NCCA
National Council for Curriculum and Assessment
An Chomhairle Náisiúnta Curaclaim agus Measúnachta

Research Report No.4

Computers and Curriculum

Difficulties and Dichotomies

Teresa O'Doherty, Jim Gleeson, Keith Johnston,
Oliver McGarr, Janet Moody

Computers and Curriculum – Difficulties and Dichotomies

An investigation into the form, content and perceived impact of a new Leaving Certificate (established) computer-based subject

A report commissioned by the
National Council for Curriculum and Assessment 2001

University of Limerick
College of Education

Teresa O'Doherty, Jim Gleeson, Keith Johnston, Oliver McGarr, Janet Moody

The findings and recommendations in this report are those of the authors. It should not be implied that the NCCA recommends, endorses or approves any of the views expressed therein.

ISSN 1649-3362

National Council for Curriculum and Assessment
24 Merrion Square, Dublin 2.
www.ncca.ie

Contents

	Introduction	**1**
	Computer use in Irish schools: historical context	2
	Purpose of study	5
PART ONE	**Methodology**	**9**
	Research aims	10
	Two-stranded approach	11
	Discussion groups	12
	Questionnaire	19
	School-based studies	22
	Principles and procedures applied to data collection	30
	Limitations and difficulties	30
PART TWO	**Main findings**	**33**
	Views on the formal introduction of a computer-based subject to the Leaving Certificate (established)	35
	Basic computer skills for all	40
	The nature and assessment of an optional computer-based subject in the Leaving Certificate (established)	54
	Perceived impact	74
PART THREE	**Findings in context**	**97**
	Contextual issues	98
	Culture of inevitability	99
	Plurality of meanings, perceptions and interests	102
	Aspects of Irish curriculum context	104
	Planning	107

Main conclusions and issues arising 112

Subject content: computer skills versus computer science dichotomy 113

Subject form: the 'ideal versus feasible' dichotomy 115

Complexity and interplay: impact on resources 116

Complexity and interplay: impact on curriculum 121

Assessment 123

Equity 124

Other issues 126

The significance of school context 126

Impact on higher and further education 128

Differences of opinion 129

Paucity of references to the economic argument 130

Importance of critical curriculum discourse 131

BIBLIOGRAPHY 133

APPENDICES

Appendix A

Options relating to the possible form of a computer-based subject 140

Appendix B

Examples of A-level content (UK) 141

Appendix C

Overview of discussion group participants 142

Appendix D

Questionnaire sent to business/industry representatives 144

Appendix E

Questionnaire administered to first year computer science university students 148

Appendix F

Questionnaire administered to teachers as part of school-based study 152

Appendix G

Questionnaire administered to students as part of school-based study 157

Appendix H

Letters sent to prospective participants 161

List of acronyms

ASTI	Association of Secondary Teachers Ireland
CAD	Computer-aided Design
CEB	Curriculum and Examinations Board
CESI	Computer Education Society of Ireland
COMPASS	Parents' Association for Schools of Minority Religions
CSPE	Civic, Social and Personal Education
DES	Department of Education and Science
ECDL	European Computer Driving Licence
FEDCBS	Federation of Christian Brothers & other Catholic Schools Parents' Councils
HFE	Higher and Further Education (discussion group)
IBEC	Irish Business and Employers Confederation
ICT	Information and Communications Technology
ISDN	Integrated Services Digital Network
ISME	Irish Small and Medium Enterprises Association
IT	Information Technology
LCA	Leaving Certificate Applied
LCVP	Leaving Certificate Vocational Programme
NCTE	National Centre for Technology in Education
NCCA	National Council for Curriculum and Assessment
NCVA	National Council for Vocational Awards
OECD	Organisation for Economic and Cultural Development
PACCS	Parents' Association for Community & Comprehensive Schools

PAVSCC	Parents' Association for Vocational Schools & Community Colleges
PE	Physical Education
PLC	Post-Leaving Certificate
RE	Religious Education
SFA	Small Firms Association
SIP	Schools Integration Project
SPHE	Social Personal and Health Education
TUI	Teachers' Union of Ireland
TYO	Transition Year Option
UCSD	University Computer Science Department (discussion group)
VPT	Vocational Preparation and Training
VTOS	Vocational Training Opportunities Scheme

INTRODUCTION

Introduction

Computer use in Irish schools: historical context

The possible uses and benefits of computers in education are well documented in international literature. While the authors of this report are cognisant of the discourse within this literature, a detailed investigation of international trends is outside the remit of this study. A comparative investigation of these trends is being undertaken by the National Council for Curriculum and Assessment (NCCA) in parallel with this study. Consequently, the following section briefly outlines the use of computers in Irish post-primary schools to date.

