ABSTRACT

Since 1991 all undergraduate primary student teachers at Chester have followed a Technology course. The distinctive pattern of our approach to Design & Technology has been acknowledged to be successful, but classroom use of Information Technology (IT) has not been as evident. This paper describes a small scale project which set out to replicate the essential elements of our approaches to Design & Technology and to apply them to Information Technology elements of the course. The outcome of the qualitative and quantitative research methods to monitor the effectiveness of the approaches are evaluated and discussed. Our tentative findings highlight the importance of students working with children using computers. Until the students had gained first hand experience of working with children in the classroom with IT, their concerns were more equipment-related than pedagogical. It would appear that students perceive issues of teaching and learning to be more important than concerns with their own IT capability after working with children. The integration of IT into students' professional coursework is identified as being influential in the development of their appreciation of the contribution IT can make to children’s learning.

There is little dispute that pre-service primary teachers need positive, constructive and relevant training and experience in the development of their IT knowledge and capabilities (DES, 1989; DES, 1992; Goler 1990; Dunn & Ridgway, 1991; Wild, 1995). Whilst there is some disagreement as to the relative efficacy of developing student-teacher IT capability through
‘permeation’ versus ‘discrete IT training’ (see, for example Wild, 1995; Oliver, 1994; Sherwood, 1993; Mockford, 1995) there is widespread agreement that the development of the pedagogy related to IT is vital if students with a high degree of personal competence are going to be effective in the classroom. Although Oliver (1994) for example acknowledges that the most significant deterrent to IT use in schools is lack of expertise and skill with new technologies, he suggests that IT courses have often tended to make the computer the focus rather than the curriculum. There is an assumption, he argues, that the development of student-teachers’ confidence and competence with the computer should enable them to become independent users of IT in the classroom but, he suggests, this has seldom been realised in practice. Whilst this statement is open to dispute, there is considerable variation in the extent to which student teachers make effective use of IT in the classroom. Few deny that teachers and student-teachers need to feel at ease with technology and to know how and what to teach with it, but there is some uncertainty as to which should have precedence. Brown (1994) insists that the three stages through which a student-teacher must pass are – competence with IT, support for classroom implementation, and reflective practice and metacognition. By contrast, Downes suggests that “use [of IT] with children can precede personal use” (Downes, 1993, p. 32). Dunn & Ridgway (1991) found lack of confidence with IT to be the most common reason for non-use of IT in schools, but Byard (1995) found little correlation between student confidence levels with IT and their use of computers on School Experience (SE).

Whilst the relative importance of aspects of pre-service IT courses may be in dispute, the accumulating evidence appears to show that that course content needs to balance the development of students’ personal IT competence with pedagogical input. Handler (1993) suggests that Initial Teacher Education tutors need to plan holistic experiences for students with discrete IT training, input on educational methods and a structured SE component.

**Context**

Most intending primary school teachers in England and Wales opt for a four year undergraduate Bachelor of Education (BEd) course at a university or college of higher education. The majority of such courses include the equivalent of two years’ study of one or two main subjects to degree level. The remainder of the course is devoted to pedagogical issues with at least half of this spent in the classroom on School Experience (SE). At University College Chester, students choose their own main subject but are required to study a compulsory ‘minor’ in Technology Education. Approximately half this programme is related to the Design and Technology curriculum which
includes practical and theoretical modules in designing, constructing and evaluating models and devices associated with materials, structures and electrical and mechanical control systems. The other half of the Technology Education programme is aimed at developing students’ own IT skills and their ability to teach with IT. Students also study other subject-related aspects of IT use through permeation in their various pedagogical study units (see Blythe & Nuttall, 1992, and Glover & Hamill, 1992). When this research was conducted, the Technology Education programme was delivered intensively during the first two years of the students’ BEd course, in four modules. The final module ‘Primary Applications’ included an opportunity for students to work with children on specific aspects of the technology curriculum. The format for the programme has since changed as part of a general restructuring of the BEd degree.

