learning quite a lot in lesson time.

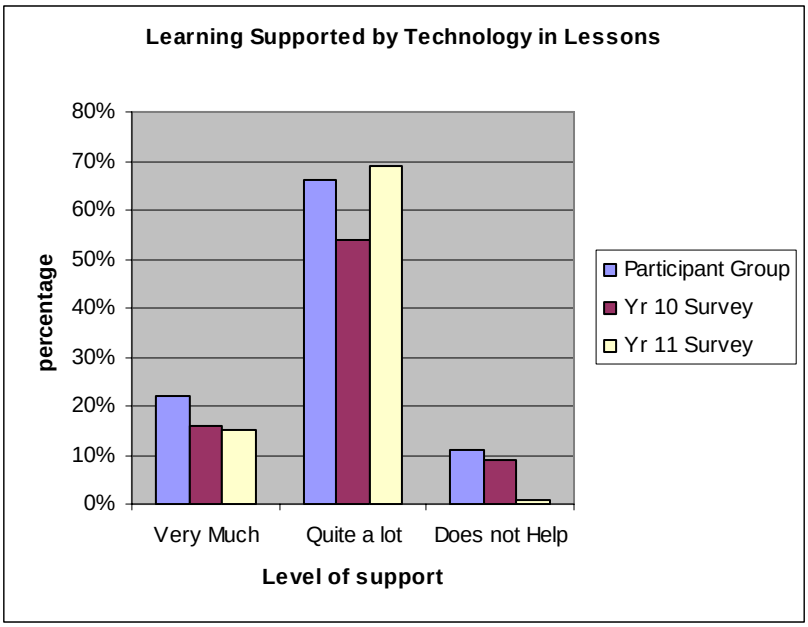

Figure 4.2: Support for Learning Provided by Technology in Lessons

2 students (22%) say technology helps them very much to learn in lessons compared with 16% of the wider Year 11 population surveyed and 15% of the wider Year 10 population surveyed.
6 students (66%) say technology helps them quite a lot to learn in lessons compared with 54% of the wider Year 11 population surveyed and 69% of the wider Year 10 population surveyed.
1 student (11%) says that technology does not help to learn in lessons, compared with 9% of the wider year 11 population surveyed and 1% of the wider Year 10 population surveyed.

Enthusiasm for using technology in lessons

Figure 4.3 suggests that while Secondary school students are generally quite enthusiastic about using technology to support their learning in lessons, a sizeable minority are not.

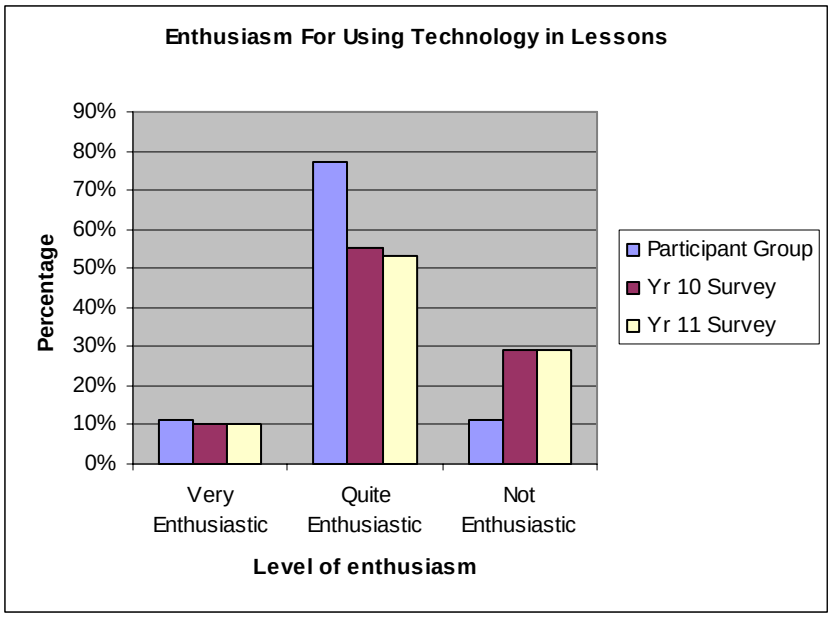

Figure 4.3: Enthusiasm For Using Technology in Lessons

1 student (11%) reports being very enthusiastic about learning with technology in school compared with 10% of the wider Year 11 population surveyed and 10% of the wider Year 10 population surveyed.

7 students (77%) say they are quite enthusiastic about learning with technology in school compared with 53% of the wider Year 11 population surveyed and 55% of the wider Year 10 population surveyed.

1 student (11%) reports being only a little enthusiastic about learning with technology in school compared with 29% of the wider year 11 population surveyed and 29% of the wider Year 10 population surveyed.

The role of technology in making learning more interesting in lesson time

Figure 4.4 shows that on the whole Secondary school students are more interested in learning when technology is used in lessons.

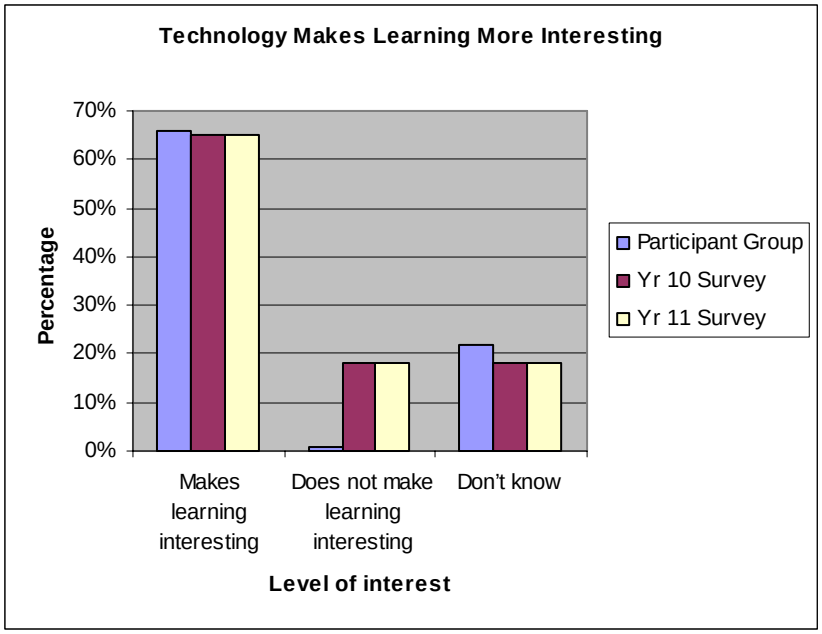

Figure 4.4: Technology Makes Learning More Interesting

6 students (66%) say using technology makes them more interested in learning in school compared with 65% of the wider Year 11 population surveyed and 65% of the wider Year 10 population surveyed.

1 student (11%) says using technology does not make him more interested in learning in school compared with 18% of the wider Year 11 population surveyed and 18% of the wider Year 10 population surveyed.

2 students (22%) did not know whether using technology makes them more interested in learning in school compared with 18% of the wider Year 11 population surveyed and 18% of the wider Year 10 population surveyed.

How often computers are used to support learning in school

Overall, Secondary school students reported that computers are used often or very often to support their learning in school, as illustrated in Figure 4.5.

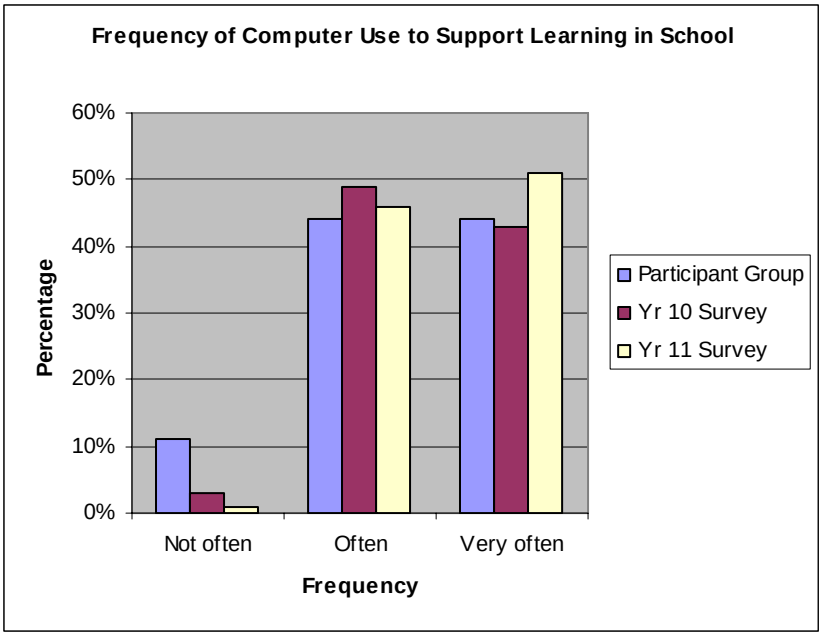

Figure 4.5: Frequency of Computer Use to Support Learning in School

1 student (11%) reported not often using the computer to learn in school, compared with 3% of the wider Year 11 population surveyed and 1% of the wider Year 10 population surveyed.
4 students (44%) use the computer often to learn in school, compared with 46% of the wider Year 11 population surveyed and 49% of the wider Year 10 population surveyed.
4 students (44%) use the computer very often to learn in school, compared with 51% of the wider Year 11 population surveyed and 43% of the wider Year 10 population surveyed.

Use of the internet to support learning in school

As Figure 4.6 shows, Secondary school students reported using the internet often or very often to support learning in school.

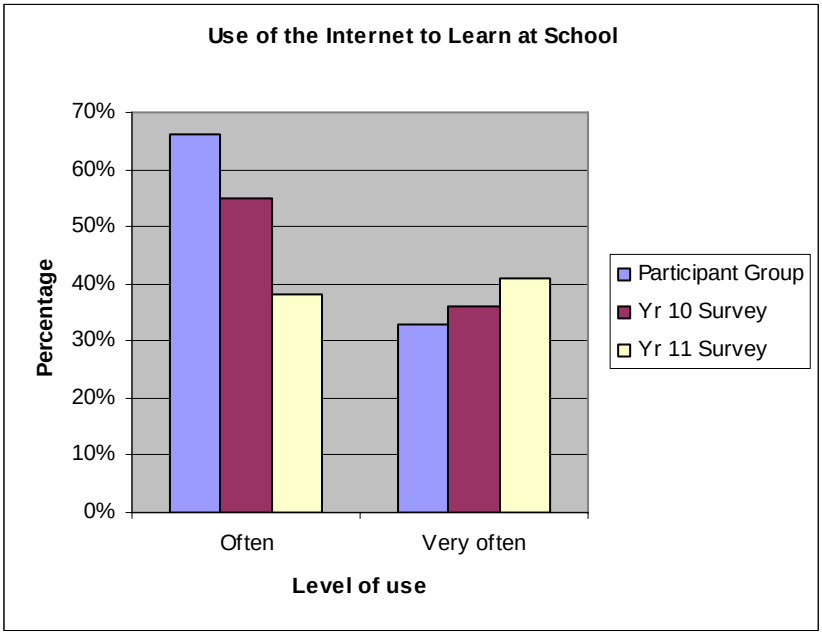

Figure 4.6: Use of the Internet to Learn at School

6 students (66%) use the internet often to learn in school compared with 38% of the wider Year 11 population surveyed and 55% of the wider Year 10 population surveyed.
3 students (33%) use the internet very often to learn in school compared with 41% of the wider Year 11 population surveyed and 36% of the wider Year 10 population surveyed.

Use of the Interactive Whiteboard to support learning in school

As Figure 4.7 suggests, while the participant group reported that the interactive whiteboard often or very often supported their learning, the findings were variable for the wider surveyed groups.