The issue of the introduction of a computer-based subject at post-primary level has been debated for several decades. The Computer Education Society of Ireland (CESI), for example, has been actively promoting the introduction of a computer-based subject since its formation in the early seventies. However, those who favoured a new subject did not always agree as to what its content might be (Kelly, 1984a; Mackey, 1984).

The first introduction of computers in post-primary schools came in 1980 with the creation of an optional computer module in Leaving Certificate mathematics. Schools opting for this module were required to submit their own syllabuses, within the context of Department of Education guidelines that placed a strong emphasis on programming. At this time the Department planned to introduce computer studies on a more comprehensive basis:

> A computer studies module is being introduced into senior cycle classes in the school year 1980/81, but this is only the beginning. Courses in computer studies will be introduced formally into the curriculum (Department of Education, 1981, p. 51).

Minister Gemma Hussey transferred responsibility for syllabus change and programme development from the Department of Education to the Interim Curriculum and Examinations Board (CEB) in the mid eighties. When that body was reconstituted as the NCCA in 1987 it began the revision of the junior cycle curriculum, moving on subsequently to the revision of the senior cycle and primary curricula. In the context of so many revisions of existing subjects, consideration of the place of computers on the curriculum was deferred. It was decided to 'go it alone' in the Limerick region, where a group of schools offered a computer subject developed on a pilot basis in 1979 in cooperation with the National Institute for Higher Education (Limerick), now the University of Limerick. This programme continues to be taught in a small number of second-level schools and is recognised by the University of Limerick and Limerick and Waterford Institutes of Technology.

Resources were particularly scarce during the eighties and early nineties due to increasing pupil numbers and serious economic difficulties. As a result, the impact of this initiative was limited (Kelly, 1984) leading to low levels of computer use in schools throughout the 1980s. Various Junior Certificate syllabuses developed towards the end of the decade incorporated elements of computer use (e.g. business studies, metalwork and technical graphics). The new Leaving Certificate engineering syllabus also included a computer element, as did Vocational Preparation and Training (VPT) and Senior Certificate courses and, more recently, the Leaving Certificate Applied (LCA) programme and Leaving Certificate Vocational Programme (LCVP). Computer-related aspects have also been incorporated into subjects

such as music, business and accounting and there is an increasing emphasis on data logging in the science subjects. Schools have increasingly incorporated information and communications technology (ICT) provision into Transition Year programmes, often involving European Computer Driving Licence (ECDL) completion. Computer-based courses form a significant part of the Post-Leaving Certificate (PLC) programme developed during the nineties under the auspices of the National Council for Vocational Awards (NCVA).

The NCCA response to the Education Green Paper (NCCA, 1993, p. 32) suggested that information technology (IT) along with social, personal and health education (SPHE), civic, social and political education (CSPE), media education, the European dimension and gender equity were in need of: 'cross-curricular as well as subject-specific development'. The NCCA also included a policy statement in relation to senior cycle curriculum in this response (1993, pp. 54-61). The primary concern in this section was with 'structural' matters such as the configuration of senior cycle education. While the introduction of a general technology subject is proposed, the document does not include any mention of computer education per se at senior cycle. It is understood that the imminent NCCA discussion paper on the senior cycle will identify ICTs as one of the current gaps at this level.

During the 1990s the dominance of applications-based courses was reflected in successive studies (McKenna et al, 1993; Drury, 1995; Mulkeen, 1997). They reported high levels of usage of industry standard applications software in computer studies and informatics courses. In the absence of departmental guidelines and policy, these courses were developed within schools in response to the perceived demands of society. Although the above studies found considerable

difference in the level of ICT resources and types of use within schools, the majority of school-initiated ICT courses had a strong focus on desktop publishing, word processing and CAD (computer-aided design) packages.