An ongoing evaluation of the Technology Education programme has revealed the need for a shift in emphasis for the IT component from the provision of basic IT familiarity and skills to more sophisticated uses of IT and a greater focus on the development of students’ IT pedagogy. Continuous monitoring since 1990 of students’ prior IT experience on entry to the course indicates a drop in those with no IT experience from 61% in 1990 to 41% by 1992 and 4% in 1996, and a widening of the gap between those with little expertise and those with wide ranging skills and experience. While take-up rates for IT on SE have been encouraging, with 73% of students in their third year (in 1995) using IT in school and 55% using it more than twice, the quality and range of classroom IT work observed by tutors has often been restricted principally to undemanding word processing exercises. Internal evaluation of Technology modules has revealed that whilst students have high levels of confidence following the Design and Technology (D&T) component of the course (84% of students feeling confident to teach D&T in 1995), similar levels are not reported for the IT component (with 48% feeling confident in 1995). This is reflected in the take-up rates and quality of D&T and IT work reported by supervising tutors on SE.

The Approach

An evaluative analysis by the tutorial team identified a significant difference in our approach to the two elements. Both the D&T and IT elements included practical workshops to develop students’ personal knowledge and skills, and practical projects to apply those skills in purposeful contexts. In addition, only the D&T component included direct involvement with

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The students had four D&T sessions in local schools working with groups of children, followed by evaluative reflection in college. Although there had always been an appreciation of the value of working with children by tutors, the logistics of placing 200 students in schools with suitable IT equipment levels had precluded this as an option. It was decided therefore, to make the approaches to the two elements more congruent by transporting groups of children to college to enable students to use the department’s IT equipment with them.

**Research Methodology**

To monitor the effectiveness of this approach, funding for a small research project was procured from the College school of education research fund. The whole cohort of 216 second year BEd students was chosen as the target group for our research as the most intensive IT sessions were delivered during this part of the Technology Education programme. The project involved seven stages:

**Stage 1 (October 1994)**

Since 1990, all students on entry to the BEd course at University College Chester have been asked to complete a questionnaire detailing their prior IT experience and to indicate their current levels of anxiety or self-perceived confidence levels with IT skills and knowledge. This retrospective information was used to provide comparative base line data about the target group’s IT experience.

**Stage 2 (June 1995)**

To provide further comparative data for when the Year 2 target group reached their third year, the quality and quantity of IT use by current third year students on SE was ascertained by asking supervising tutors to complete an observation proforma.

**Stage 3 (October 1995)**

A sub-group of twenty students (approximately 10%) of the ‘target’ cohort was selected at random for interviews at the beginning of their second year to provide qualitative evidence to augment questionnaire data.

**Stage 4 (May – June 1996)**

The students worked on computers with groups of children in college. Each student was assigned 2 or 3 children and worked with them for two 2.5 hour sessions over two consecutive weeks.

**Stage 5 (June 1996)**

Following their work with children in college at the end of the module, a questionnaire was administered to the second year cohort to assess their perceived competence and confidence to teach IT.

**Stage 6 (June – July 1996)**
Observation of the second year cohort by tutors supervising SE following the IT module. Tutors used the same instrument as that used to monitor the third year students’ SE (see Stage 2 above).

Stage 7 (July – August 1996)
As the end of their SE coincided with the end of the college term it was not possible to carry out face-to-face interviews with the sub-group, so open-ended questionnaires (using the same questions used in the interviews) were sent to the twenty students. Fourteen returns were received.

The seven stages are summarised in Table I.

Table I. Schedule for research project.

**Findings**

*Student Confidence and Competence with IT*

The course entry questionnaire data indicated that the target group's prior IT experience was broadly similar to that of preceding year groups. Approximately 50% of those who had IT experience had used word processing software solely and a further 25% also had experience of data handling. The rest of the group had in addition, used design or modelling software either professionally or in education.
Information provided by the random sample of twenty Year 2 students revealed that five students felt their main concern was the lack of personal skills while seven students were concerned about how to cope with having only one computer in the classroom and giving children fair access. Two students were concerned that children would not have time to do anything productive. Three students were concerned that they had little knowledge of relevant software. Individual students were concerned about ‘things going wrong’ and work getting lost, that ‘children wouldn’t understand what they were doing’ and ‘pitching [explanations] at the right level’. Their self-perceived confidence levels to teach with IT are shown in Figure 1.