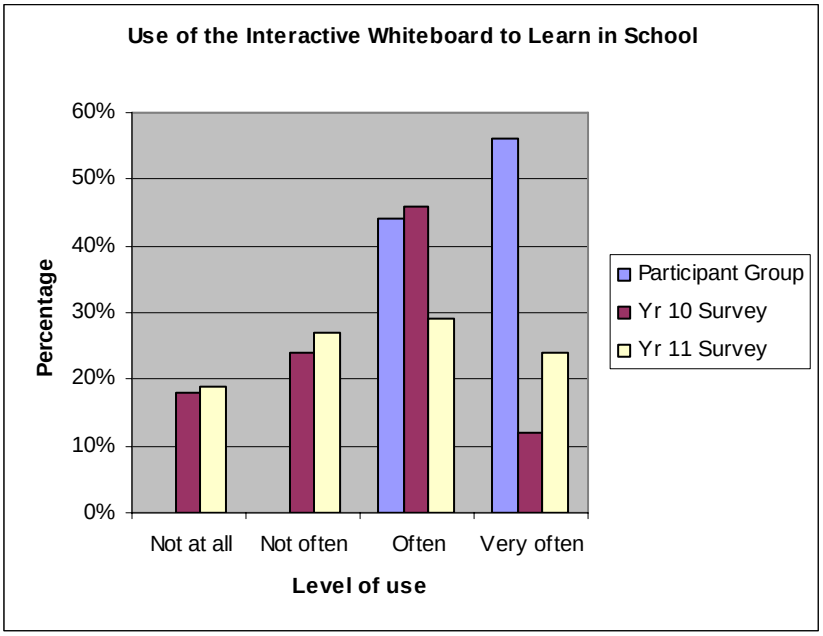

Figure 4.7: Use of the Interactive Whiteboard to Support Learning in School

4 students (44%) use the interactive whiteboard often to learn in school, compared with 29% of the wider population surveyed and 46% of the wider Year 10 population surveyed.
5 students (56%) use the interactive whiteboard very often to learn in school, compared with 24% of the wider Year 11 population surveyed and 12% of the wider Year 10 population surveyed. It should be noted that 19% of the wider Year 11 population surveyed and 18% of the Year 10 population surveyed reported not using the interactive whiteboard at all for learning. Similarly, 27% of the wider Year 11 population surveyed and 24% of the Year 10 population surveyed reported not using the interactive whiteboard often for learning.

4.1.2 Specific uses of technology for learning in the Secondary school sector

The survey findings from the participating students are compared with findings from the wider Secondary school populations surveyed (Years 11 and 10) in Table 4.1

Table 4.1: Comparative survey findings of uses of technology for learning in the participating and wider Secondary school student populations surveyed

Technology uses	**Participating students: Year 11 (N=9)**		**Wider Secondary school population: Year 11 (N=109)**		**Wider Secondary school population: Year 10 (N=97)**	
	N	%*	N	%	N	%
Using technology to find things out:						
Not at all	0	0	0	0	1	1
Not often	1	11	12	11	5	5
Often	6	66	62	57	56	59
Very often	2	22	34	32	34	35
Using technology to solve problems:						
Not at all	0	0	4	4	9	10
Not often	2	22	30	30	23	24
Often	7	77	61	57	48	50
Very often	0	0	12	11	15	16
Using technology to sort out ideas:						
Not at all	0	0	5	5	6	6
Not often	2	22	34	31	34	37
Often	5	55	59	55	38	41
Very often	2	22	10	9	15	16
Using technology to Make work better:						
Not at all	0	0	1	1	1	1
Not often	1	11	16	15	4	4
Often	3	33	57	53	52	55
Very often	5	55	34	31	37	39
Using technology to be critical of information:						
Not at all	1	11	11	10	15	17
Not often	3	33	49	47	35	39
Often	4	44	36	34	32	35
Very often	1	11	9	9	8	9
Using technology to revise:						
Not at all	1	11	4	3	7	7
Not often	2	22	28	26	16	17
Often	2	22	44	41	41	43
Very often	4	44	32	30	31	33

* percentage values maybe inflated due to the small sample size

Table 4.1 suggests that findings from the participating students are mainly consistent with the wider populations surveyed. Being critical about information, sorting out ideas and problem solving are identified as underdeveloped uses of technology for learning.

4.1.3 How FE students perceive the usefulness of technology for learning

Reasons for participants' use of technology in FE

As Figure 4.8 shows, FE students considered the main reason for using technology was to get the work done.

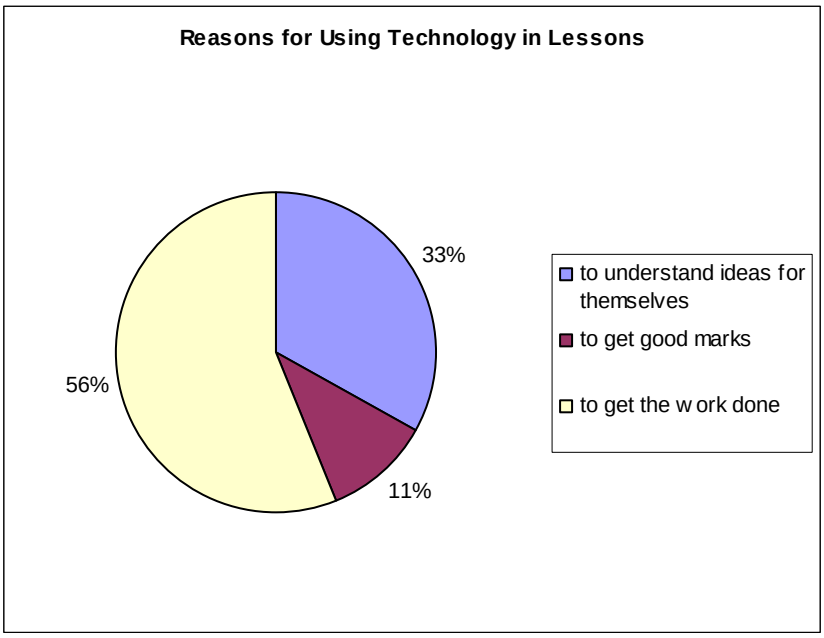

Figure 4.8: Reasons for Using Technology in Lessons in FE

3 students (33%) use technology in lessons to understand ideas for themselves

1 student (11%) uses technology in lessons to help to get good marks

5 students (56%) use technology in lessons to get the work done

The level of support for learning provided by technology in FE

As Figure 4.9 shows, FE students consider that technology plays an important role in supporting learning in lesson time.

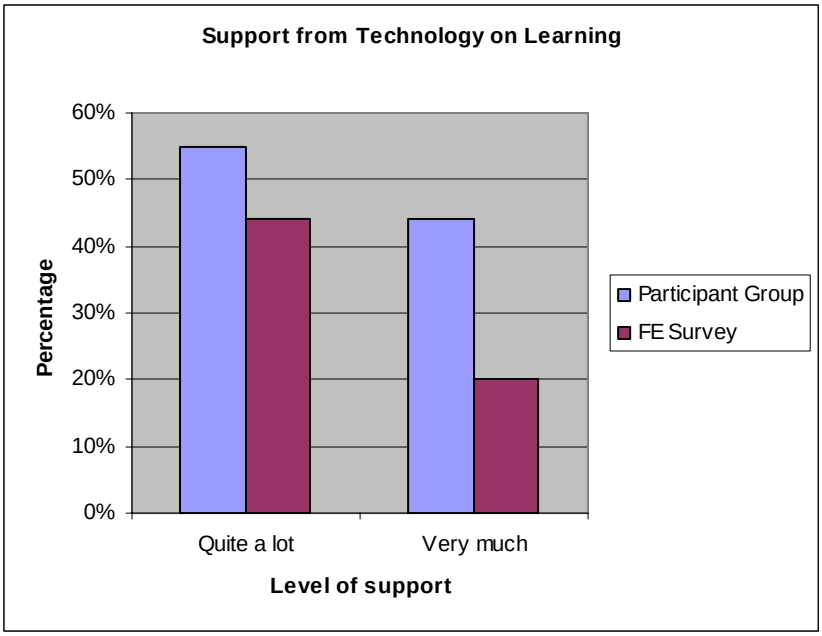

Figure 4.9: Support for Learning provided by Technology in Lessons

5 students (55%) say technology helps them quite a lot to learn in lessons, compared with 44% of the wider FE population surveyed

4 students (44%) say technology helps them very much to learn in lessons compared with 20% of the wider FE population surveyed

Enthusiasm for using technology in lessons

Figure 4.10 suggests that while FE students in the participant group are generally quite enthusiastic about using technology to support their learning in lessons, the enthusiasm for using technology for learning in the wider surveyed group is more variable.

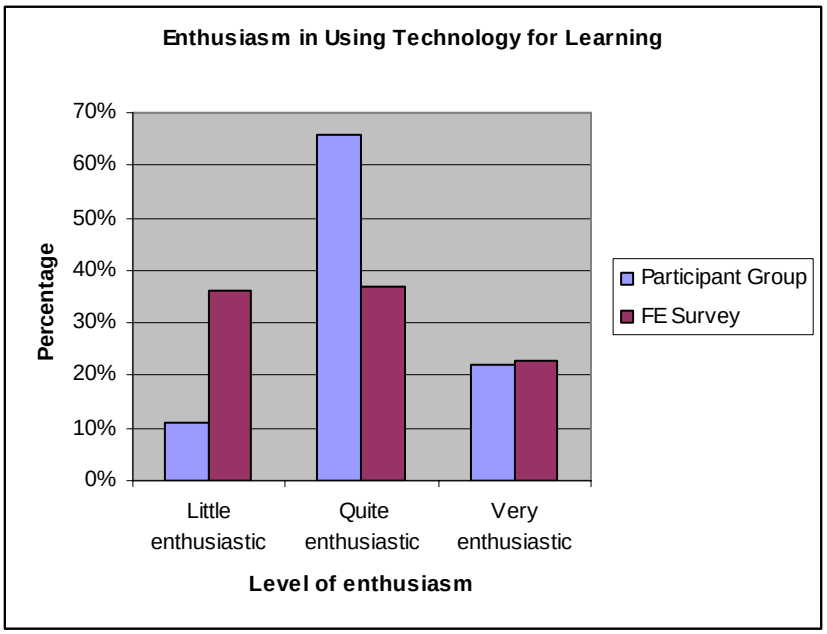

Figure 4.10: Enthusiasm in Using Technology for Learning

1 student (11%) reports being only a little enthusiastic about learning with technology in college, compared with 36% of the wider FE population surveyed

6 students (66%) say they are quite enthusiastic about learning with technology in college, compared with 37% of the wider FE population surveyed

2 students (22%) report being very enthusiastic about learning with technology in college, compared with 23% of the wider FE population surveyed

The role of technology in making learning more interesting in lesson time in FE

Overall, FE students surveyed considered that using technology made them more interested in learning at college, as Figure 4.11 shows.

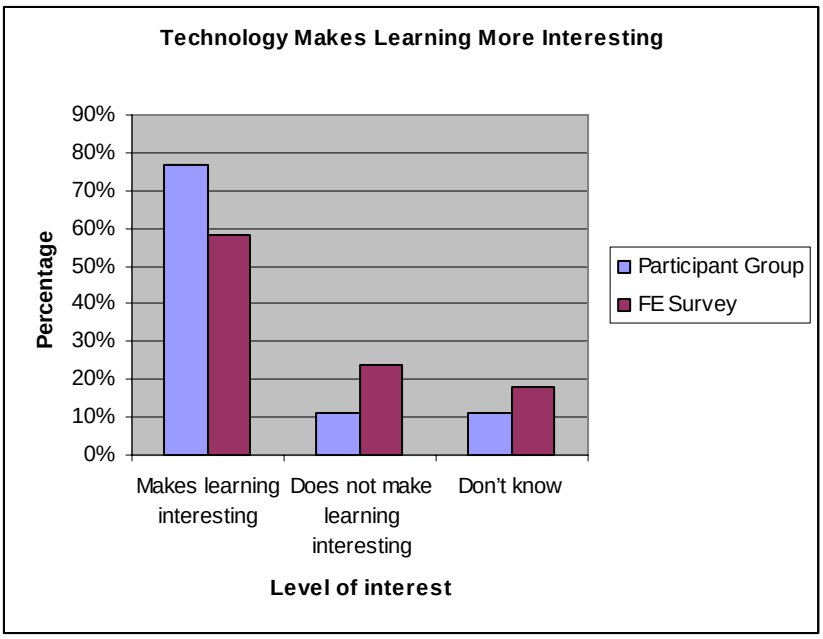

Figure 4.11: The role of technology in making learning more interesting in FE

7 students (77%) say using technology makes them more interested in learning in college, compared with 58% of the wider FE population surveyed

1 student (11%) says using technology does not make him more interested in learning in college, compared with 24% of the wider FE population surveyed

1 student (11%) did not know whether using technology makes them more interested in learning in college, compared with 18% of the wider FE population surveyed

How often computers are used to support learning in FE college

Overall, FE students reported that computers are used often or very often to support their learning in college. The level of computer use of the participant group appeared ro exceed that of the wider surveyed FE population, as Figure 4.12 suggests.

