



Analysing the benefits and constraints of specific communication and information technologies for learning and teaching

C&IT as a tool

Computers provide powerful tools for modelling the real world and for analysing data (statistical or text-based). Many subjects taught at university have their own computer-based tools and techniques which students must master during their course: for example, medical digital imaging, statistical analysis for the social sciences, textual analysis for language-based subjects, graphics and publishing packages for the visual arts. Computer-based systems are also increasingly used for generic research activities. These might include web browsers, search engines, databases and other tools for managing and analyzing data resources.

C&IT as a resource

Students now have access to digital libraries, courseware, datasets, multimedia and other digital resources that provide subject-relevant content. Lecturers still need to devise meaningful activities to help students understand and use the knowledge available. As with traditional print resources, digital resources may be primary (data, graphics, original texts, historical records) or secondary (courseware, learning materials, structured reading lists). With access to the vast unstructured library of the World Wide Web, students will need considerable information-management skills to find and interpret information in a meaningful way.

C&IT as a medium of communication

CMC, discussion boards, email, IRC, audio- and video conferencing and data sharing applications all provide students with new ways of collaborating with one another. The same systems can be used to communicate with tutors and other experts, and to reach out to the wider world. Wireless and mobile technologies look set to extend these capabilities considerably in coming years. Supporting learners in these new communication environments requires a different approach to supporting learners face-to-face, in addition to the basic technical competence needed to operate the system. Students will also need time to acquire new communication skills when they are asked to operate in an unfamiliar medium. CMC systems often have the advantage that they leave a record which can be used to assess student's participation, something which may be difficult to achieve in face-to-face interactive situations.

Virtual learning environments

VLEs such as Blackboard, WebCT, or systems that have been tailor-made to meet specific institutional requirements, enable C&IT to be used for learning in all the ways suggested above. Typically a VLE will provide opportunities for students to access resources and discussion areas, find information about their current programmes of study, and practice generic or subject specific learning skills. Where VLEs are fully integrated with other student management systems (Managed Learning Environments), students may also be provided with a profile of their assessment outcomes, learning preferences, and other relevant data gathered during their studies.

Computer based tools: benefits and constraints

	Benefits	Constraints
Worldware Word processing Spreadsheets Databases Presentation software Web browser	Provide transferable skills for the world of work (C&IT, maths, information handling, writing, communication) Generally available on university networks Plenty of training materials/ courses	Students may not see these skills as relevant to their aims or to their subject area Takes time to become proficient (time lost from study of subject content)
Discipline-specific or professional tools Data analysis Textual analysis Graphic design software CAD/CAM software Computerised instrumentation	Provide professional skills for the world of work May be essential for students to become proficient in their discipline Show the course is up-to-date	Usually expensive (hardware/software) Require specialist and up-to-date expertise on part of tutor and support staff Often take a long time to master (on part of students)
Educational and authoring tools Graphics packages Web authoring packages Web editors Programming languages	Students must construct their own understanding Provide transferable skills Opportunities for research/ independent learning Opportunities for collaborative work	May take a long time to master (tutor and students) Danger of assessing skills not directly relevant to learning outcomes of course
Simulations and models Graphical representation of data (able to take variable inputs) Dynamic animations using Java or a browser helper Instrument simulation A computer-based model of a real-world system Simulation games: can include role-play, multiple players Case studies can be presented as hypertext	Allow testing of hypotheses and concept formation Allow manipulation and representation of complex data/concepts Dynamic, motivational Opportunities for collaborative work Opportunities to approach complex real-world problems Many can be downloaded from the web	Development requires programming skills May be expensive to buy, and cannot be adapted to other uses

Computer-based resources: benefits and constraints

Diagram shows resources becoming increasingly structured, increasingly rich and specific to students' learning needs, but increasingly expensive to develop or purchase, and increasingly difficult to adapt for different learning situations and contexts.

	Benefits	Constraints
Multimedia files (text, graphics, video, audio, java applets)	<p>Different media/modes to suit a range of learning styles</p> <p>Better illustration and visualisation of concepts (colour, animation, sound)</p> <p>Flexible use – incorporation into lectures and tutorials, independent access for study</p> <p>Relatively easy to source and/or digitise existing materials</p>	<p>Unstructured resource requires students to have information gathering and evaluation skills, learning skills, self-motivation.</p> <p>Time/money to produce/buy new resources to meet exact learning requirements</p> <p>Copyright</p> <p>Relatively large file sizes require high bandwidth, storage space (server/CD)</p> <p>Students need access to multimedia PC/Mac</p> <p>Lecture/seminar rooms may also need access</p>
Subject-specific gateways, indexes, resource libraries	<p>Quality controlled, usually evaluated for educational purposes</p> <p>Usually free to educational users (many JISC-funded)</p> <p>No storage/server requirements</p> <p>Large resources for independent student research</p>	<p>Same access requirements as above</p> <p>Demand information handling skills on part of students</p> <p>Not tailored to specific needs of course and students</p> <p>Not personally quality-controlled by lecturer</p>
Resource collection (lecture notes, tutorial resources)	<p>Resources highly relevant to needs of course and students</p> <p>Quality controlled by lecturer</p> <p>Index or other navigational aid to help direct learning</p>	<p>Investment of time to gather, produce and index resources</p>
Structured CAL tutorials (including interactive elements?)	<p>'All-in-one' resource for a specific tutorial topic</p> <p>Structured pathway through material, which may include interactive elements</p>	<p>Development requires educational design and hypertext skills</p> <p>May be expensive to buy, and difficult to adapt to specific learning needs</p>