After working with children using computers in college, the Year 2 students’ responses to open questions in a post-module evaluation questionnaire were aggregated by grouping similar statements (see Tables II – VI).

Interestingly, in response to: ‘In what ways has the activity contributed to your competence and confidence in dealing with IT in the classroom?’ 54% of students felt the activity had contributed to the development of their own IT confidence and competence whereas a smaller proportion (40%) indicated ways in which the activity had contributed to their ability to teach IT, suggesting personal IT skills assumed a higher priority for them than issues of pedagogy (see Table II).
Similarly, when asked to suggest ways in which their confidence and competence might be further enhanced, 68% felt they needed more technical support while only 31% felt more input on pedagogical aspects would be beneficial (see Table III).

Table II. Year 2 BEd students' responses to ‘In what ways has the activity contributed to your competence and confidence in dealing with IT in the classroom?’ (n=212).

Table III. Year 2 BEd students' responses to ‘In what ways could your confidence and competence be further improved?’ (n=212).

By contrast, information from the interview sub-group gathered after the module and their SE painted a different picture. Of the fourteen respondents eight students stated that their main concern was the lack of IT resources in schools and five students were concerned that this would lead to insufficient time for children to gain ‘hands-on’ experience. One was
concerned about the management of IT stating ‘if children are using a new program on a computer, they need a lot of individual help – what about the other thirty or so children who are not using it?’

Figure 2. The Year 2 interview sub-group’s IT teaching confidence levels after the activity and SE (n=14).

Three students commented on concerns over gaps in their knowledge about appropriate software to augment their teaching. Far fewer students were now concerned about lack of personal IT skills than previously, with only one student expressing concern that she would not know what to do if programs ‘crashed’. Two students who had previously indicated anxieties over personal IT competence reported they had been able to offer informal in-service training on the use of the computer to their supervising teachers! An overview of the fourteen respondents’ self-perceived confidence levels to teach with IT is shown in Figure 2.

Although there was little change in the sub-group’s self-perceived overall confidence levels, analysis of their comments revealed a shift in emphasis away from concerns about students’ technical skills to the practicalities of managing IT in the classroom.
Furthermore, comparison of the entire year 2 and year 3 students’ levels of confidence to teach with IT whilst on school experience is very revealing (see Figures 3 and 4). While 42% of third year students felt uneasy about teaching IT, only 12% of the ‘target group’ reported similar levels of unease. Similarly, only 20% of Year 3 students reported high confidence levels, whereas 41% of Year 2 students felt confident.

It was not possible to ascertain the extent to which the college-based work with children had contributed to these widely discrepant levels of confidence.

**Professional Development**

While the tutors had a clear view of the contribution the IT aspect of the module ought to be making to the students’ professional development, we
were interested in discovering the students’ views as to its educational effectiveness.
In response to the question, ‘What did you learn as a teacher?’ 22% of students indicated the activity had contributed to their general pedagogical understanding, 29% felt it had helped them develop specific curricular skills, 37% felt they had developed particular teaching skills, 8% felt the activity had reinforced their own IT competencies and 4% commented on affective aspects (see Table IV).

Table IV. Year 2 BEd students’ responses to ‘What did you learn as a teacher?’ (n=212).

When asked to indicate what the students felt the children had learned, 69% of students reported a focus on the development of IT specific skills and knowledge, 22% felt the activity had contributed to non-IT related learning, 9% commented on the contribution IT had made to cross-curricular learning (see Table V).
Table V. Year 2 BEd students’ responses to ‘What did the children learn from the activity?’ (n=212).

Table VI. Year 2 BEd Students’ responses to ‘What did IT contribute to the activity?’ (n=212).

An analysis of the ways in which students felt IT contributed to or enhanced the children’s learning revealed that 42% of students felt the IT activity had enhanced curricular learning, 29% felt IT had improved the quality or affective aspects of the activity for the children, 18% commented on the contribution of IT to working processes and 11% reported on ways in which IT had contributed to children’s learning processes (see Table VI).

More detailed information from the interview subgroup about their perceptions of the value of IT yielded some interesting results. Prior to the IT activity, most respondents held the view that IT in schools has only a
utilitarian purpose in preparing children for ‘later life’. Seven students stated this quite explicitly and two others saw the main value of IT as being to develop and improve low-level, manipulative and typing skills. Others gave more insightful answers, but these were in the minority - three students felt that the use of computers was a ‘safe’, non-threatening way for children to investigate problems, three students felt that the use of computers is more motivating for children, one student felt that computers help children ‘do more complex things more easily’, one student stated that computers help children to organise and sequence information, one student felt that computers ‘raise questions that children can go on to investigate’, one student stated that IT fosters co-operative teamwork.

Following the module and the SE eight students from the sub-group of fourteen respondents still felt that the value of IT in schools lies in preparing children for the world of work and ‘later life’, four students valued the contribution of IT to learning in other subjects, three students stated that word processing, in particular, encourages ‘imagination and creativity’ and allows all children to produce aesthetically pleasing texts. One student felt that IT could be a valuable ‘self learning tool’ and another that it ‘improves thinking skills’. One student valued the co-operative nature of many IT activities, suggesting that ‘children can ... learn a number of skills and develop strategies by teaching one another’. There was, it appears, very little shift in perspective regarding the students’ perceptions of the educational value of IT, despite the change in structure of the module. The students who had originally identified the utilitarian aspects of IT still held these views while those who had previously appreciated the more challenging educational aspects had strengthened their views, though only very slightly.

Discussion

Students’ Personal IT Confidence and Competence

The most remarkable finding is the contrast in confidence levels reported by Year 2 SE students and Year 3 students. One might assume that as the Year 3 students are further on in their course they ought to have more confidence with IT than their second year counterparts. Downes (1993) for example found there was increased use of IT on SE by students as they progressed through their courses. Veen (1993) points out that student teachers are mostly concerned with maintaining order and discipline in their earlier SEs rather than worrying about pedagogical innovation such as the use of computers. It could be inferred that providing students with
experience of working with children and computers prior to their going in to
schools might be reassuring – giving them a successful base from which to
work while trying to get to grips with their new role as a teacher.
Some of the interview sub-group were anxious about how they would
explain things to children or pitch activities at the right level before
working with the children, although their greatest concern was their
own personal skills with IT. After the activity 11 students commented
that it had helped them to improve their explanations or provided
experience in supporting children. When drawing up plans and objec-
tives for module content, it is sometimes all too easy to forget that
while our concerns might be focused on students’ intellectual, educa-
tional and professional development, their agenda might well be more
mundane and fundamental – what are the right words to use to make
myself understood by a nine-year-old?
Analysis of the sub-group’s self-perceived confidence levels indicates a
modest increase in their overall confidence levels to teach with IT (see
Figures 1 and 2). Qualitative data from their comments reveal there
has been a shift from anxieties over personal IT competence to a reali-
sation they need to know more about the pedagogy of integrating IT
into their teaching.
The steady increase in the numbers of students with IT experience
entering Initial Teacher Education courses, and the widening of the
competence spread of students, would seem to suggest that an even
greater shift in the focus of courses from the development of personal
IT confidence and competence, to professional aspects of the use of IT
in an educational setting, is becoming increasingly important from a
students’ viewpoint. It would appear that a breadth of input – from
the mundane to the theoretical – would be appreciated. The next stage
of our investigations might be to discover whether indeed Downes’
contention that the use of IT with children can precede the develop-
ment of students’ personal IT expertise is tenable.

Professional Development
Kay (1994) suggests students need to appreciate the educational value of IT
to be able to integrate it successfully. The responses of the interview
subgroup would appear to indicate that for the majority, the principal aim of
IT work with primary children is the preparation it gives them for later life.
With over two-thirds of the whole cohort reporting that the development of
children’s IT skills and knowledge was the most significant learning outcome
of the activity, it would appear that a more interventionist approach to the
development of the students’ appreciation of the role of IT in teaching and
learning would be beneficial.
Oliver (1994) suggests that new teachers are often inclined to teach
the way they were taught and Wright (1993) emphasises the impor-
tance of role modelling by lecturers. Both the D&T and IT strands of
Technology modules at University College Chester have, in the past,
followed the pattern of:

- awareness raising of the educational significance of D&T and IT;
- practical workshops in the development of students’ personal skills;
- self-managed projects in which the students apply their skills and
  knowledge in context.

This is now followed by work with children in each strand. The intention has
always been that the second two parts of the programme would mirror the
type of activities which would be appropriate for children - albeit at levels
more appropriate for the students. The BEd course at University College
Chester has, as a whole, attempted to balance discrete input on IT skills
(provided by the Technology Department) with IT activities integrated into
other primary curriculum subject studies. The shift in student need from the
development of IT skills to the development of both personal and
educational skills, knowledge and understanding is already having an effect
on the way in which IT is being organised and delivered through the BEd
programme. An audit of students’ IT experience through the course has
revealed that, whereas the Handling and Communicating of Information is
addressed comprehensively by most of the subjects, Computer Control is
encountered in very few modules and that Modelling is touched upon in only
two modules in four years. Already a rewrite of the BEd programme
has resulted in greater emphasis being placed on aspects of Control in the
Technology course and negotiations are under way for a shift in focus in
other subject modules to incorporate more opportunities for students to use
IT for Modelling in appropriate contexts. With less emphasis having to be
placed on the discrete development of students’ IT skills, there is more space
and time for the pedagogical aspects to be addressed in the programme as a
whole and in the Technology course in particular.

The Use of IT on School Experience

Downes (1993) posits that the effectiveness of IT courses in teacher-training
institutions is usually measured by changes in students’ attitudes and IT
skills and knowledge. She argues that none of these is a reliable indicator of
take-up rates by students of IT in the classroom. The fact that 73% of our
baseline cohort used IT with children on SE is encouraging compared with
other studies (29%, Marker & Ehman, 1989; 40%, Dunn & Ridgway, 1991;
39%, Downes, 1993; 17%, Wild, 1995). However, with increased availability
of IT resources in schools and more emphasis placed on the integration of
IT into all areas of the National Curriculum in England and Wales since
1995, one has to be cautious about making historical comparisons. While
situational factors such as access to equipment may be an inhibiting factor
for some students, the shift in focus from anxieties about technical
knowledge and skills to pedagogical concerns by the sub-group of students
would suggest that the reshaping of the IT module from the development of
students’ personal IT expertise to the use of IT with children has been
appropriate and timely.

Goodwyn (1992) and Handler (1993) point to the significance of
successful use of IT during SE in helping newly qualified teachers to
develop rapidly their use of IT in the classroom. At present, there is a
requirement for all students on SE to make use of IT and their compe-
tence levels are logged by supervising tutors or teacher-mentors. There
is no specific requirement for particular IT activities to be carried out
by students who are left to negotiate IT activities with supervising
teachers. There is some evidence that when a requirement to make
particular use of IT is planned into a SE then not only are take-up
rates enhanced, but teachers appreciate the opportunity these activi-
ties provide for their children to further enhance their IT skills (not to
mention the informal concomitant in-service input the teachers
receive). Gulland & Robertson (1991) found for example, that when
students were asked to use a database on SE, practically all did and
teacher support was extremely high.

Initial findings from a pilot BEd course at University College Chester
(Bennett, 1996) shows that where there is a particular requirement in
the form of a written component evaluation of an open-ended IT activ-
ity in school, take-up rates for IT on SE are 100%—even in the first
year. In one case a self-confessed computer phobic student who found
herself in a school in which there were no functioning computers
managed to repair one of the machines in order to carry out her
assignment!

Wild (1995) suggests that the most significant influences on student
use of IT include involvement of children in IT sessions, ownership of
appropriate software by students, follow-up support by supervising
mentors or mentors and role modelling by the placement class teacher
on SE.