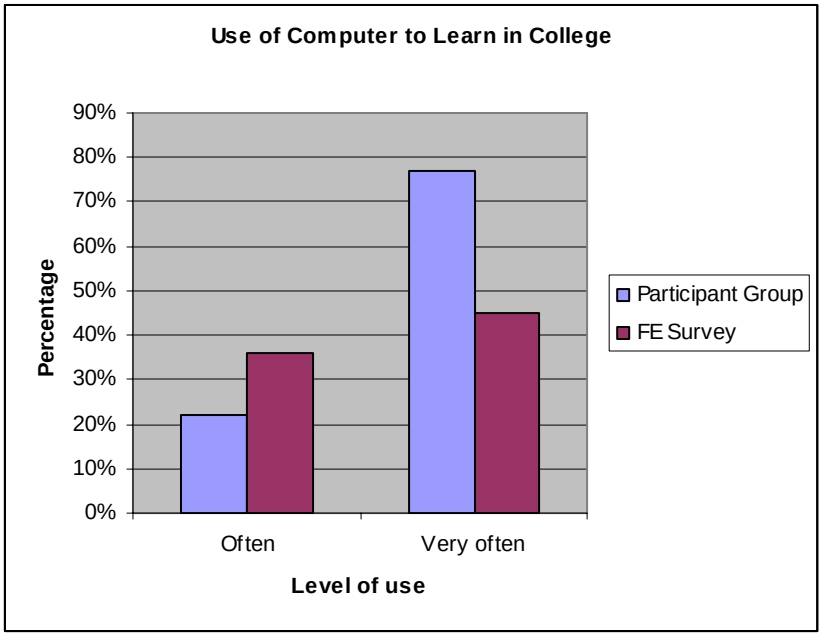

Figure 4.12: Use of Computers to Learn in FE Colleges

2 students (22%) report using a computer often to learn in college, compared with 36% of the wider FE population surveyed online

7 students (77%) report using a computer very often to learn in college, compared with 45% of the wider FE population surveyed

Use of the internet to support learning in FE colleges

As Figure 4.13 shows, FE students reported using the internet often or very often to support learning in college. A higher level of use was indicated by the participant group.

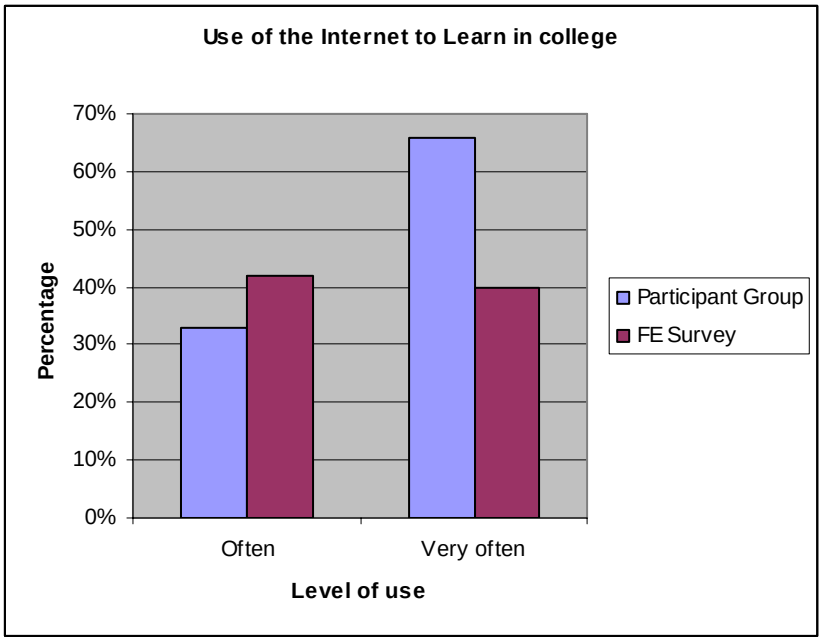

Figure 4.13: Use of the Internet to Learn in FE Colleges

3 students (33%) use the internet often to learn in college, compared with 42% of the wider FE population surveyed

6 students (66%) use the internet very often to learn in college, compared with 40% of the wider FE population surveyed

Use of the Interactive Whiteboard to support learning in FE colleges

As Figure 4.14 suggests, reported use of the interactive whiteboard was variable.

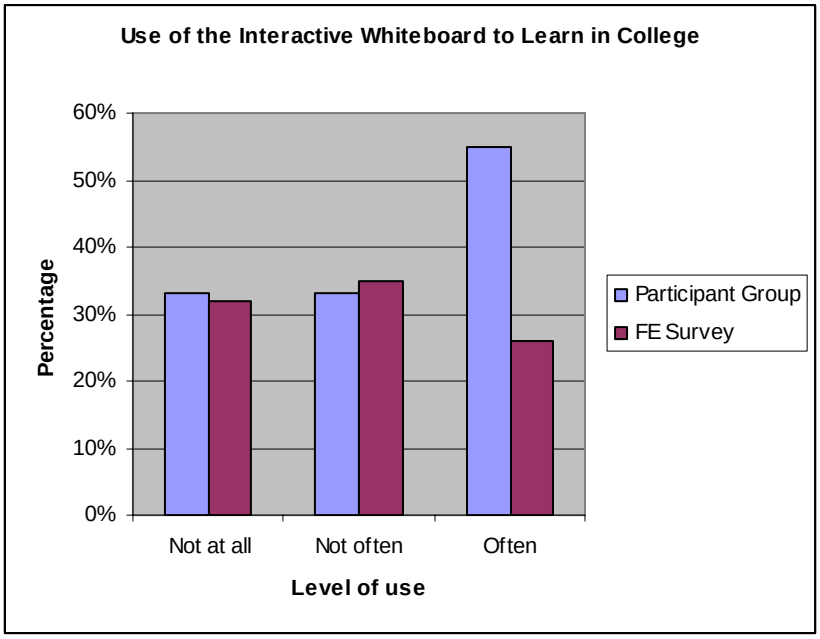

Figure 4.14: Use of the Interactive Whiteboard to Learn in FE Colleges

3 students (33%) report that they do not use the interactive whiteboard at all to learn in college, compared with 32% of the wider FE population surveyed

3 students (33%) report that they do not often use the interactive whiteboard to learn in college, compared with 35% of the wider FE population surveyed

5 students (55%) report that they often use the interactive whiteboard to learn in college, compared with 26% of the wider FE population surveyed

4.1.4 Specific uses of technology for learning in the FE sector

The survey findings from the participating students are compared with findings from the wider FE student population in Table 4.2.

Table 4.2: Comparative survey findings of uses of technology for learning in the participating and wider FE student populations

Technology uses	Participating FE students: N=9		Wider FE student population: N=81	
	N	%	N	%
Using technology to find things out:				
Not at all	0	0	1	1
Not often	0	0	4	5
Often	6	66	22	28
Very often	3	33	51	65
Using technology to solve problems:				
Not at all	0	0	1	1
Not often	3	33	18	23
Often	4	44	42	54
Very often	2	22	17	22
Using technology to sort out ideas:				
Not at all	0	0	3	4
Not often	1	11	35	45
Often	6	66	28	36
Very often	2	22	12	15
Using technology to Make work better:				
Not at all	0	0	1	1
Not often	0	0	12	15
Often	2	22	45	58
Very often	7	77	20	26
Using technology to be critical of information:				
Not at all	0	0	11	14
Not often	4	44	29	38
Often	3	33	23	30
Very often	2	22	14	18
Using technology to revise:				
Not at all	1	11	5	6
Not often	1	11	17	22
Often	5	55	31	40
Very often	2	22	25	32

4.1.5 How HE students perceive the usefulness of technology for learning

Reasons for participants' use of technology in HE

As Figure 4.15 shows, HE students considered the main reasons for using technology was to understand ideas for themselves or get the work done.

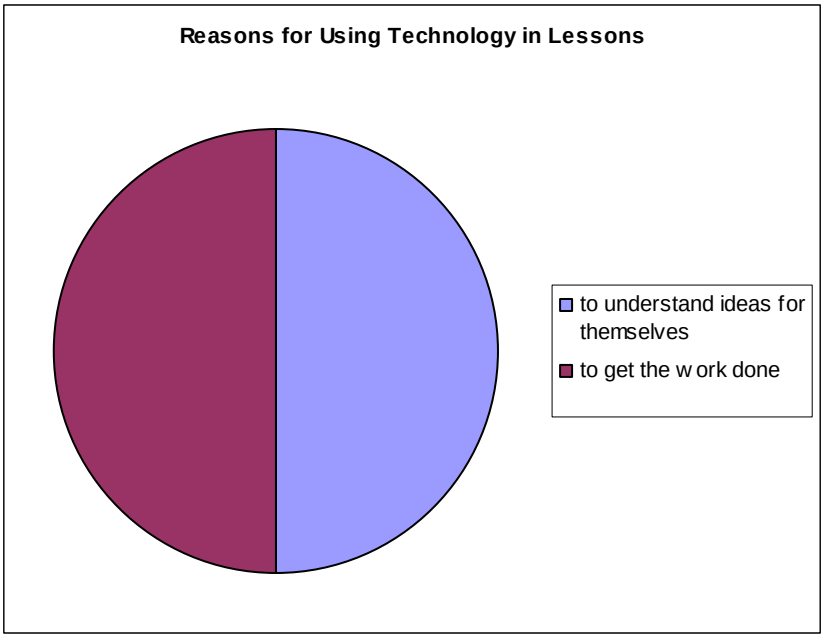

Figure 4.15: Reasons for Using Technology in Lessons in HE

2 out of 7 students say they use technology on their course to understand ideas for themselves.

2 out of 7 students say they use technology on their course to get the work done. The students did not identify using technology to get good marks.

The role of technology in learning

Figure 4.15 shows that HE students consider technology plays an important part in learning on their courses.

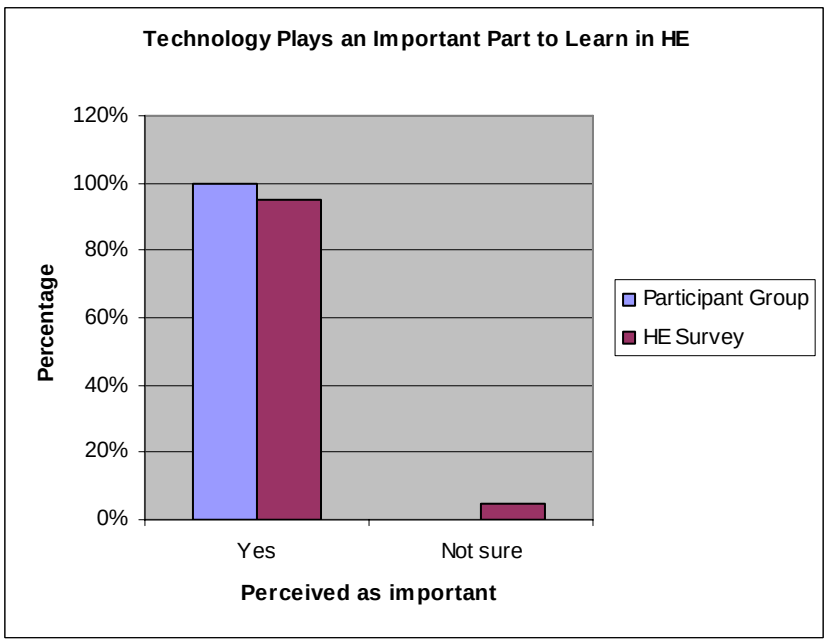

Figure 4.16: The Role of Technology to Learn in HE

All participating students say technology has played an important part in their learning on their course compared with 95% of the wider HE student population surveyed, of which 5% were unsure.

Use of the Interactive Whiteboard to support learning in HE

As Figure 4.16 suggests, the interactive whiteboard was reported to play an important role in students' learning in HE.

