

Integrating ICT, Literacy and Numeracy: *CyberLab*

Steve Harris reports on new research into integrating ICT with literacy and numeracy. This has been made highly topical by the designation of ICT as a Skill for Life and the desire to integrate it with the other skills.

The learners

During the academic year 2003-4 nine adult basic skills learners participated in an experimental ICT-based course, *CyberLab*, delivered over 8 months at the Coleg Morgannwg School of Basic Skills Open Learning Centre (OLC), an adult basic education (ABE) provider in the South Wales Valleys. The participants were 6 male and 3 female learners aged between 32 and 67, whose literacy skills ranged from pre-entry (1 participant) to level 2 (1 participant); numeracy from entry 2 to Level 1, with the majority around Entry 3; their technology skills were assessed (on the basis of an early draft of the Skills for Life ICT curriculum), as ranging from Entry 2 to Level 1.

The learning programme

Attending one 3-hour session per week during term time, learners worked to improve their basic skills in reading, writing, numeracy and ICT while exploring a series of topics in science, technology and mathematics. These topics were approached from a historically and culturally contextualized perspective, made relevant to learners' lives through practical, technology-mediated, engagement. The ICT activities emphasised using the modelling and simulation facilities of computers and other devices to "do science" via valid experimental investigations, providing an immediate, real-world context of shared practice and experience within which the learning activities were situated.

Each individual session was designed within a consistent framework which always included some typical elements. Sessions began with a 15 minute recapitulation of the previous week's learning, the aim being to situate current topics with regard to what had happened in previous weeks, and, through questions and answers, to identify and deal with any difficulties or special concerns of learners with regard to previous activities. The tutor then went on to present background information that placed the current topics within their broad cultural and historical context. The tutor then identified and defined some central concept or 'germ cell' to be explored during the session, usually in the form of a key word or phrase (e.g. 'algorithm' 'communication and control') which learners recorded in their portfolios. The aim was to provide an orienting basis for the various activities that followed, so that learners would always be clear as to the goal of that activity and why it was taking place.

Old and new technology in teaching and learning

The preparatory phase of the session was completed by direct instruction in skills and techniques – such as additional programming commands, how to operate a new software package, or how to devise a title for a report - appropriate to the practical activities which followed. These typically involved the planning, research, and carrying out of some experiment or simulation, where learners (in pairs or small groups) observed, recorded, and discussed results. Software tools used in activities included the Terrapin Logo and StarLogo programming environments; Microsoft Word, Excel, PowerPoint, Notepad and Internet Explorer; Fractal Explorer, a mathematical modelling package; and a variety of online interactive applications such as the "Chaos Game" at <http://www.shodor.org/interactivate/activities/chaosgame/>.

As well as digital resources learners also used pens, paper, calculators, and measuring equipment, made drawings, and produced models in paper and cardboard. The latter part of each session used these practical activities as a basis for the presentation of findings by learners, question and answer sessions, and whole-group discussions.

By mixing constructional, instructional, exploratory and problem-solving approaches to ICT-based teaching and learning in individual, small-group and whole-group settings, *CyberLab* continued a longstanding tradition of innovation in integrated ICT/ABE at the OLC (see Harris & Shelswell, in press, and 2001a, 2001b; Harris, 2002, 2003). Since 1997, OLC staff have developed an approach to integrating digital technologies into basic skills teaching and learning influenced by the work of Lave and Wenger on situated learning in communities of practice (Lave & Wenger, 1991; Wenger, 1998) and drawing on activity theory and social constructivism.

Controlled teaching interventions

During *CyberLab*, three controlled teaching interventions were carried out under the aegis of the NRDC Research Programme: ‘ICT: Effective Teaching and Learning’, directed by Harvey Mellor and Maria Kambouri of the Institute of Education. These interventions aimed at investigating ways of designing, delivering, and evaluating integrated ICT/ABE learning. The first, over 3 sessions in November 2003, investigated the notion of “cycling between the real and virtual” by linking, comparing and contrasting the uses and meanings of digital and material artifacts. For example, one activity involved first modelling a basic control problem - obstacle avoidance - using the Logo programming environment, and then observing similar behaviour being carried out by a number of physical robots, loaned to the class by the local university. In a final stage, learners returned to the computers to reconsider the models and discuss their relationship to the real world.

This and similar activities were organized in groups of varying sizes. Through their participation learners encountered a number of new words and their definitions; new programming commands and techniques; and a number of new mathematical concepts and numeracy skills. Following the sessions, observation of discussions, portfolio entries and programming activities suggested that learners had become able to use these new ideas and skills in a meaningful way, and that using digital and material artifacts together had contributed to that learning. A number of problematic issues also became evident. Although learners had engaged in large variety of literacy and numeracy activities, it was not clear precisely how these activities related to specific elements in the national curricula, nor whether sufficient allowance had been made for learners’ varying levels of ability.

Further integrating numeracy, literacy, and ICT

Issues identified in the first phase of study were specifically addressed by a second teaching intervention, which took place over 12 weeks from January to April 2004. This involved developing improved methods of planning integrated ICT/ABE lessons, delivering classes based on those methods, and evaluating the results. Following 4 preparation days, which resulted in a series of curriculum-oriented checklists for formative and summative evaluation of lesson plans, a 5-session teaching cycle was developed and delivered. This cycle focused on the theme “patterns and numbers in nature and culture”, exploring fractals, the Fibonacci number series, and the Golden

Ratio through a series of activities involving research using cameras and the internet, computer programming, numerical calculation, the use of modelling software, discussions, question-and-answer sessions, and the tabulation of data using word-processors.

Informal evaluation by tutor and NRDC observers suggested that the planning and delivery methods adopted improved the efficacy of the sessions, both in terms of the integration of content with literacy, numeracy and ICT skills, and with regard to the clear mapping of session activities to appropriate elements of the national curricula. However, one of the overarching aims - to develop a transferable methodology for the planning, execution and evaluation of topic-based integrated ABE/ICT courses – was not fully realized and will need to be addressed in future work at the centre. A more immediate concern revealed by the study data was that although reading, speaking and listening, numeracy and ICT skills learning were well integrated in these classes, writing skills were being seriously underemphasised. This issue was addressed by the final teaching intervention, which focused on the collaborative production of “research reports”. At the time of writing, data from this study was still under analysis.

Retention and achievement

At course completion *CyberLab* had retained all the original enrolees, reflecting the high level of engagement that was evident throughout. Observation, formal assessment, and output from activities suggested evidence of significant learning gains in literacy, numeracy, and ICT. Dialogue and discussion with and between learners also suggested that some were developing transferable skills in planning, stepwise problem-solving, and self-evaluation. NRDC observers saw evidence of autonomous learning as learners worked together through breaks and frequently carried out course-related work outside of class hours. Course accreditation was via specially written OCN units in basic computer programming and NOCN units in communication. Although all participants successfully gained one unit at Level 1, one finding from the studies was that accreditation strategies for integrated courses were underdeveloped, a problem which will be addressed by future work at the centre.

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