The next phase in the reappraisal of IT in the University College
Chester BEd programme will be to explore ways in which the IT
requirement on SE can be strengthened, an increase in the range of software which can be loaned by students for use on SE and an examination of the ways in which the role of the supervising tutor and mentor can be enhanced.

The Technology Education programme at University College Chester has already undergone a few changes. Whilst originally taught intensively over two years, it has now become a four year programme, with the same number of modules. The content of the Primary Applications module will now be taught in years 3 and 4 of the BEd course, providing opportunities for students and staff to reflect on the effectiveness of the IT sessions in Year 3 and ‘revisit’ areas of weakness. Despite cuts in funding and increased requirements for school-based training, it is still intended to bring children into college for IT-based sessions. Schools appreciate the value of providing their children with intensive hands-on experience with computers and are willing to provide their own transport to bring the children. Teachers make use of the sessions to gain some valuable in-service training either by observing the students at work with their own children or by spending time at the keyboard with new software.

Conclusions

Despite the limitations of this type of case study research there are some general conclusions which can be drawn from this project.

Although the approach to Technology Education which has been adopted by University College Chester is distinctive, all institutions offering primary teacher training in England and Wales will be having to reappraise their approaches to developing students’ IT competences within the year. New requirements (DfEE, 1997) specify that all student teachers should attain certain minimum competences with IT in order to reach qualified teacher status. To satisfy these requirements, institutions will need to reappraise the IT experiences they offer their students. The outcome of our research suggests that while working with children in college does not have an immediate effect on the development of students’ IT pedagogy it is beneficial in increasing their willingness and confidence to use IT on subsequent school-based modules. As a consequence, students are more likely to encounter and appreciate the difficulties of classroom management of IT. It is important, therefore that college-based IT sessions with children are seen as integral to a continuing programme of IT activities. As a result of our studies our programme will be revised to follow this pattern:
1. Introductory college-based module to raise student awareness of the educational uses of IT
2. College-based IT sessions with children, to develop student confidence
3. School-based IT activities as part of SE
4. Follow-up college-based sessions to address management and organisational issues
5. School-based IT activities as part of SE
6. College-based reflection and sharing of experiences.

Our conclusions therefore tend to endorse the views of Brown (1994) and Handler (1993), that an holistic approach which incorporates the development of teaching related IT competences with classroom experience and reflective practice appears to be the most beneficial.

It is our belief that there is a place for discrete units of IT work, provided these are integrated with ongoing permeation through subject-study and SE components of the course. The advantages of discrete IT units are:
- continuity of experience and progression of knowledge and skills is easier to manage
- the units can address aspects of IT use which do not permeate the subject-pedagogical studies (e.g. computer control, some aspects of modelling)
- there are more opportunities for the ongoing assessment of students' IT capability.

Furthermore, college-based work with children is beneficial in:
- increasing student confidence by working with children on familiar equipment with technical back-up
- allowing students to work intensively with a small number of children to explore teaching and learning issues with IT
- providing opportunities for reflection and dialogue with fellow-students and tutors on common issues associated with IT pedagogy
- providing children and their teachers with some intensive IT input using equipment which is more sophisticated that that which they have in school (e.g. flatbed scanners, digital cameras, video digitising, Internet access)
- raising students’ (and teachers’) awareness of what children are capable of achieving with IT when given the opportunity, the equipment and the right kinds of support.

This ‘snapshot’ view of IT provision within one aspect of the BEd course at University College Chester has provided us with much food for thought and has led us to make considered changes to our programme. The extent to which these are ‘informed’ changes is open to debate, but our take-up rates for IT on SE do appear to be rising as
are the confidence levels of our students. However, measures of quantity can sometimes mask issues of quality. Our next focus will be to explore the quality of SE supervision and the levels of challenge offered to children by students’ IT activities in college and in school.

Correspondence

Andrew Hamill, Centre for Technology in Education, University College Chester, Cheyney Road, Chester, CH1 4BJ, United Kingdom (a.hamill@chester.ac.uk).

References