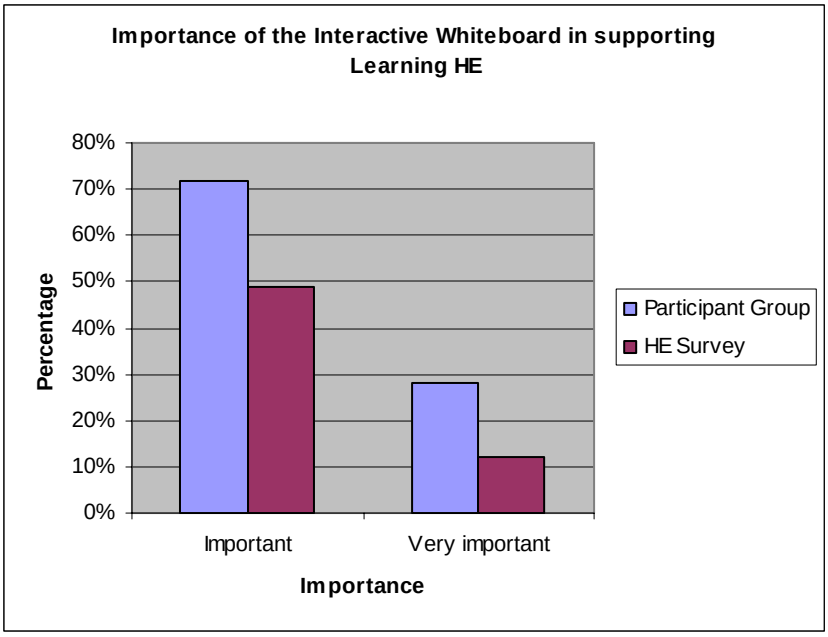

Figure 4.17: Importance of the Interactive Whiteboard in supporting Learning HE

5 students (72%) report that the interactive whiteboard is important in supporting their learning, compared with 49% of the wider HE student population surveyed.

2 students (28%) report that the interactive whiteboard is very important in supporting their learning, compared with 12% of the wider HE student population surveyed.

4.1.6 Specific uses of technology for learning in the HE sector

The survey findings from the participating students are compared with findings from the wider HE student population in Table 4.3.

Table 4.3: Comparative survey findings of uses of technology for learning in the participating and wider HE student populations

Technology uses	Participating HE students: N=9		Wider HE student population: N=69	
	N	%	N	%
Using technology to learn facts:				
Not at all	0	0	1	2
Not often	0	0	9	13
Often	4	57	27	39
Very often	3	43	32	46
Using technology to find things out (enquire and investigate):				
Not at all	0	0	0	0
Not often	0	0	4	6
Often	2	28.5	11	16
Very often	5	71.5	54	78
Using technology to solve problems:				
Not at all	0	0	0	0
Not often	2	28.5	10	15
Often	2	28.5	23	33
Very often	3	43	36	52
Using technology to structure ideas:				
Not at all	0	0	2	3
Not often	2	28.5	18	26
Often	2	28.5	27	39
Very often	3	43	22	32
Using technology to make work better (correct and improve):				
Not at all	0	0	1	2
Not often	3	43	8	11
Often	1	14	21	29
Very often	3	43	39	58
Using technology to be critically evaluate ideas/ information:				
Not at all	0	0	3	4
Not often	1	14	15	22
Often	5	71.5	29	43
Very often	1	14	21	31
Using technology to revise:				
Not at all	0	0	7	10
Not often	1	14	20	29
Often	4	57	17	25
Very often	2	28.5	25	36

4.1.7 Summary of survey findings for the 3 educational sectors

Two approaches were taken to analysing the survey findings. The first approach looked at the majority responses to each question. Findings were: -

- Technology often and very often helps to find things out in the Secondary school, and FE and HE sectors
- Technology often helps students to sort out their ideas and to solve problems in the three educational sectors
- Overall, technology often or very often helps them to make their work better in the three educational sectors
- While the majority of participating students in all three educational sectors say that they often or very often use technology to be critical, a large minority each sector say that this happens not often or not at all
- Technology often and very often helps students to revise in each educational sector.

The second approach looked at the minority responses to ensure that student voice is faithfully represented and to identify possible areas where the potential of technology for supporting learning could be explored and developed further.

A summary of the minority responses that appear to have particular significance is presented in Table 4.4.

Table 4.4: Summary of participants' views of how the technology supports their learning in taught sessions in the Secondary school, FE and HE sectors: minority responses

Secondary Sector 1 student (11%), 33% of the wider year 11 population surveyed and 29% of the wider Year 10 population surveyed report being only a little enthusiastic about learning with technology in school; 12% of the wider year 11 population surveyed and 6% of the wider Year 10 population surveyed report being not at all enthusiastic about learning with technology in school 1 participating student (11%), 18 % of the wider Year 11 population surveyed and 18% of the Year 10 population surveyed say using technology does not make them more interested in learning in school; 2 participating students (22%), 28% of the wider Year 11 population surveyed and 24% of the wider Year 10 population surveyed say technology does not often help them to solve problems; 2 participating students (22%), 31% of the wider Year 11 population surveyed and 37% of the Year 10 population surveyed say that technology does not often help them to sort out their ideas; 1 participating student (11%), 10% of the wider Year 11 population surveyed and 17% of the Year 10 population surveyed says that technology does not help them at all to be critical of information; 3 participating students (33%), 47% of the wider Year 11 population surveyed and 40% of the Year 10 population surveyed say technology does not often help them to be critical of information;
FE Sector I participating student (11%) and 36% of the wider FE population surveyed report being only a little enthusiastic about learning with technology in college; While 7 participating students (77%) and 58% of the wider FE population surveyed say using technology makes them more interested in learning in college, 1 participating student (11%) and 24% of the wider FE population surveyed say using technology does not make them more interested in learning in college; 3 students (33%) and 32% of the wider FE population surveyed report that they do not use the interactive whiteboard at all to learn in college; 3 students (33%) and 35% of the wider FE population surveyed report that they do not often use the interactive whiteboard to learn in college; 3 participating students (33%) and 23% of the wider FE population surveyed say that technology does not often help them to solve problems; 1 participating student (11%) and 45% of the wider FE population surveyed say that technology does not often help to sort out ideas; 4 participating students (44%) and 38% of the wider FE population surveyed say that using technology does not often help them to be critical about information;
HE Sector 5 students (72%) report that the interactive whiteboard is important in supporting their learning, compared with 49% of the wider HE student population surveyed

2 participating students (28.5%) and 15 % of the wider HE student population surveyed say technology does not often help them to solve problems;

2 participating students (28.5%) and 26% of the wider HE student population surveyed say that technology does not often help them to structure their ideas;

1 participating students (14%) and 22% of the wider HE student population surveyed say technology does not often help them to critically evaluate information and ideas

3 participating students (43%) and 11% of the wider HE student population surveyed say that technology does not often help them to improve their work

Table 4.4 indicates consistencies between the Secondary school, FE and HE sectors in participants' views of how the technology supports their learning in taught sessions. For a significant minority of students, technology is consistently not often used to solve problems, sort out and structure ideas, or to be critical about information and ideas although this way of using technology to support student's learning reportedly increases across the educational sectors.

4.1.8 Quantitative Findings from observations made whilst shadowing students

The total number of taught sessions observed was 77. The number of taught sessions observed in each sector was: -

- Secondary = 36 (including 2 lessons on computer-related courses)
- FE = 26 (including 7 lessons on computer-related courses)
- HE = 15

Quantitative analysis from observations focussed on the following:

The amount and percentage of taught curriculum time learning technology is used as a tool for learning, and differences within and across educational sectors; the amount and percentage of taught curriculum time students spend using different learning technologies, and differences within and across educational sectors. The findings are presented in Table 4.5.

Table 4.5: Quantitative findings from observations

Statistics from data	Secondary school sector	FE sector	HE sector
Number of taught sessions using technology to support learning	22	19	10
Percentage of lessons observed in which technology was used to support learning	61	73	66
Percentage of lessons observed in which technology was used to support learning (not computer-related courses)	59	50	67
Average (mean) no. of minutes per session using technology to support learning	40	46	61

Average (mean) no. of minutes per session using technology to support learning (not computer-related courses)	37	40	61
Average (mean) % time per lesson using technology to support learning	63	64	71
Average (mean) % time per lesson using technology to support learning (not computer-related courses)	61	55	71
Number of taught sessions for IWB	12	4	10
Average (mean) minutes per session for IWB	31	24	61
Average (mean) % time per session for IWB	51	34	71
Number of taught sessions using computer	12	15	0
Number of taught sessions using computer (not computer-related courses)	10	8	1
Average (mean) minutes for computer	45	46	40
Average (mean) minutes for computer (not computer-related courses)	43	47	40
Average (mean) % time per lesson for computer	70	68	38
Average (mean) % time per lesson for computer (not computer-related courses)	70	64	38

The results in Table 4.5 show that learning technology is used more often in taught sessions that are not computer courses in the Secondary schools than in the FE colleges. The use of the interactive whiteboard as a support for learning was observed more frequently in taught sessions in the Secondary schools than in the FE colleges and most often in taught sessions in HE courses as PowerPoint presentations. One observation was made of students using computers in taught sessions in the HE setting.

4.2. Qualitative Findings

Qualitative analysis of data obtained from student lesson logs and from lesson observations focussed on learner voice and cognitive–empirical analysis to investigate learner strategies using learning technology in taught sessions. Data analysis produced findings in the following four areas: -

1. Participants' perceptions of how the technology supported their learning.

2. The cognitive learning strategies (CLS) (describe, explain, explicate, evaluate, argue, predict, define) students use when learning with technology in taught curriculum time.

3. The active learning strategies (ALS) students use to structure, elaborate and restructure information, ideas and concepts in response to the input/learning experiences in taught sessions.

4. The learning outcomes in taught sessions resulting from the learner strategies. It does not seem unreasonable to suggest that the learning outcomes might be directly or indirectly associated with observed learner strategies. However, there is a need for further research to explore more fully the relationship between learner strategies and learning outcomes that might be observed or otherwise captured.

Separate results were obtained from observations of Interactive Whiteboards and computers supporting learning for the different educational sectors (Secondary school, FE and HE). A distinction was made between taught sessions in computer-related courses and in the use of ICT across the curriculum (ICTAC). Findings in the four areas identified above are reported in the following sections.

4.2.1 Participants' perceptions of how the technology supported their learning in taught sessions: Evidence (Logs)

It was possible to group students' perceptions of how technology supported their learning in the following ways: informative, instructional, procedural, explanatory, reflective/evaluative, and other ways that students might identify. The *informative* category was where technology provided information such as fact or opinion. The *instructional* category was for support in the form of instructions for learning. *Procedural* support referred to how a specific personal learning aim or objective may be achieved or how a learning need might be met.

Explanatory support helps the learner to understand the learning content in terms of reasons why, procedures describing how, and relationships defining a concept event or artefact.

Reflective/evaluative support helps the learner to consider the learning content from an interpretative and critical stance.

While the category 'other' was used to capture additional ways that students might consider technology as a support to their learning in taught sessions, none were found. Students' perceptions are grouped as informative, instructional, procedural, explanatory and reflective/evaluative in Table 4.6 below.

Table 4.6: Participants' perceptions of how the technology supported their learning in the Secondary school, FE and HE sectors

Secondary sector Technology : IWB

Student perceptions: how the interactive whiteboard supported learning

Informative
It gave me a picture to imagine everything that was going on, which made it easier to learn (Jack, RE)
Showed examples and images of what (guerilla) war would have been like (Vietnam) (Joseph, Hi)
Putting things in order and suggesting a good way of presenting (instructions for preparing a meal) (Cheryl, Food Technology)
Illustrating in an understandable way; I could see video that I wouldn't be able to see for real (Ellie, Science: reactivity of alkaline metals, cesium)
Showed examples of the work and it moved (dynamic representations of moving averages) (Justin, Maths)

Instructional
Even though the teacher was telling me the tasks I was able to read the tasks so I could understand it more (Jack, Applied Sc)
Told us the aims of the lesson and how to set up and complete an experiment (Cheryl, Sc)

Procedural
It quickened the speed (of my learning). (Jack, Ma)
It helped me to write my notes down and with my ideas (Jane, En Lit)
Improved my listening skills and showed phrases in French. It made it easy to copy down the phrases (Heather, French)

Explanatory
The diagrams explained easier. (Jack, Ma)
Explained ideas (how brightness helps us to find out how far away a star is) (Joseph, Physics)

Reflective/evaluative
No examples given

Secondary sector Technology: Computer

Student perceptions: how the technology supported learning

Informative
(Finding) personal opinions and evidence to support my work (Cheryl, Sociology)
Collected information using macromedia Fireworks and the school server, and excel to produce graphs (about the effects of tourism on a locality) (Heather, Geography)
Used collection of digital photos to find examples of how tourism is managed and sustained (Jonathan, Geography)

Instructional
No examples given

Procedural
To create accurate measurements for (decorative) wings and how to do extra things (Katie, Graphics)
To complete a media English assignment using Microsoft word; this helped with my spelling, correct use of technical accuracy and paragraph structure (Cheryl, En)
Editing and making the course work look neater (Ellie, Sociology)
Showed me how to do different textures on an image (Jane, DIDA)
To learn other (key) skills (Jane, DIDA)

Explanatory
Cleared any misunderstandings I had (about past and future tenses) (Katie, French)