Computer mediated communications: benefits and constraints

	Synchronous	Asynchronous	strengths	weaknesses
Text-based	Internet Relay Chat (IRC), MUDs, MOOs, electronic whiteboards, data conferencing	Email, bulletin boards, distribution lists, computer conferencing (e.g. FirstClass), text file sharing	Encourages clarity of expression, allows formalisation of knowledge, indexable, searchable, archivable, small data files, relatively easy to learn, robust technologies.	May be difficult to capture tacit and practical knowledge, relative poverty of learning environment, requires keyboard skills, good text-based communication skills
Multimedia	Live videoconference, audioconference, data conference, virtual reality environments	Video- and audio-on-demand, video-mail, multimedia file sharing	Vivid, rich, stimulating learning environment; allows showing as well as telling; allows concise expression of visual data; does not require text-based skills to produce and receive.	Large data files; hard to index and search; does not encourage formalisation of knowledge and argument; may require considerable technical skill, technologies often less robust.
Strengths	Interactive, timely, motivational, sense of audience and event (telepresence), allows rapid turn-taking and negotiation, allows synergy, brainstorming	Allows flexible access, gives time for reflection and reference, can enable interaction among large numbers (especially one-to-many), technologies generally more robust and less bandwidth-hungry.		
Weaknesses	Inflexible use of time, may not scale up well to large numbers, dependent on fast, robust connectivity.	Less interactive (especially many-to-many), can be slow and cumbersome, requires high motivation to participate.		

Based on Goodyear and Steeples, Creating shareable representations of practice, *ALT-J* 6 (3) (1998)

Virtual learning environments: benefits and constraints

	Benefits	Constraints
<p>Providing course information</p> <p>Course aims, objectives, learning outcomes timetable, assessment methods and criteria.</p> <p>Course philosophy, values and rationale</p> <p>Late amendments, new information</p>	<p>Easy to do for staff</p> <p>Easy to access, read and print off for students</p> <p>Readily updated</p> <p>Cuts down printing and admin costs (for staff – not always for students)</p>	<p>Students need access to a networked computer</p> <p>Students need access to and familiarity with browser software</p>
<p>Course resources online</p> <p>Downloadable course materials, lecture notes and presentations, support for lectures and tutorials, details of assignments</p> <p>Frequently asked questions</p> <p>Links to online resources (Web pages, databases and datasets, search indexes, mailbase lists)</p> <p>Can include images, simulations, online tools etc</p>	<p>Easy to publish (e.g. directly from Word or Powerpoint)</p> <p>Course materials available flexibly (time/place) for independent study</p> <p>Students can be guided to develop information skills</p> <p>Links to other sites</p> <p>Wider range of learning styles accommodated (if wider range of files types is used)</p>	<p>Students need familiarity with searching and browsing</p> <p>Students may need help with information retrieval and evaluation skills</p> <p>May need to convert course materials e.g. translate text files, scan images</p>
Discussion groups	As per previous table	
<p>Structured CAL materials</p> <p>Pages linked in branched programme through which students select path</p> <p>Can include interactive elements such as quizzes (see below)</p> <p>Usually used for self-study</p>	<p>Allows non-linear access (suits range of different learning needs; allows individual exploration)</p> <p>Information selected and structured for specific learning outcomes</p>	<p>Less easy to print off</p> <p>More work involved in translating and (especially) structuring information</p> <p>Requires awareness of instructional design</p> <p>Less flexible in use: more specifically designed</p>
<p>Multimedia files</p> <p>Images</p> <p>Audio files</p> <p>Animations</p> <p>Video clips</p> <p>3D representations</p>	<p>Different media/modes to suit a range of learning styles</p> <p>Better illustration and visualisation of concepts (colour, animation, sound)</p> <p>Captures attention, may be motivational</p> <p>Professional finish to learning materials</p>	<p>Large file sizes – greater bandwidth</p> <p>May not be compatible with all browsers/ computers</p> <p>Needs specialist equipment for video/audio editing, image processing etc</p> <p>Requires technical and educational design skills</p>
<p>Assessment and feedback</p> <p>Simple interactive simulations and models</p> <p>Online assessment tests – especially MCQ</p> <p>Diagnostic tests to assess students' existing concepts and skills</p> <p>Drill-and-practice for reinforcement of simple skills and concepts</p>	<p>Dynamic, reinforces learning</p> <p>Students can revise at their own time and pace</p> <p>Feedback can be tailored to deal with misconceptions</p> <p>Output data can be used to analyse overall performance, or build student profiles</p> <p>Formative and summative assessment options</p>	<p>Computer-based assessment should not replace personally-tailored and delivered feedback.</p> <p>New skills are required to design assessment for online learning environments.</p>

SWOT analysis

Your SWOT analysis concerns the **strengths** and **weaknesses** of one specific learning technology (e.g. QuestionMark Perception), and the **opportunities** and **threats** which might arise from using that learning technology in a specific context (i.e. the learning context of your action research project).

Technology:

Strengths:

Weaknesses:

Opportunities:

Threats: