

Developing Research Models for ICT-Based Pedagogy

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The need for evidence concerning ICT's positive effects on learning has been recognised since the early instances of computer aided learning (Rushby 1979), yet over the past 25 years, the results of our quest for such evidence have been less than overwhelming. Yet it seems that increasing numbers of educators are convinced of ICT's potential and, despite our inability to demonstrate clear gains from merely providing ever more technology for schools and colleges, governments have continued to fund a rapid expansion in ICT resources for education (for example, BECTA 1998). This investment has been maintained because of a political conviction that ICT is beneficial for all aspects of life in the 21st century, and that education should be able to exploit the features of ICT (TTA 1998) in the same way as business does. There are now indications, however, that this investment may not continue unless politicians can be reassured that learners are benefiting to an extent which is commensurate with the level of provision. A significant body of qualitative/interpretive research over recent years has yielded valuable insights into the underlying processes of learning with ICT, but such studies do not directly compare the impact of different factors. It is unlikely that isolated case studies of successful teaching, or detailed interpretive analyses of learning processes, will provide convincing evidence for the political audience.

If we are to establish a credible case for resourcing ICT in education, there is a need for measures of the gains in learning over other methods. There are two main ways in which quantitative methods have been used to analyse learning gains:

1. quasi-experimental models, in which the gains in knowledge for groups of students using ICT have been compared with gains for groups learning the same subject matter using a standard approach (Tellez 1993);

2. post-hoc models, in which students' knowledge over a range of subject matter has been statistically correlated with the amount of ICT which they had available in their institutions (for example Watson 1993, BECTA 2001).

These suffer from major disadvantages, however. The main difficulty for each approach is that of measuring the gains in knowledge, since the knowledge gained through the use of ICT may be of a different nature from that gained by other methods and is not effectively assessed using standard tools. In addition, each model poses problems for those seeking to apply the results; in the case of the quasi-experimental model, the pedagogical conditions of the intervention study may not easily be reproduced in other classrooms, whilst the use of a post-hoc model may show only small effects since, even in well-resourced schools, ICT is used for a small minority of the time—less time, in fact, than students use ICT outside school.

I suggest that it will be fruitful to develop a Progressive Improvement (PI) model for analysis of pedagogical interactions with ICT. This will draw on the strengths of the Instructional Development model (Willis 1993) and Action Research (Somekh and Davies 1991) for enquiry into the development of ICT-based pedagogy. Rather than make purely quantitative comparisons between with/without ICT, or qualitative interpretations of interactions involving ICT, we should combine an interpretive study of the interaction of factors in pedagogical situations with limited measurements of changes in students' abilities. Our aim in applying such approaches is to learn where in the curriculum ICT is best used, and how it is most effectively integrated into different pedagogical environments, styles and strategies. The qualitative observations help us to examine the way in which features of the teacher, the student and the resources interact during pedagogical situations; the measurement of learning enables us to evaluate the effect of different combinations of these features. A PI model recognises that there is no absolute best way of using ICT in teaching and learning particular aspects of the curriculum; whether and how best to use ICT depends on many other features of the context.

One possible design for a PI model involves the analysis of affordances and constraints (Kennewell 2001). Affordances are the attributes of the setting which provide potential for action; constraints are the conditions and relationships amongst attributes which provide

structure and guidance for the course of actions. These features cannot be considered absolute in nature, however; affordances and constraints must be considered in relation to the abilities of the students in the activity they support. When students are working on a task designed to bring about learning, their progress towards the task goal depends on:

- the potential for appropriate action provided by the affordances of the setting;
- the structure for appropriate action provided by the constraints of the setting;
- their abilities in the subject they are learning and in other skills such as literacy (and ICT if it is involved in the activity).

The role of the teacher is to orchestrate the affordances and constraints in the setting in order to maintain a gap between existing abilities and those needed to achieve the task outcome, a *learning gap* which is appropriate to the development of intended abilities. If students find the task easy, little learning will result and the affordances and constraints need to be reduced. Similarly, if they find the task too hard, other features can be added or the current ones adapted in order to provide more appropriate support. This orchestration involves adding, removing and changing features of the setting as the students become attuned to the features and then focusing their attention on the features during subsequent reflective activity in order to develop conceptual schemes and improve the students' subsequent performance.

Where the teacher has a direct role in the orchestration of the setting, this may be planned in advance (proactive) or may be contingent on the continuous stream of events in the classroom (reactive) (Kennewell 2001). Where ICT is used, the orchestration may be completely delegated (in the case of an Integrated Learning System) or shared (in the case of a Virtual Learning Environment).

Simple forms of the model can be used by teachers—as individuals or in action research groups—to evaluate and develop their own practice. Teachers are already using measurements of pupils' attainment to demonstrate improvements in learning. What a PI model does is help them plan specific developments in their teaching of topics using ICT and to evaluate the effects of these changes by focused observation of how the features of ICT provide potential and structure for both action and reflection.

ICT in education is here to stay. In advanced technological societies, too much has already been invested to abandon the quest for improvements in learning through the use of ICT. Rather than establishing that the use of ICT is intrinsically better than other methods of teaching, we should focus on demonstrating progressively improved use of ICT and establishing how best resources should be allocated and teachers educated in order to replicate success. This will be achieved, not by large scale projects requiring significant levels of funding, but rather by large numbers of individual teachers researching their own practice. Their findings will be disseminated through the networking of practitioners using a system which affords classroom-

based enquiry, the sharing of ideas, and reflection on practice and learning. This idea is currently being piloted in Wales, where the General Teaching Council is funding Continuing Professional Development for teachers in a variety of innovative forms, including teacher research bursaries and professional networks. These initiatives show great potential for generating and disseminating evidence concerning how ICT can help bring about improvements in the learning of specific subject matter.

References

- BECTA (1998): *Networking Schools, Connecting People*. Coventry, BECTA.
- BECTA (2001): *Primary Schools—ICT and Standards*. Coventry, BECTA.
- GTCW (2002): *Professional Development Pilot Projects*. Cardiff, General Teaching Council for Wales.
- KENNEWELL, S. (2001): Using affordances and constraints to evaluate the use of ICT in teaching and learning. *Journal of IT and Teacher Education* **10**: 101–116.
- RUSHBY, N. (1979): *Introduction to Educational Computing*. London, Croom Helm.
- SOMEKH, B. and DAVIES, R. (1991): Towards a pedagogy for information technology. *Curriculum Journal* **2**: 153–170.
- TELLEZ, K. (1993): Experimental and Quasi-experimental research in technology and teacher education. In *Approaches to Research in Technology and Teacher Education*. WAXMAN, H. and BRIGHT, G. (eds). Charlottesville VA, AACE.
- TTA (1998): *The Use of ICT in Subject Teaching: Expected Outcomes for Teachers*. London, Teacher Training Agency and the Departments of Education.
- WATSON, D. (ed) (1993): *The Impact Report: an evaluation of the impact of information technology on children's achievements in primary and secondary schools*. London, Kings College.
- WILLIS, J. (1993): A research and development agenda. In *Approaches to Research in Technology and Teacher Education*. WAXMAN, H. and BRIGHT, G. (eds). Charlottesville VA, AACE.