Reflective/evaluative
I was able to go back to the video and look at things over and over again before answering the questions (Jack, Sports analysis)

FE Sector Technology: IWB

Student perceptions: how the computer supported learning

Informative
Seeing the (orchestral) performance (on YouTube) helped to give a better understanding of the piece (Justin, Music)
Showed me lots of things about what it is like to live with autism (Megan, Psychology)
To watch EYFS DVD (Jenny, Child Care and Education)

Instructional
No examples given

Procedural

No examples given

Explanatory
No examples given

Reflective/evaluative
No examples given

FE Sector Technology: Computer

Student perceptions: how the technology supported learning

Informative
Quick access to a number of documents, clearly set out (Justin, History)
Provided information from the internet; provided software to write-up my work (Jenny, Child Care and Education)
To finish a systems requirements poster using Microsoft Word and Photoshop, and to check some old work for definition of RAM (Kerry, IT Btech)
To research a website (Kerry, IT Btech)

Instructional
No examples given

Procedural
To complete the work set (If I wasn't on the computer I would have been unable to complete the work I completed) (James, Computer studies)
To transfer printed data to the computer so I could edit it (UK confectionary Value 2002-2007) (James, Business Studies)
To create an evaluation of my presentation, to organise and develop my thoughts and organise the sections (of my assignment) correctly (Megan, Health and Social Care)
To write a report on IT troubleshooting, helped me with spellings (Imran, Btech IT)
Quick way of getting work typed in, and also a better way of presenting it with colour, bullet points etc (Candy, Leisure and Tourism)
Photoshop allows me to crate the perfect and aimed effect of the images in a quick interesting way (Candy, Photography)

Explanatory
To develop what we have learned in class through using the internet to extend my knowledge (of titration) (Megan, Applied Science)

Reflective/evaluative
No examples given

HE Sector Technology: IWB

Student perceptions: how the interactive whiteboard supported learning

Informative
As well as my tutor talking, I could see it in black and white and was given a copy (Sadie, Youth and Community)
It lead the lesson and showed what we were doing (ratio analyses in accounting) (Holly, International Business Studies)
Easy to refer to, not too much note taking (because the presentation was downloaded from Blackboard prior to the lecture), supplement learning (Jasmine, Law)
I could write down the notes that I needed (Avril, Law)
To look at information on black minority ethnic (BME) communities (Kerry, Youth and Community Work)
It enabled each slide to be viewed and discussed individually (Tariq)

Instructional
To find out how my assignment needs to be set out (Sadie, Youth and Community Work)
Developed my understanding of the assignment brief (Kerry, Youth and Community Work)

Procedural
No examples given

Explanatory
It explained and clarified new information and helped me to develop my understanding (Kerry, Youth and Community)

Reflective/evaluative
No examples given

Other
It enables the teacher to interact with the students (Tariq, Pharmacuetical Science)

HE Sector Technology: Computer

Student perceptions: how the computer supported learning

Informative

No examples given

Instructional
I was able to download work (Statistics handout with tasks) (Holly, International Business Studies)

Procedural
No examples given

Explanatory
No examples given

Reflective/evaluative
No examples given

Table 4.6 shows that students in all three educational sectors perceive the use of the interactive whiteboard to be mainly informative. Few explanatory or reflective/evaluative uses are identified in reference to taught sessions. Students in all three educational sectors identify the computer's main focus of support as developing procedural knowledge. As with findings for the interactive whiteboard, few explanatory or reflective/evaluative uses of the computer are identified with taught curriculum time.

4.2.2 Findings for cognitive learning strategies (CLS), active learning strategies (ALS) and learning outcomes

Cognitive learning strategies (CLS) were identified as describing, explaining, explicating (clarifying), evaluating, arguing (challenging or defending information or ideas), predicting, and defining evidenced in students' talk and writing/word processing. The findings are presented below for the different educational sectors (Secondary school, FE and HE), course type and technology used in taught sessions. Active learning strategies (ALS) were identified as observed behaviours that support the learner in structuring, elaborating and restructuring their knowledge and understanding. *Structuring* is organising information or ideas into a coherent meaning. *Elaborating* is introducing additional information from other sources (through questioning/searching) to support and develop knowledge or understanding. *Restructuring* is adapting or changing understanding or an artefact of learning in response to new information or ideas.

The analysis of active learning strategies (ALS) was informed by the descriptors of learner engagement identified by Pianta et al (2007). Tables 4.7 to 4.14 show participants' cognitive learning strategies (CLS), active learning strategies (ALS) and learning outcomes observed in the various taught sessions during the observation periods.

Findings are presented separately for the different learning technologies, lesson/course types and educational sectors. The focus of each taught session, the cognitive learning strategies and the active learning strategies are listed beneath each table.

Table 4.7: Cognitive learning strategies (CLS), active learning strategies (ALS) and learning outcomes using the computer in computer-related courses: Secondary School sector

Participant	Subject	Cognitive Learning Strategy (CLS)	Active Learning Strategy (ALS)	Learning outcome
Jane	Key Skills	Describe	Structures through manipulating ideas using Microsoft Word	How to use landscape for a grid (P)
Jane	DIDA	Describe & evaluate	Structures through manipulating ideas using Adobe Photoshop	Learned different skills (creating different textures on an image) for creating a PowerPoint (P)
Jon	DIDA	Describe & evaluate	Structures through; grouping information into categories Elaborates through , reading previous notes on evaluation of planning section for portfolio, reflecting on peer evaluation, discusses with teacher the requirement to clarity and signpost and link to other sites Restructures through re-presenting /transforming the text by changing the Word document to HTML through Flashpaper and converting to PDF	How to change a word document into a web page (P) Identified areas of weakness in the project (detail, signposting, clarity of purpose for each section) (Ref/Eval)

Focus of the taught sessions:
Jane, Key Skills: To create a grid for competition fixtures
Jane, DIDA: Creating a PowerPoint page for the artefact component of her assignment
Jon, DIDA: Creating an e-portfolio

CLS: describing, evaluating
ALS: manipulating ideas, grouping information into categories, reflecting on peer evaluation, discussing with teacher, re-presenting and transforming ideas and text, composing and editing

Table 4.8: Cognitive learning strategies (CLS), active learning strategies (ALS) and learning outcomes using the computer across the curriculum: Secondary School sector

Participant	Subject	Cognitive Learning Strategy (CLS)	Active Learning Strategy (ALS)	Learning outcome
Jack	PE	Describe, explain & evaluate	Structures through manipulating and deconstructing learning materials (video) Elaborates through reflecting on personal skill level and technical ability Restructures through applying analysis to another sport video	How to deconstruct a sports video for performance analysis (P) How to solve a graphics design problem (P)
Katie	Graphics	Describe, evaluate,	Structures through manipulating software, consulting the teacher and consulting /sharing ideas with peers	A better use of vocabulary and use of punctuation within my English media assignment; a better way of presenting (P)
Cheryl	English	Evaluate	Structures through manipulating text using Microsoft word	

			Elaborates through referring to mark scheme Restructures through applying test criteria information to her document	
Cheryl	Sociology	Describe & evaluate	Structures through evaluating and editing existing information she has collated in a document from previous internet searches Elaborates through sharing information with a peer and exploring and evaluating additional internet sites Restructures by extending the focus of the assignment in response to new information obtained through searches and seeking to re-present information	Types of influence of celebrities on young teenagers (Inf) How to present information, re-arranging and putting in order (P)
Ellie	Sociology	Describe, explain, explicate & evaluate	Structures through exploring ways of supporting her research hypothesis by referring to e- documents citing the work of Naomi Wolf Elaborates through asking a peer for feedback on the rationale for her hypothesis Restructures by word processing an additional paragraph to explain and justify how she operationalised the concepts she has introduced in her questionnaire (acting on advice given by her teacher)	How to evaluate secondary evidence properly (P) How to operationalise key concepts in the literature in a research study (P)
Heather	Geography	Describe & explain	Structures through composing and editing text to support her hypothesis; manipulates learning materials by representing supporting evidence from traffic survey in graphical form	Developed ideas about the good and bad effects of Tourism in Castleton (Exp)
Jon	Geography	Describe, Evaluate	Structures through using photographic evidence of management Elaborates through adding text boxes to explore ideas of management and sustainability (acting on advice given by his teacher) Restructures through editing text to focus on sustainability	Examples of management and sustainability in a tourist place (Inf);

Focus of the taught sessions:
Jack, Science: How catalysts work, the effect of metal salts on the rate of reaction; how biological washing powders work at low temperatures
Jack, PE: Sports performance analysis

Joseph, Physics: Photoenergy, and how brightness allows us to calculate the distance of a star
Joseph, Mathematics: Equivalent and negative vectors
Joseph, History: Views on guerrilla warfare, Platoon video clip and other sources
Katie, French: Past, present and future tenses
Cheryl, Applied Science: Photosynthesis
Cheryl, Sociology: The influence of celebrities on teenage behAviour
Cheryl, Food Technology: Planning food preparation
Cheryl, English: Completing an English media assignment using Microsoft Word
Ellie, Sociology: Using secondary evidence in a research 'What do teenage girls want to look like and why?'
Ellie, Science: Reactivity
Jane, English: How Shakespeare uses text to effect
Heather, Geography: How tourism in and around Castleton is making the area unsustainable
Heather, French: French conversation; future tenses
Justin, Mathematics: Moving averages
Jon, Geography: Management and sustainability issues related to tourism

CLS: Describe, explain, evaluate, explicate
ALS: Manipulating and deconstructing learning materials, referring to guides/prompts, reflecting, applying analysis, evaluating and editing text, sharing information, exploring and evaluating additional internet sites, seeking to re-present information, justifying how concepts are operationalised, representing in graphical form

Table 4.9: Cognitive learning strategies (CLS), active learning strategies (ALS) and learning outcomes using the interactive whiteboard across the curriculum: Secondary School sector

Participant	Subject	Cognitive Learning Strategy (CLS)	Active Learning Strategy (ALS)	Learning outcome
Joseph	Physics	Describe, Explain	Structures through drawing diagrams and plotting points	How brightness helps us to find out how far away a star (Ex)
Joseph	Mathematics	Describe	Structures through asking the teacher if it is better to put the vectors in alphabetical order; working through diagrammatic examples	I learned about vectors (Inf) How to represent equivalent and negative vectors (P)
Joseph	History	Describe, Explain, Evaluate	Structures through answering questions; making bullet point notes; writing bullet point answers to related exam questions; critically evaluating the source	About American feelings through the Vietnam war (Inf) The use of language and rhetoric in historical sources (Ref/Eval) The advantages and disadvantages of of film as an historical source (Ref/Eval)
Katie	French	Describe, Explicate	Structures through giving and receiving exemplification; applying information to real world situations	Understood past and future tenses and learned how to construct more complex sentences in French (P) Use of 'sortir'; translation acuity and speed (P)
Cheryl	Applied Science	Describe, Predict	Structures through diagrammatically representing experimental data	That the brighter the light the more photosynthesis occurs (Inf) A better way of presenting data (P)
Cheryl	Food Technology	Describe	Structures through annotating copy	How to answer the question about planning (Preparation for GCSE exam) (P)

Ellie	Science	Describe, Explain, Predict	Structures through copying representation of different reactivities as shown on video clip Elaborates through questioning about the difference in the reaction of neutrons to nuclei Restructures through explaining and recording the reason for the different reactions of the metals	The differences in reactivity down group 1 in the periodic table (Inf) That different reactivity is determined by the difference in the attraction of neutrons to the nucleus (Ex)
Jane	English	Describe	Structures through annotating copy	How Shakespeare uses text to effect eg ambiguity, extended simile and rhetorical questions (Inf) How to understand Shakespeare (P)
Heather	French	Describe	Structures through identifying missing words in text; makes notes; consults vocabulary lists; applies information on tenses to real worlds situations	Use of future tenses (P)
Justin	Mathematics	Describe, Evaluate, Predict	Structures through consulting teacher on appropriate scale; represents information graphically and works examples	How to do moving averages for long strings of data (P)
Jack	Applied Science	Describe, Explain, Evaluate	Structures through asking and answering questions; Elaborates through practical test; Restructures through asking questions about the application to real world situations (How catalysts work in biological washing powders)	I am now prepared for the lesson ahead (Inf) How catalysts work (Ex) How biological washing powders work at low temperatures (Ex)

Focus of the taught sessions:
Jack, Science: How catalysts work, the effect of metal salts on the rate of reaction;
Joseph, Physics: Photoenergy, and how brightness allows us to calculate the distance of a star
Joseph, Mathematics: Equivalent and negative vectors
Joseph, History: Views on guerrilla warfare, Platoon video clip and other sources
Katie, French: Past, present and future tenses
Cheryl, Applied Science: Photosynthesis
Ellie, Science: Reactivity
Jane, English: How Shakespeare uses text to effect
Heather, French: French conversation; future tenses
Justin, Mathematics: Moving averages.