The lack of integration of ICT in teaching and learning led to the launch of the *Schools IT 2000* initiative in 1997 (DES, 1997). This initiative aimed to ensure that all students achieve computer literacy and that teachers are supported in developing and renewing skills that enable them to integrate ICT in the learning environment. This emphasis on the integration of ICT in teaching and learning across the curriculum represents a marked shift from the dominant type of computer use within schools.

Purpose of study

The NCCA is currently considering the place of ICT in primary and post-primary curricula. The development of guidelines for the integration of ICT across the curriculum at both primary and post-primary levels has been the initial focus of this work. The second area of interest is the introduction of a computer-based subject to the Leaving Certificate (established) programme either as a stand-alone subject or cross-curricular provision.

An earlier research project, *An investigation into the interest in and feasibility of introducing a computer-based subject to the Leaving Certificate* (O'Doherty et al, 2000), suggested widespread support for the introduction of such a subject. An overwhelming majority of principals, teachers, educational partners, third-level academics and industrialists surveyed felt that there was a need for the introduction of a computer-based subject to the Leaving Certificate (established)

programme. The primary reason put forward was the promotion of computer literacy. While respondents agreed on the need for a subject, there was far less agreement on the nature of this provision. Issues such as the form and content of a new subject were raised in questionnaires but clarification of opinions held could not be ascertained. The perceived impact of the introduction of such a subject emerged from this research as one of a number of issues which require further investigation.

This study, which was commissioned by the NCCA and carried out by a research team at the Department of Education and Professional Studies of the University of Limerick, investigates the possible form, content and perceived impact of the introduction of a new computer-based subject to the Leaving Certificate (established). It seeks to clarify the issues raised in the earlier research, by taking a more qualitative approach. By providing participants with a number of options (in terms of form and content) for a computer-based subject in a structured yet non-directive manner, the researchers aimed to develop an understanding of the preferred form and content and resulting impact of a computer-based subject. The methodology was developed in close consultation with the NCCA, who identified the research sectors to be included and the key issues to be addressed.

Strand one of the present study was undertaken in the period November 2000 to February 2001, and an interim report was submitted to the NCCA in March 2001. Data were gathered by means of discussion groups that were held with teachers, school principals, parents, representatives of higher/further education, representatives of business and industry and other members of the education community. During the second strand, following feedback

from the NCCA in relation to the interim report, questionnaires were used to obtain a more representative sample of those in business/industry and higher/further education, and to clarify certain issues raised in strand one. In addition, studies were undertaken in two schools in order to explore the impact of the possible introduction of a computer-based subject in particular school settings.

The nature of this study was investigative and its purpose was to explore issues relating to possible form, content and perceived impact of a new computer-based subject. It is not within the remit of this report to suggest recommendations but to highlight the factors to be considered by decision makers and to illustrate the possible implications of decisions made.

Part 1 of this report describes the research methodology.

Part 2 presents the research findings under four main headings: respondents' views in relation to the formal introduction of a computer-based subject to the Leaving Certificate (established); the perceived importance of basic computer skills for all; the nature and assessment of a computer-based Leaving Certificate (established) subject; the perceived impact of the introduction of such a subject on school resources, both human and technical, on curriculum and on students.

Part 3 locates the findings in context and identifies main conclusions and issues arising from the findings.

PART 1

Methodology

Methodology

Introduction

The initial study, *An investigation into the interest in and feasibility of introducing a computer-based subject to the Leaving Certificate* (O'Doherty et al, 2000), which was based on quantitative data, raised a number of issues which the NCCA considered merited further research. A qualitative approach was chosen for the present study in order to clarify these issues in relation to the possible form and content of a new computer-based subject, and to explore the perceived impact of the introduction of this subject.

Research aims

The research aims were to

- investigate the preferred form and content of a new computer-based programme
- investigate the perceived impact of such a subject if introduced to the Leaving Certificate (established).

TWO-STRANDED APPROACH

The research methodology was designed to gather the required data from personnel from the following: the education partners, third-level/further education institutions, business/industry and schools. A two-stranded approach was adopted: strand one involved consultations with representatives of the above sectors through discussion groups and questionnaire while strand two involved school-based studies. The data for this study were gathered from the following sources:

- discussion group interviews
- questionnaires
- school-based studies conducted in two settings.

As the research aimed to clarify and probe the findings of the previous study, discussion group interviews were selected as the primary source of data, in consultation with the representatives of the NCCA. The discussion group interviews encouraged interaction among the contributors, thereby facilitating the exchange of ideas and giving opportunities to participants to re-evaluate their opinions and ideas in light of those expressed by others. These interviews were conducted on the basis of a topic guide, which consisted of a set of core issues. This research instrument was developed and piloted with a principal and teachers in a local school, in co-operation with the NCCA. A member of the NCCA attended the pilot group interview and was closely associated with each stage in the development of the methodology. In addition to the core issues, further issues of specific relevance to each particular discussion group were included as appropriate.

An interim report was submitted to the NCCA in March 2001. In light of the feedback from the NCCA, further investigations of the views of those in third-level and business/industry were undertaken. Given the limitations of the discussion group approach and the small numbers who attended, questionnaires were disseminated to representatives from business/industry in the mid-west to validate the findings of the discussion group interview. The initial higher and further education discussion group consisted of a cross-section of representatives from a number of disciplines and institutions. Again following NCCA recommendations, a second discussion group was convened to obtain the views of academics within the computer science sector.

Two school-based studies were undertaken to explore the perceived impact of the introduction of a computer-based subject in particular school settings. The data for the school-based studies were obtained from a discussion group consisting of a cross-section of the teaching staff, a questionnaire sent to all members of the teaching staff in the school and a questionnaire disseminated to fifth year students in the school. The school principal was also interviewed in both settings.

Discussion groups

In total, six discussion groups were conducted in the period November 2000 to January 2001. A seventh discussion group, composed of representatives of a third-level computer science department, was conducted in May 2001. The optimal size of each discussion group was six to eight members and approximately twelve persons were invited to each session to allow for non-attendance. Industrial action taken by the Association of Secondary Teachers Ireland (ASTI) coincided with the data collection phase of this research, and attendance at the groups was significantly influenced by events occurring at this time. Five of the original six discussion groups were held in the Cork region and the sixth in Dublin city.

The Cork region was selected as the primary location for the fieldwork, given the wide range of school types and sectors represented in this area, the close proximity of urban/rural schools, access to recognised disadvantaged schools as well as the relative convenience of this location to the research team. Each group discussion was facilitated by two researchers, and lasted approximately ninety minutes. A discussion group interview was held with each of the following:

- representatives of parents' groups
- ICT teachers/co-ordinators
- representatives of higher/further education
- school principals
- NCCA education officers
- representatives of business/industry
- representatives of a university computer science department.

Each session began with clarification of the purpose of the session, an introduction of group members and an agreement of basic ground rules, including confidentiality.

All discussion groups were based on the following core topic guide:

- initial statement by contributors of agreement/disagreement with the introduction of a new computer-based subject as part of the Leaving Certificate (established) programme, including rationale for their views – followed by discussion
- presentation of the NCCA's three-strand approach to computers in Irish education:
  - the integration of ICT across the curriculum
  - the development of ICT skills to assist the teaching and learning process
  - exploring the possibility of developing ICT as a stand-alone subject.

- discussion on possible form of a new subject, including the introduction of several possible options (as outlined below)
- discussion on possible content
- other issues arising
- reiteration of original question, including summary of views on form and content.

The following options (see Appendix A) relating to the possible form of a computer-based subject were presented:

Option 1. Discrete, stand-alone subject.

Option 2. Self-contained modules within various subjects such as ICT in business, mathematics or physics. Separate assessment, i.e. an examination result in a subject called ICT/IT.

Option 3. Core subject area plus modules in various subjects. Assessed separately, i.e. an examination result in a subject called ICT/IT.

Option 4. ICT integrated within existing subjects, or a number of subjects. These subjects would require that ICT be used within certain experiments/procedures, for example. Assessment would be part of the existing subject assessment, e.g. specific modules within a subject, specific questions in an examination.

Option 5. ICT/IT integrated within each subject/a number of subjects and perceived as a tool for teaching/learning. While the curriculum would require the use of ICT, its use would not be assessed directly/indirectly.

Additional issues particular to each group were included where appropriate. Details of those who attended each discussion group interview plus the additional issues addressed are included in the following section.