CLS: Describe, explain, evaluate, explicate, predict,
ALS: drawing diagrams, asking the teacher, answering questions; giving and receiving Exemplification, making bullet point notes; writing bullet point answers, critically evaluating the source, annotating copy.

Table 4.10: Cognitive learning strategies (CLS), active learning strategies (ALS) and learning outcomes using the computer in computer-related courses: FE sector

Participant	Subject	Cognitive Learning Strategy (CLS)	Active Learning Strategy (ALS)	Learning outcome
James	Computer Studies	Describe, explain	Structures through manipulating learning materials and functions using EXCEL; re-presenting information; Consulting with peers and teacher on appropriate strategies and functions	Learned a new function on Excel (P) Function for average (P) That charts need to be the same scale for comparisons (Inf) To consider (unequal) length of texts for fair test (P) How to manage graphical representation of very small values (P)
Imran,	BTec Computer Studies1	Describe, explain	Structures through composing and editing; refers and re-refers to task sheet; refers to home page; asks others for feedback	Know how to layout a questionnaire (P) How to formulate open and closed questions to effectively evaluate a website (P)
Imran BTec Computer Studies2		Describe, explain	Structures through problem solving; uses productive searches on Google; Elaborates through using forums to discuss troubleshooting problems	Found out things about CDROM Slave and Master (Inf) Reasons why CDRom drive is not listed among the drives on a computer (Ex)
Kerry	Btech Intermediate 1	Describe, explain	Structures through manipulating databases and following and repeating query procedures; Elaborates through explaining to another student how to perform the task	Learnt how to do more queries (working with data bases) (P) Validation rule as a set of parameter for an acceptable range of data (Inf) How to change field types (P) How to create a query in design view (P) How to create a query report (P)
Kerry	Btech Intermediate 2	Describe, explain, defines	Restructures through defining and clarifying key terms; editing text	I reminded myself what RAM was (Ex) Definitions of key computing terms (Ex)
Kerry	Btech Intermediate 3	Describe, explain, evaluate	Structures through evaluating techniques to aid user interaction in reference to given criteria; Elaborates by evaluating in reference to specific terminology; restructures through completing a usability questionnaire	Features of user interaction (on a website) (Inf)

Focus of the taught sessions:
James, Computer Studies: Project on word length in a range of different text genres
Imran, Computer Studies : Creating a usability test for a website
Imran, Computer Studies : Troubleshooting hardware and software repairs
Kerry, Btech Intermediate Computer Studies I: Using a data base to set up a query report

Kerry, Btech Intermediate Computer Studies a: Creating a poster on what is needed to make software work
Kerry, Btech Intermediate Computer Studies: Evaluating techniques to aid user interaction with a website.

CLS: Describe, explain, define, evaluate
ALS: Manipulating learning materials, re-presenting information, consulting with peers and teacher, composing and editing, asks for feedback, problem solving, searches on Google, using forums, explaining to another student.

Table 4.11: Cognitive learning strategies (CLS), active learning strategies (ALS) and learning outcomes using the computer across the curriculum: FE sector

Participant	Subject	Cognitive Learning Strategy (CLS)	Active Learning Strategy (ALS)	Learning move
James	Business Studies	Describe, define, explain	Structures through manipulating learning materials (Snapshots report) Elaborates through asking the teacher about CMG (Compound Market Growth) Restructures through problem solving, transforming information in a graphical representation	Compound Market Growth (CMG) (Inf) How to graphically represent actuals and trends in a superimposed form (P)
Justin	History	Describe, explain, evaluate	Structures through manipulating learning materials; introducing sub-headings; Elaborates through sharing ideas with peer and consulting with teacher; referring to a key text Restructures through transforming text by editing sub-headings and paragraphs; identifying key points and editing text into summary points; challenging information; Understanding different perspectives and justifying the position taken	Clearer understanding of nAvigation on the intranet and Moodle to aid revision (P) How to use a key text (article) to present an interpretative and analytical analysis (P) How to use appropriate subheadings to effectively structure an evaluative written answer (P)
Megan	Health and Social Care	Describe, evaluate	Structures ideas for an evaluation report by using an evaluation prompt and exemplar report	Organise sources into a bibliography (P) How to structure an evaluation report (P)
Megan	Applied Science	Describe, explain	Structures through referring to previous experimental work; refers to guidance notes; working through Elaborates through referring to guidance notes and Wikipedia; defines titration in reference to internet search; Consults peer;	Learned about titration through using the internet (Inf)

			Restructures through composing detailed deconstruction of the process elements and how they interrelate	
Jenny	Child Care	Describe, explain	Structures through using internet searches in reference to notes from previous searches	Effects of child poverty (Inf)
Candy	Travel and Tourism	Describe	Structures through manipulating learning materials, sharing ideas with peer; Elaborates through questioning teacher; Restructures through editing and supplementing information	How to compose a complaints report (P)
Candy	Photography	Describe, explain, evaluate	Structures through manipulating learning materials Elaborate through Restructures through transforming ideas/information	How to use a dodge tool (P) By playing around with the text used I in my images, I learnt which had the best effect by being critical of my own work (Ref/Eval)

Focus of the taught sessions:
James, Business Studies: Secondary market research into the UK confectionary market
Muslim disunity
Megan, Health and Social Care: Evaluating a presentation on effective communication skills with nursery children
Megan, Applied Science: Report writing of titration experiment
Candy, Travel and Tourism: Composing a complaint report
Candy, Photography: Creating a portfolio of photographs for a magazine
Justin, History: Key reasons for the success of the First Crusade; assess the significance of Muslim disunity
Jenny, Child Care: Child poverty and education

CLS: Describe, define, explain, evaluate
ALS: Manipulating learning materials, asking the teacher, problem solving, transforming information in a graphical representation, sharing ideas with peer, editing text into summary points; challenging information; considering different perspectives, justifying the position taken, using prompt and exemplar material, uses internet searches.

Table 4.12: Cognitive learning strategies (CLS), active learning strategies (ALS) and learning outcomes using the interactive whiteboard across the curriculum: FE sector

Participant	Subject	Cognitive Learning Strategy (CLS)	Active Learning Strategy (ALS)	Learning move
Justin	Music	Describe, evaluate	Structures through analysing and evaluating the information; Elaborates through Question and answer session; Restructures by annotating musical score and finding material questions from the musical score	Greater understanding of the piece (Ref/Eval) The importance of two horns in the harmonic series (Eval/Refl) The developmental stages of a musical piece : introduction, exposition, recapitulation, coda (Ref/Eval)

Megan	Psychology	Describe	Structures through note-making	Learned many new things about autism (features)(Inf)
Jenny	Child Care	Describe	Structures through analysing and reflecting on information	Understand different activities used to promote mathematical development in the Foundation stage, mainly measuring (P)
Jenny	Child Care	Describe	Structures through exploring and evaluating sources; sharing information in PowerPoint presentation	Features of the High Scope Project for pre-school education (Inf)

Focus of the taught sessions:
Justin, Music: Revision work on Stravinsky; introduction to Weber Freischutz
Megan, Psychology: Autism
Jenny, Child Care and Education: Presentation on the High Scope Project for pre-school education
Jenny, Child Care and Education: How to promote mathematical development in the Foundation Stage

CLS: Describe, evaluate
ALS: Analysing and evaluating information, asking and answering questions, annotating, note making, evaluating source, sharing information

Table 4.13: Cognitive learning strategies (CLS), active learning strategies (ALS) and learning outcomes using the computer: HE sector

Participant	Subject	Cognitive Learning Strategy (CLS)	Active Learning Strategy (ALS)	Learning outcome
Holly	International Business Studies	Describe, explain	Elaborated through printing off and following worked examples to undertake statistical procedures	How to conduct statistical significance tests (P)

Focus of the taught sessions:
Holly, International Business Studies: Statistical significance testing

CLS: Describe, explain
ALS: Printing copy, following worked examples

Table 4.14: Cognitive learning strategies (CLS), active learning strategies (ALS) and learning outcomes using the interactive whiteboard: HE sector

Participant	Subject	Cognitive Learning Strategy (CLS)	Active Learning Strategy (ALS)	Learning outcome
Kerry	Youth and Community	Describe, evaluate	Structured by making notes on information presented, annotating related handout, discussing in groups, pictorially representing an organisational culture, writing a question	The difference between profiles and case studies (Inf); external and internal features of organisational culture and values (Inf)
Kerry	Youth and	Describe	Annotates handout	Understanding of

	Community Work			assignment brief (Instr)
Kerry	Youth and Community Work	Describe, define, explicate	Makes notes; discusses in a group; pictorial representation of an organisation; labels pictorial representation; makes notes of peers' views	The difference between profiles and case studies (Inf); organisational culture and values
Jasmine	Law	Describe	Structured by making notes on information presented, annotating and highlighting on related handout	Aspects of TORT law on ownership, occupancy and visitors (Inf)
Sadie	Youth and Community Work	Describe	Structured by annotating copy	How to conduct anti-oppressive practice-how to challenge assumptions (P)
Sadie	Youth and Community Work	Describe, explain, explicate	Structured by annotating copy; identifies hot tips	How to deal with challenging behaviour (P)
Sadie	Youth and Community Work	Describe, explicate, evaluate	Structured by annotating copy Elaborated by identifying examples of theories in work experience Re-structured by evaluating theories in group discussion	Theories of child development (Piaget, Vygotsky, Bruner); How theories of child development inform perspectives on young people (Ex)
Tariq	Pharmaceutical Science	Describe, explain	Annotates copy; offers explanations	Increased knowledge of arsenic in poisons and toxins (Ex)

Focus of the taught sessions:
Kerry, Youth and Community Work: Organisational Culture and Values
Jasmine, Law: Occupier liability
Sadie: Youth and Community Work: Working with young people with challenging behaviour
Tariq, Pharmaceutical Science: Criminal Poisoning

CLS: Describe, evaluate
ALS: making notes, annotating, highlighting, discussing in groups, pictorial representation, labelling, identifying examples; evaluating theories, offering explanations

5. Conclusions and recommendations

The research project's findings represent a partial snap-shot of the learning strategies of students in the Secondary school, FE and HE educational sectors. Although small-scale, the project produced a rich data set and findings that appear to have important implications for teaching and learning in taught curriculum time. In particular, the project highlights areas for development in the use and usefulness of learning technologies in supporting learners' strategies, cognitive learning strategies (CLS), active learning strategies (ALS), and the type of learning outcomes resulting from the use of learning technologies in taught sessions. The main findings and recommendations for each area for development are identified below.

5.1 The use and usefulness of learning technologies in supporting learners' strategies in taught sessions

Continuities and discontinuities in the use of learning technologies between educational sectors may determine how students engage with technology for learning and the strategies they employ. Similarities between Year 11 in the Secondary school and the FE sector in quantitative engagement with computers for learning in taught sessions suggests a continuity in provision that should empower students to develop learning strategies across the two educational sectors. However, computers as learning tools were used in 29% of the lessons observed in the Secondary schools that were not computer courses, 42% of the lessons observed in the FE sector that were not computer courses, and 10% in the HE setting. It is recommended that opportunities for students to use computers in taught sessions are increased in all three sectors to maximise learner engagement and personalised learning across the sectors and to provide a secure platform for learning strategies to develop and become embedded.

Students' perceptions of the use and usefulness of learning technologies in supporting learning may affect their motivation to develop and use effective learning strategies. For this reason it is important to understand students' perspectives. The majority of participating Secondary school students (56%) and FE students (56%) identified the use of technology in lessons to get the work done, placing the emphasis on learning technology as an aid to task completion rather than a cognitive tool for knowledge construction. It is recommended that the role of technology in personal knowledge construction is modelled by teachers and opportunities are provided for students to develop their identity as constructive learners in this way through taught sessions.

Being critical about information, sorting out ideas and problem solving are identified as underdeveloped uses of technology for learning in the Secondary school, FE and HE sectors. It is recommended that increased support is directed to developing the use of learning technology in taught sessions for each of these learning strategies by teachers modelling the

strategies and offering strategic scaffolds for students across the curriculum and in their chosen subjects in Key Stage 4 and beyond.