Representatives of parents' associations

The following parents' groups were contacted and invited to send representatives to the discussion group interview:

- Catholic Secondary Schools Parents' Association
- Parents' Association for Community & Comprehensive Schools (PACCS)
- Parents' Association for Vocational Schools & Community Colleges (PAVSCC)
- Parents' Association for Schools of Minority Religions (COMPASS)
- Federation of Christian Brothers & other Catholic Schools Parents' Councils (FEDCBS).

Representatives from the first four of these associations attended: the first three organisations sent two representatives each, while one person represented COMPASS. Only two of the representatives had discussed the matter beforehand within their own organisation (PACCS); other participants expressed their personal views.

In addition to the core issues, questions relating to equity and possible student profile were addressed.

ICT teachers/co-ordinators

Fourteen teachers who were teaching computing/ICT and were school ICT co-ordinators in a cross-section of school types in the Cork region, both urban and rural, were contacted. The local ICT advisor also attended. The eight teachers who attended teach in the following school types:

- secondary school, male, urban
- secondary school, male, urban, disadvantaged
- secondary school, female, urban
- secondary school, female, urban, disadvantaged
- comprehensive school, mixed, urban
- secondary school, mixed, rural
- vocational school, mixed, rural
- community school, mixed, suburban.

In addition to the core issues, the need for a mandatory ICT experience for all students, the perceived impact of a computer-based subject on existing computer resources and on staffing and the role of the ICT co-ordinator were addressed. In this group the discussion of content was informed by examples taken from UK A-level syllabuses (Appendix B).

Representatives of higher/further education (HFE)

The heads of a number of third-level computer science, engineering and electronics departments were contacted by email and invited to nominate representatives to attend the discussion group. Cork City and County VECs were also contacted and in total ten participants were invited, representing all third-level institutions and further

education provision in the region. The discussion group consisted of four members, two from the area of computer science, one from electronics, and one representing further education under the aegis of County Cork VEC. The discussion focused on the form and content of a possible subject.

School principals

Principals were selected from all school types present in the region, both urban and rural, and invited to take part in the discussion group. In total twelve principals were invited to attend. The discussion group consisted of five members drawn from the following school types:

- community school, male, urban, 300 students
- community school, mixed, urban, 900 students
- comprehensive school, mixed urban, 520 students
- secondary school, mixed, urban, 1,265 students
- secondary school, female, urban, 600 students.

In addition to the core issues, the perceived impact of a new subject on the school was discussed in respect of the following issues: staffing and training needs; timetabling issues; competition with existing Leaving Certificate subjects; present computer provision, including PLC courses and the LCA programme; resources (including the maintenance and updating of hardware/software); present ICT policy and profile of potential student group.

NCCA education officers

The NCCA education officers were invited to contribute to the discussion as it was felt that they would be abreast of educational change in Ireland, would be familiar with the macro-curricular framework and, hence, would be well placed to comment on the perceived impact of an additional subject. Through their interaction with professional associations and with a broad spectrum of schools and teachers, it was thought that they would express concerns/views held by a majority of non-ICT teachers. Some of those who attended were not second-level teachers and were not current practitioners in the classroom.

While ten education officers were invited to participate, the group consisted of six members representing a spread of subject specialisms. Three were from the broad areas of science/mathematics/technology, one from business studies, one from modern languages and one from home economics. The discussion focused on the core issues of content, form and perceived impact.

Representatives of business/industry

IBEC (Irish Business and Employers Confederation), ISME (Irish Small and Medium Enterprises Association) and the SFA (Small Firms Association) were contacted and each was asked to nominate two representatives to attend the discussion group. In addition, the Cork electronics' school liaison officer was invited to participate. The business/industry discussion group consisted of four members: two representatives from IBEC, one representative from the SFA, and the school liaison officer. In addition to the core issues, the needs of industry/business and whether these needs are currently being addressed, were raised in this discussion group.

Representatives of university computer science department (UCSD)

The head of a third-level computer science department was contacted and invited to nominate members who would represent a cross-section of the department. The discussion group comprised five faculty members, teaching at both undergraduate and postgraduate levels, and the head of department. Areas of specialism included programming, operating systems, systems analysis, relationship between mathematics and programming, computation and musicology. In addition to the core issues, equity and possible student profile were addressed.

A chart containing an overview of all discussion group participants is included as Appendix C.

Questionnaires

In two cases it was deemed desirable to follow up the findings of the discussion groups through questionnaires which were administered to (1) representatives of business/industry and (2) first year university computer science students. In the case of business/industry, the questionnaire served to obtain a larger and more representative sample, while in the case of the third-level computer science students, the questionnaire served to obtain a further third-level perspective from students who had recently completed the Leaving Certificate (established).

Business/industry questionnaire

The main purpose of the business/industry questionnaire (Appendix D) was to validate the findings of the previously held discussion group, with a particular focus on the following key issues:

- perceived need for a computer-based subject, including rationale
- main focus of such a subject in terms of content
- essential ICT skills - as a Leaving Certificate subject or in some other form
- possibility of rapid obsolescence of a computer-based syllabus.

The questionnaire consisted of a number of statements of the findings of the previous discussion group and respondents were asked to agree/disagree with each given statement, giving their reasons.

An electronic database of companies was supplied by Shannon Development, which consisted of a list of all companies with more than ten employees in the Shannon region, a total of 430 companies. The Shannon region consists of Limerick city and county, County Clare, County Tipperary N.R., South-West Offaly and North Kerry. A 25% random sample of these companies was generated electronically and a questionnaire and accompanying letter was sent to each named contact person on the database in May 2001. A follow-up telephone call was made in the case of non-respondents. The final response rate was forty-four, which represented 41% of the sample group. The company size of the research sample and respondent group were both in direct proportion to the total population of the region, as outlined in the following table:

	Total population	**Sample**	**Respondent group**
11-50 employees	64%	67%	68%
51-100	16%	19%	11%
100+	20%	14%	21%

Computer science student questionnaire

The questionnaire administered to first year university computer science students (Appendix E) investigated the perceived benefits to students of the introduction of a computer-based subject at Leaving Certificate level. The questionnaire obtained data on the following:

- subjects studied by the students at Leaving Certificate level
- whether students would have chosen a computer-based subject at Leaving Certificate level, if such a subject were offered
- perceived benefits, or otherwise, of such a subject at Leaving Certificate level in light of their third-level experience to date
- content of such a subject
- possible knock-on effects of a computer-based subject at Leaving Certificate level, in terms of subject dropped.

The questionnaire consisted of both open and closed questions and was distributed to first year computer science students during April 2001. It was decided to use a group-administered approach during student tutorials to ensure a high response rate. A total of seventy-one responses were obtained (approximately 50% of first year computer science students).

School-based studies

Two school-based studies were undertaken to explore the perceived impact of the introduction of a computer-based subject in particular school settings and to examine the issue from the perspective of schools as organisations. Due to the then continuing ASTI industrial action it was necessary to select two vocational schools, where all staff members belonged to the Teachers' Union of Ireland (TUI). In each case data were gathered from: a discussion group consisting of a cross-section of the teaching staff; a questionnaire sent to all members of the teaching staff in the school; a questionnaire disseminated to fifth year students and an interview with the school principal.

Staff discussion group

In each school the principal was asked to nominate staff representing a cross-section of subject areas. The main focus of the discussion group was the likely impact on the school in terms of: possible student profile; other subjects; teachers and teaching, and resources. The discussion group also addressed the perceived need for a new subject plus rationale; the main focus of such a subject in terms of content; the place of ICT in the curriculum; and the possible form and assessment of such a subject.

Teacher questionnaire

Questionnaires (Appendix F) were distributed by the school principal to all teaching staff immediately prior to the discussion group. The main issues in the questionnaire were as follows:

- background data: gender, subjects taught, ICT training or experience
- perceived need for a computer-based subject, including rationale
- willingness to teach such a subject if introduced
- main focus of such a subject in terms of content
- perceived impact on the school.

Fifth year student questionnaire

A further questionnaire (Appendix G) was administered by the principal to fifth year students. The main focus of this questionnaire was as follows:

- background data: access to computers, subjects taken, intentions on leaving school
- perceived need for a computer-based subject, including rationale
- willingness to have taken such a subject, if it were available and the most likely subject dropped
- main focus of such a subject in terms of content.

School principal interview

As with the principals' discussion group, the interviews with the two school principals focused on a number of school-related issues, as well as the core issues of form and content. These included the perceived impact of a new subject on: staffing; timetabling; existing Leaving Certificate subjects; existing computer courses (including PLC and LCA programmes); resources; present ICT policy and profile of potential student group.