Low levels of motivation to use a variety of learning strategies may be associated with the lack of enthusiasm for learning with technology reported by some Year 11 students (29%), Year 10 students (29%) and FE students (36%) surveyed. The lack of enthusiasm for learning with technology expressed by these small but significant minorities of students suggests that an urgent review is required of the technologies available to students, the nature of the learning tasks, and the strategies students employ. To inform this review and related policy interventions, it is recommended that student views be obtained on how they may be re-enthused as learners using technology, what pedagogic changes are required, what learning strategies they prefer and what learning outcomes would be expected.

Learning technology was not used to support learning in taught sessions for a small number of subjects during the observation periods in each educational sector. While it is possible that this was unusual for some of the subjects, in the majority of cases the students reported that it reflected their usual experience. It is recommended that, while observing the principle of fitness for purpose, the possibility of engaging students' learning with technology is addressed in all curriculum areas.

Secondary school students' reports of not using the interactive whiteboard at all for learning (between 19% and 27% of all students surveyed) suggests that this small but significant group of students does not have the opportunity and/or the strategies to support their learning with this technology. It is recommended that a range of strategies for learning with interactive whiteboards, including annotating, questioning, critiquing, collaborating and discussing, are regularly introduced and developed alongside other learning experiences in taught sessions to engage and empower all learners.

The findings suggest a negative trend in students' perceptions of the use and usefulness of interactive whiteboards as a learning tool across the educational sectors from Secondary school to FE to HE. Compared with none of the Secondary school participant group and 19% of the Year 11 students surveyed, 33%of the FE participant group and 32% of the wider FE population surveyed report that they do not use the interactive whiteboard at all to learn in college. The importance university students place on the use of interactive whiteboards is in the perceived usefulness of the related handouts, the Virtual Learning Environment (VLE) links and the variety of learning strategies that may be used. However, there is also a perception of an over-dependence on PowerPoint and insufficient variety in teaching styles in some cases. To increase the effective use of the interactive whiteboard to support learning more widely in FE and to build on learning strategies observed in HE, it is recommended that the developmental potential of interactive whiteboards as cognitive tools for learning be given further consideration to meet the learning needs of students across the educational sectors.

This could usefully include conceptual mapping strategies and other dynamic, interactive representations of concept development and knowledge building processes and collaborative tasks.

The perceptions of Secondary school students, FE students and HE students indicate that the use of the computer is under-developed as a tool for explanation, reflection and evaluation in all three sectors. It is recommended that more opportunities are provided in taught sessions in each sector for students to engage in these higher-order cognitive processes using computer technology.

Students' perceptions of the interactive whiteboard as mainly an informative support for learning suggest that the use of interactive whiteboards should provide more opportunities for procedural, explanatory and reflective/evaluative learning strategies. It is recommended that interactive whiteboard use should focus more on encouraging and developing a wider range of learner strategies to lead to higher-order learning outcomes.

5.2 Cognitive learning strategies (CLS)

Multiple cognitive learning strategies (CLS) are usually associated with learning outcomes resulting from using the computer in courses across the curriculum and in computer-related courses in Year 11 in the Secondary school sector and in the FE sector. Multiple cognitive learning strategies (CLS) are often associated with structuring, elaborating and restructuring knowledge or ideas and with multiple learning outcomes. Higher-order learning outcomes (explanatory, reflective and evaluative) are often associated with the related cognitive learning strategies of explaining and evaluating, and are often combined with describing. It is recommended that students be supported in developing and using the range of cognitive learning strategies with computers to maximise the opportunity for higher-order learning outcomes. In order to build on the learning strategies that students are developing using the computer as a cognitive tool in taught sessions across the curriculum in the Secondary school and FE sectors, it is recommended that computers be introduced more widely in taught curriculum sessions in HE.

Multiple cognitive learning strategies (CLS) were applied in 72% cases where learning was identified using the interactive whiteboard in non-computer-related courses in Year 11 in the Secondary school sector. Structuring, elaborating and restructuring knowledge or ideas occurred in 72% cases where learning was identified, and in 36% of cases higher-order learning outcomes were identified. Where single cognitive learning strategies were applied in the majority of cases where the interactive whiteboard was used in the FE sector, higher-order learning was not identified.

It is recommended that opportunities and support for multiple cognitive learning strategies leading to higher-order learning are sustained and embedded in Year 11 and are introduced and developed in earlier years in Secondary schools. Alongside the recommended increased use of interactive whiteboards in the FE sector, more opportunity and support needs to be given in the FE sector for students to develop, use and evidence a range of cognitive learning strategies in addition to describing. This is supported by the example of learning with the interactive whiteboard in an A level music lesson, in which multiple cognitive learning strategies (CLS) were associated with higher-order learning outcomes. Multiple cognitive learning strategies (CLS) were applied in 5 out of 8 (63%) cases where learning was identified using the interactive whiteboard in non-computer-related courses in the university setting. It is recommended that opportunities for university students to develop the observed strategies of explication and explanation are developed more widely.

5.3 Active learning strategies (ALS)

Observed active learning strategies (ALS) associated with learning outcomes using computers in computer-related courses in Year 11 and in FE were composing, editing and manipulating ideas using various software (Microsoft Word, Adobe Photoshop); grouping information into categories; re-presenting and transforming ideas and text; reflecting on peer evaluation, and discussing with the teacher. Additional learning strategies observed in FE were problem solving; searching on Google; using a forum, and explaining to another student. In both sectors interactive strategies with teachers and peers were important for learning. It is recommended that opportunities for supported and shared learning with computers through discussion, reporting, evaluation and feedback are built into taught curriculum time.

The wider range and level of sophistication observed in active learning strategies (ALS) using the computer across the curriculum and in non-computer-related courses in Year 11 in the Secondary school sector suggest that the students are using the technology as cognitive tools to support their constructive learning and personal learning agendas. The strategies include manipulating and deconstructing learning materials, reflecting, applying analysis, evaluating and editing text, sharing information with teacher and peers, exploring and evaluating additional internet sites, seeking to re-present information, justifying how concepts are operationalised, and representing in graphical forms. The range and level of sophistication of learning strategies observed in Year 11 is extended by those used by FE students. Additional strategies include problem solving; transforming information in a graphical representation; editing text into summary points; transforming and re-presenting text, for example by using new sub-headings; challenging information; considering different perspectives, and justifying the position taken. To ensure that students continue to be engaged in learning in transition to, and through higher education, it is further recommended that the active learning strategies students are using and may develop in the Secondary school and FE sectors continue to be used and extended in taught sessions in university courses.

It is recommended that close attention is given to the active learning strategies (ALS) students use with the computer in non-computer-related courses in order that students' preferred learning strategies and styles may be understood and supported, and that a range of increasingly sophisticated strategies might be encouraged as students become more skilful learners. Close attention to active learning strategies also indicates areas of difficulty where students may require additional support. In the Year 11 observations, for example, Cheryl, Ellie, Heather, and Jon experienced difficulties structuring and restructuring information using the computer. In contrast, Justin, an FE student, used sub-headings effectively to structure and re-structure his work.

As well as the traditional active learning strategies (ALS) of annotating handouts, making bullet point notes, writing bullet point answers, asking the teacher and verbally answering questions, Year 11 students were observed using the interactive whiteboard in non-computer-related courses by drawing diagrams, giving and receiving exemplification, and critically evaluating source material. Students in the FE sector used similar strategies when the opportunities arose. Extended active learning strategies used by university students, including representing pictorially, conceptual labelling, evaluating theories and offering explanations, could be usefully introduced in Year 11 and in the FE sector.

It is recommended that, to build on the more interpretative and critical learning strategies that some students demonstrated, and to extend and empower learning (Becta, 2007), the following and similar strategies for learning with computers and interactive whiteboards should be developed: -

1. Pictorial representation

Drawing graphs, diagrams, concept maps, and representing information and ideas in idiosyncratic and personal ways.

2. Note taking/annotation strategies to support higher-order cognitive activity

Noting questions, evaluations, and critical analytical comments rather than retelling or repeating information or ideas.

3. Transforming or re-representing information

Personalising ideas and information by explication or elaboration, re-presenting information and ideas in different forms and/or genres.

4. Collaborative and supported learning

Using learning technologies as a medium for social learning, both in pursuing the same learning goal (collaborative learning) and in supporting personalised learning (supported learning).

5. Probing expertise

Using learning technology as a vehicle for probing the subject expertise of the teacher and peers through discussion focussed on the development of subject-specific concepts and knowledge building.

6. Self and peer assessment focus

Adopting an open system of self-review and peer evaluation and assessment of learning that included the learner's use of learning technology as a cognitive tool. This would support thinking and talking about the processes and strategies for learning, placing the emphasis on engaging and empowering learners.

5.4 Learning outcomes

Learning outcomes in computer-related courses in the Secondary school sector were mainly procedural (N=3). One example of reflective/evaluative learning was noted. It is recommended that strategies for explanatory learning also be promoted in computer-related courses.

Learning outcomes in computer-related courses in the FE sector, while mainly procedural (N=9), were also informative (N=2) and explanatory (N=3). It is recommended that this range of learning outcomes is supported by the tasks and learning objectives set, and that reflective/evaluative learning outcomes are also expected.

The learning outcomes of Year 11 students in non-computer-related courses cover the full range investigated in the project. While learning outcomes using the computer were mainly procedural (6) and some informative (3), outcomes associated with the interactive whiteboard were more widely distributed across procedural (5), informative (4), explanatory (2) and reflective/evaluative (2). It is recommended that the full range of learning outcomes is supported by the tasks and learning objectives set using the computer as a learning tool in taught sessions. It is recommended that emphasis is placed in supporting explanatory and reflective/evaluative learning outcomes using the interactive whiteboard.

Learning outcomes using the computer in non-computer-related courses in the FE sector were mainly procedural (N=7) with some examples of informative learning (N=3). However, when using the interactive whiteboard, more learning outcomes were reflective/evaluative (N=3) than procedural (N=1) or informative (N=1). It is recommended that explanatory, reflective and evaluative learning outcomes are supported more by the tasks and learning objectives set using the technologies as learning tools in taught sessions in the FE sector.

Learning outcomes in learning across the curriculum and in non-computer-related courses in the HE sector using the interactive whiteboard were mainly informative. It is recommended

that consideration is given to ways in which more explanatory, reflective and evaluative learning outcomes might be supported in taught sessions on university courses.

Students' descriptions of learning outcomes become less specific across the educational sectors from Secondary to HE. Reasons for this finding may be difficulties in reflecting on multiple learning strategies and learning outcomes; complexities in learning with representations of information (Ploetzner et al, 2004); the range of different learning strategies; or the amount of information resulting in cognitive overload (Bodemer et al, 2004). It is recommended that the good practice in using a lesson plenary to identify the learning that has occurred in the session and subsequent learning objectives be introduced where learning technology is used to support learning. Reflection on learning strategies could be scaffolded.

The findings suggest important ways in which learners structure, elaborate and re-structure information and ideas when learning with technology, and indicate that these learning processes present challenges to some students who are unsure how to manage the wealth of information that technology makes available to them. It is recommended that an emphasis is placed across educational sectors on developing stylistic, interpretative and critiquing strategies for managing information meaningfully through structuring, elaborating and restructuring.

As this report recommends that instructional, informative, procedural, explanatory and reflective/evaluative learning strategies are promoted to support the different types of learning outcomes, examples of strategies are suggested below in Table 5.1.

Table 5.1: Strategies to support different learning outcomes using learning technologies

<table>
<tr><td>Informative strategies:
The elevator tale
The next question
Key words
Key points
Challenge
Question authenticity and status of source
Seek other sources
Evaluate evidence
Reference (Endnote)</td><td>Instructional strategies:
Personalise goals
Flow charts (goals and methods)
Timeline/ GANNT chart (MS Project, MS Excel)</td></tr>
<tr><td>Procedural strategies:
Chains
Decision trees/ flow charts
Repeat/rehearse</td><td>Explanatory strategies:
Questions (Question Mark)
Challenges (Learning Activity Management System LAMS)
Concept maps (Open Mind; Mind Genius))
Graphical /pictorial representations</td></tr>
<tr><td colspan="2">Reflective/evaluative strategies
Questions
Challenges
Concept maps
Critiques
Logs
Blogs</td></tr>
</table>

It is hoped that examples will be added to the categories in Table 5.1 as practitioners and future research projects identify successful learning strategies that students use in taught sessions.

5.5 In conclusion

5.5.1 How can we develop more effective learning strategies?

The research project's findings suggest that we can develop more effective learning strategies by understanding and responding to students' perceptions of the role of technology in their learning in taught sessions; by adapting provision to focus on effective cognitive and active learning strategies; using learning technology as a cognitive tool for higher-order learning and a process tool for structuring, elaborating and re-structuring information and ideas; and using learning technology as a social-constructional tool for learning with and from others. Through these approaches, learning strategies will be aligned to empowering and engaging learners and will focus on knowledge building and concept development.