Description of schools and participants

School A

School A is a medium-sized (just under 500 students with a full-time staff of thirty-four) co-educational vocational school in a provincial town in the mid-west region. The school offers the Leaving Certificate (established), the LCVP and LCA programmes as well as PLC programmes.

Data on years of teaching experience were available from the staff questionnaire: 21% of respondents had less than five years' teaching experience, with an equal percentage having between five and ten years' experience, 28% with ten to twenty years and 31% with over twenty years' experience. Almost 60% of staff, therefore, had more than ten years' experience; 67% of the male teachers were in this category and 50% of the female teachers. (In school A twenty-nine responses to the teachers' questionnaire – fifteen male, fourteen female – were received, representing 85% of total staff numbers.)

Sixty-one per cent of fifth year students stated that they intended to go on to third-level, with 10% opting for apprenticeship and 29% unsure. (Thirty-four responses were received from fifth year students – twenty male, fourteen female.)

ICT resources

The school is well equipped in terms of computer resources, with two computer clusters, each with twenty networked multimedia machines, all with internet access. There is a further, smaller cluster, also networked and with internet access. Major improvements have been made since 1995, when there were approximately ten

computers (386s) with limited usage. Two computers are available in the science classroom, plus one in the library for administrative purposes. The school has an Integrated Services Digital Network (ISDN) line but with one channel only, which diminishes speed of access. Peripherals include: one scanner; five printers; two data projectors; two webcams and a digital camera. Software available includes: word processing; spreadsheet; desktop publishing; accounting and Autocad, as well as web design; encylopaedia; creative writing and biology packages.

Current use of ICT

All computer rooms are heavily booked both during the school day and at night. One of the large computer clusters is used for PLC work, with a strong focus on keyboarding/secretarial skills. The other large cluster is available to Junior Certificate and Leaving Certificate programmes. All first year students take an introductory computer skills course of approximately six hours during the year, with students withdrawn from other subject classes. Second year business students have a few sessions at the end of the school year. The other main users are Transition Year students engaged in projects and applications work. LCVP students also use the clusters as part of their programmes. These sessions are mainly staffed by the business and computing/ICT teachers. This cluster is also available if pre-booked for approximately fifteen periods a week to *all* teachers. Irish, French, materials technology (wood), technical graphics, science and mathematics teachers use the facility most. At times computing/ICT teachers support non-ICT teachers during these sessions. The cluster is timetabled for staff internet use twice a week. Students have access to the internet for an hour once a week after school and at various other times during computer classes. The school has its own web site.

The school is a recognised centre for the ECDL programme, National Centre for Technology in Education (NCTE) courses (*Schools IT 2000* Phase 1 and Phase 2, both primary and post-primary), Intel *Teach to the Future,* night classes, FÁS courses, and Vocational Training Opportunity Scheme. The school is also involved in a wide range of computer projects, including a Transition Year newsletter, a nutrition project incorporating Powerpoint, the internet project *Spin-a-Web* and a computer club.

The school has an ICT plan but there is no post of responsibility for ICT. The ICT co-ordinator spends a great deal of personal time maintaining and upgrading computers and, in the absence of a maintenance contract, undertakes all technical requirements.

Staff members rate themselves highly in terms of ICT skills and training. Questionnaire data illustrate that almost half of the staff rated themselves as having very good or good current ICT skills, 35% rating themselves as average, 14% giving a self-rating as poor and a mere 3% rating themselves as very poor. Almost two-thirds of the staff have completed Phase 1 and Phase 2 in *Schools IT 2000,* at least. Only three staff members (all with less than three years' teaching experience) reported that they had no relevant ICT experience, with a further five members having completed Phase 1 only. Ten of the staff attended the Intel *Teach to the Future* course, which was offered in the school and facilitated by a member of staff. Three of the staff have postgraduate qualifications in ICT.

Questionnaire data from the fifth year students (thirty-four students) on student access to computers revealed that over 70% had home access to computers, with 79% of this figure having access to the internet; this means that more than 55% of the respondents had home internet access.

Research subjects in school A

In school A teachers of the following subjects participated in the discussion group:

- business studies, accounting and computers
- ICT and business studies
- mathematics (also the deputy principal of the school)
- physics
- modern languages, English, history
- construction studies, technical graphics, mathematics and computers
- guidance and counselling.