It is important that the need to develop more effective learning strategies is considered as a matter of urgency. Students are reporting dwindling enthusiasm for learning with technology and a sense of lost momentum, and discontinuities between educational sectors are leading to discontinuity and lack of progression in the learning strategies students use.

To make a difference at policy level, support and guidance materials should be produced for teachers in the Secondary school, FE and HE sectors on the development of effective cognitive learning strategies and active learning strategies as identified and recommended in this report. To inform the proposed support material, further research is recommended to explore more fully the relationship between learner strategies using technology and learning outcomes that might be observed or otherwise captured.

5.5.2 A new way of thinking about e-maturity

'E-maturity', defined as the integration of technology-based applications and processes into practice, is an indicator of the extent to which learning technology is integral to teaching and provides students opportunities to engage strategically in learning with technology in taught curriculum time (Harnessing Technology Review, Becta, 2007). The findings and recommendations from the present research project suggests that a new way of defining e-maturity is the range of cognitive and active learner strategies evident in students' engagement with learning technology in taught curriculum time. This new definition might prove helpful in re-focussing on the learner and learning processes rather than on the technology.

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7. APPENDICES

Appendix 1
The focus of learning with technology: Secondary school students

Using technology to find things out
I student (11%) says that technology does not often help her to find things out
6 students (66%) say technology often helps them to find things out
2 students (22%) say technology very often helps them to find things out

Using technology to solve problems
2 students (22%) say technology does not often help them to solve problems
7 students (77%) say technology often helps them to solve problems

Using technology to sort out ideas
2 students (22%) say that technology does not often help them to sort out ideas
5 students (55%) say technology often helps them to sort out ideas
2 students (22%) say that technology very often helps them to sort out ideas

Using technology to make work better
1 student (11%) say that technology does not often help to make work better
3 students (33%) say technology often helps them to make their work better
5 students (55%) say technology very often helps them to make their work better

Using technology to be critical of information
1 student (11%) says that technology does not help her at all to be critical of information
3 students (33%) say technology does not often help them to be critical of information
4 students (44%) say technology often helps them to be critical of information
1 student (11%) says technology very often helps her to be critical of information

Using technology to revise
1 student (11%) says that technology does not help her to revise
2 students (22%) say that technology does not often help them to revise
2 students (22%) say that technology often helps them to revise
4 students (44%) say technology very often helps them to revise

The focus of learning with technology: FE students

Using technology to find things out
5 students (55%) say that technology often helps them to find things out
4 students (44%) say that technology very often helps them to find things out

Using technology to solve problems
3 students (33%) say that technology does not often help them to solve problems
4 students (44%) say that technology often helps them to solve problems
2 students (22%) say that technology very often helps them to solve problems

Using technology to sort out ideas
1 student (11%) says that technology does not often help to sort out ideas
6 students (66%) say that technology often helps them to sort out ideas
2 students say that technology often helps them to sort out ideas

Using technology to make work better
2 (22%) students say that technology often helps to make their work better
7 (77%) students say that technology very often helps to make their work better

Using technology to be critical of information

4 students (44%) say that using technology does not often help them to be critical about information
3 students (33%) say that using technology often helps them to be critical about information
2 students (22%) say that using technology very often helps them to be critical about information

Using technology to revise
I student (11%) says that technology does not help at all to revise
I student (11%) says that technology does not often help to revise
5 students (55%) say that technology often helps to revise
2 students (22%) say that technology very often helps to revise

Appendix 2
Learning outcomes associated with students' use of technology in taught curriculum time

The informative, instructional, procedural, explanatory, reflective/evaluative, and other categories used to analyse students' perceptions of technological support for learning were applied to students' learning outcomes.

1. Secondary sector
IWB related
Informative
Students' perceptions (Logs)

I learned about vectors (Joseph, Mathematics)
Frequency of star measure distance with colour (Joseph, Physics)
I am now prepared for the lesson ahead (Jack, Applied Science)
About American feelings through the war (Joseph, History)
The differences in reactivity down group 1 in the periodic table (Ellie, Science)

Observations
What vectors represent (Joseph, Mathematics)
That the brighter the light the more photosynthesis occurs (Cheryl, Science)
That different reactivity is determined by the difference in the attraction of neutrons to the nucleus (Ellie, Science)
How Shakespeare uses text to effect eg ambiguity, extended simile and rhetorical questions (Jane, English)

Instructional
No examples given

Procedural
Students' perceptions (Logs)
Understood past and future tenses and learned how to construct more complex sentences (in French) (Katie, French)
How to answer the question about planning (Preparation for GCSE exam) (Cheryl, Food Tech)
How to understand Shakespeare (Jane, English)
Improved my French (speaking) (Heather, French)
A better way of presenting data (Cheryl, Applied Science)
How to do moving averages for long strings of data (Justin, Mathematics)

Observations
How to represent equivalent and negative vectors (Joseph, Mathematics)
Use of 'sortir'; translation acuity and speed (Katie, French)
How to answer the question about planning (Preparation for GCSE exam) (Cheryl, Food Tech)
Use of future tenses (Heather, French)
How to do moving averages (Justin, Mathematics)

Explanatory
Students' perceptions (Logs)
No examples given

Observations
How catalysts work (Jack, AppliedScience)
How brightness helps us to find out how far away a star is (Joseph, Physics)

Reflective/evaluative
Students' perceptions (Logs)
No examples given

Observations
The use of language and rhetoric in historical sources (Joseph, History)

2. Secondary sector
Computer related
Informative
Students' perceptions (Logs)

Informative
Students' perceptions (Logs)

Types of influence (of celebrities on young teenagers) (Cheryl, Sociology)
Examples of management and sustainability in a tourist place (Jonathan, Geography)
Developed ideas about the good and bad effects of Tourism in Castleton (Heather, Geography)

Observations
As above

Instructional
Students' perceptions (Logs)
No examples given

Observations
None

Procedural
Students' perceptions (Logs)
How to use 2D design in detail (Katie, Graphics)
A better use of vocabulary and use of punctuation within my English media assignment; a better way of presenting (Cheryl, English)
How to present information, re-arranging and putting in order (Cheryl, Sociology)
How to evaluate secondary evidence properly (Ellie, Sociology)
Learned different skills (with creating different textures on an image) for creating a PowerPoint (Jane, DIDA)
How to use landscape for a grid (Jane, Key Skills)
How to change a word document into a web page (Jonathan, DIDA)

Observations
How to deconstruct a sports video for performance analysis (Jack, PE)
How to solve a graphics problem (Katie, Graphics)
How to operationalise key concepts in the literature in a research study (Ellie, Sociology)
How to create a landscape grid format by moving and positioning boxes appropriately (Jane, Key Skills)
How to create different textures on an image for creating a PowerPoint (Jane, DIDA)
How to change a word document into a web page (Jon, DIDA)

Explanatory
Students' perceptions (Logs)
No examples given

Observations
None

Reflective/evaluative
Students' perceptions (Logs)
No examples given

Observations
Identified areas of weakness in the project (detail, signposting, clarity of purpose for each section) Jon, DIDA

3. FE sector
IWB related
Informative

Students' perceptions (Logs)
Learned many new things about autism (Megan, Psychology)

Observations
The importance of two horns in the harmonic series (Justin, Music)
The developmental stages of a musical piece : introduction, exposition, recapitulation, coda (Justin, Music)
Features of Autism (Megan, Psychology)

Instructional
Students' perceptions (Logs)
No examples given

Observations
The need to link observations in classrooms to the theory of the High Scope approach (Jenny, Child Care)

Procedural
Students' perceptions (Logs)
Understand different activities used to promote mathematical development, mainly measuring (Jenny, Child Care and Education)

Observations
As above

Explanatory
Students' perceptions (Logs)
No examples given

Observations
None

Reflective/evaluative
Students' perceptions (Logs)
Greater understanding of the piece (Justin, Music)

Observations
As above

4. FE sector
Computer related
Informative
Students' perceptions (Logs)
Learned about titration through using the internet (Megan, Applied Sc)
Effects of child poverty (Jenny, Child Care and Education)
Found out things about CDROM Slave and Master (Imran, IT Btech)
I reminded myself what RAM was (Kerry, IT Btech Intermediate)
Features of user interaction (on a website) (Kerry, IT Btech Intermediate)

Observations
Compound Market Growth (CMG) (James, Business Studies)
A higher proportion of 4 letter words (James, Computer Studies)
That charts need to be the same scale for comparisons (James, Computer Studies)
To consider (unequal) length of texts for fair test (James,Computer Studies)
The features required of the feedback component in an evaluation report of a presentation
(Megan, Health and Social Care)
The process of titration (Megan, Applied Science)
Effects of child poverty on education (Jenny, Child Care and Education)
Different activities used to promote mathematical development
in the Foundation Stage (Jenny, Child Care and Education)
Features of user interaction (on a website) (Kerry, IT Btech Intermediate)
Definitions of key computing terms (eg RAM,requirements (Kerry, IT Btech Intermediate)
Validation rule as a set of parameter for an acceptable range of data (Kerry, IT Btech Intermediate)

Instructional
Students' perceptions (Logs)
No examples given

Observations

None

Procedural
Students' perceptions (Logs)
Understand different activities used to promote mathematical development, mainly measuring (Jenny, Child Care and Education)
Learned a new function on Excel (James, Computer Studies)
I have discovered how to create a certain graph (a superimposed graph) (James, Business Studies)
Clearer understanding of nAvigation on the intranet and Moodle to aid revision (Justin, History)
Organised sources into a bibliography (Megan, Health and Social Care)
Know how to layout a questionnaire (Imran, IT Btech)
Learnt how to do more queries (working with data bases) (Kerry, IT Btech Intermediate)

Observations
How to graphically represent actuals and trends in a superimposed form (James,Business Studies)
Function for average (James, Computer Studies)
How to manage graphical representation of very small values (James, Computer Studies)
How to use a key text (article) to present an interpretative and analytical analysis (Justin, History)
How to use appropriate subheadings to effectively structure an evaluative written answer (Justin, History)
How to structure an evaluation report (Megan, Health and Social Care)
How to formulate open and closed questions to effectively evaluate a website (Imran, Computer Studies)
How to change field types (Kerry, IT Btech Intermediate)
How to create a query in design view (Kerry, IT Btech Intermediate)
How to create a query report (Kerry, IT Btech Intermediate)
How to compose a complaints report (Candy, Travel and Tourism)
How to use a dodge tool (Candy, Photography)

Explanatory
Students' perceptions (Logs)
Reasons why CDRom drive is not listed among the drives on a computer (Imran, Computer Studies S2)

Observations
None

Reflective/evaluative
Students' perceptions (Logs)
By playing around with the text used I in my images, I learnt which had the best effect by being critical of my own work (Candy, Photography)
Observations
A critical evaluation of own work (Candy, Photography)

Other
Students' perceptions (Logs)
Nothing. I'm familiar with Microsoft word (Candy, Travel and Tourism)

Observations
None

5.HE sector
IWB related
Informative
Students' perceptions (Logs)
Knowing the structure of the court system (Avi, Law)
About Piaget's theory on personal development (Sadie, Youth and Community)
Useful, informative (Jasmine, Law)
The difference between profiles and case studies (Kerry, Youth and Community work)
Increased knowledge of arsenic in poisons and toxins (Tariq, Pharmaceutical Science)

Observations
Informational
About Piaget's theory on personal development (Sadie, Youth and Community)
External and internal features of organisational culture and values (Kerry, Youth and Community work)
Aspects of TORT law on ownership, occupancy and visitors (Jasmine, Law)

Instructional
Students' perceptions (Logs)
I've learned exactly what my tutor wants from me for my assignment (Sadie, Youth and Community)
Understanding of assignment brief (Kerry, Youth and Community work)

Observations
As above

Procedural
Students' perceptions (Logs)
Ratio analyses in accounting (Holly, International Business Studies) (OHT)
How to deal with challenging behaviour with young people (Sadie, Youth and Community)
How to conduct statistical significance tests (Holly, International Business Studies)

Observations
How to conduct anti-oppressive practice-how to challenge assumptions (Sadie, Youth and Community)

Explanatory
Students' perceptions (Logs)
None

Observations
How theories of child development inform perspectives on young people (Sadie, Youth and Community)

Reflective/evaluative
Students' perceptions
None

Observations
None

8. Contact information and acknowledgements

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