School B

School B is a small rural vocational school with approximately 350 students and twenty-four teachers. The school offers a range of subjects at both junior and senior cycles. These include: chemistry; biology; history; geography; construction studies; engineering; technical graphics; art; home economics; business studies; music and applied mathematics. The school provides the LCA programme and the LCVP in parallel with the Leaving Certificate (established) programme. It has a high proportion of young teachers: 25% of the staff surveyed have taught for five years or less, while 37% of the staff have been teaching between ten and twenty years. Of the twenty-four staff, eleven are male and thirteen are female. (Seventeen responses to the teacher questionnaire were obtained, representing a 70% response rate – ten male, four female, three gender not specified.)

Of the students surveyed, 56% were male and 44% were female. Eighty-five per cent of those surveyed intend to continue their studies at third-level. (Forty-two questionnaire responses were received from the fifth and sixth year students – twenty-three male, eighteen female, one gender not specified.)

ICT resources

The school has one PC cluster room containing approximately twenty computers. These machines range in age and specification with some over eight years old. The ICT co-ordinator does not have an official post but is responsible for maintaining the ICT equipment in the school. Presently older machines are used for parts to maintain more modern machines. The engineering room is equipped with one multimedia computer and a data projector, which are used as part of the LCVP Schools Integration Project (SIP). This project enables LCVP students to submit parts of their coursework on an interactive CD ROM to the Department of Education and Science (DES).

In general, the school is poorly resourced in terms of ICT and staff are very aware of these limitations. However, the school will shortly relocate to new premises and is therefore reluctant to invest in ICT resources prior to this move.

Current use of ICT

Computers are predominantly used as part of the link modules in the LCVP and are also used in business studies and technical graphics. As the resources are of a low standard and confined to one computer room, little integration of ICT in other subjects has occurred. Almost half the teachers rate their current ICT skills as

poor or very poor. This is reflected in the number of teachers who had not received any ICT training (40%).

Of the students surveyed, 71% have access to a computer at home with just under half of these (45%) having internet access also. However, teachers in the discussion group felt that home computer ownership was closer to 50%.

Research subjects in school B

The teachers who took part in the discussion group in school B taught the following subjects:

- home economics/business studies
- technical graphics/engineering
- mathematics and learning support
- English/French/CSPE
- science and biology
- engineering
- engineering/guidance counselling (deputy principal).

Principles and procedures applied to data collection

- Participation was generally negotiated by means of a letter sent to prospective participants in advance of the discussion group, or to the school principal in the case of the school-based studies. This letter invited the prospective contributors to attend the discussion group and outlined the background to the research and the issues for discussion at the discussion group. Copies of all letters sent are included in Appendix H.

- All contributors were guaranteed anonymity and confidentiality.

- Permission for audio taping was sought on each occasion.

- Those who attended discussion group interviews were asked to state whether they were expressing their own personal views or those of an organisation.

- The NCCA position in relation to computers in Irish education was presented to each of the discussion groups.

- The discussion was conducted in a non-directive manner, giving research subjects freedom to dictate the course of the discussion in relation to each point on the topic guide.

Limitations and difficulties

A number of limitations and difficulties were encountered by the research team over the course of this research.

The data collection stage coincided with the ASTI industrial action. It was difficult to obtain the co-operation of teachers and schools under such circumstances and this was reflected in the relatively low attendances at some of the discussion groups. The researchers experienced great difficulty in having an optimum attendance at

discussion groups; in several cases numbers attending were considerably smaller than had been hoped. The ASTI industrial action also limited the schools which could be selected to form part of the school-based studies: the staff in both schools were exclusively TUI members and thus only one (vocational) of the four main school types was represented.

The apparent lack of shared understanding of key concepts was evident during many of the discussion groups. Terms used by both researchers and participants such as: computer-based subject; computer science; computer skills; computer literacy; modular; cross-curricular and integration, are all examples where different meanings were held. Given such a lack of shared meanings, it was difficult to ensure that points raised by participants were based on a common understanding of the issues under discussion.

The multiple sources of data yielded many insights and perspectives on the issue of a possible computer-based subject. In compiling the report the researchers were faced with the difficulty of presenting, in a structured manner, participants' viewpoints on the issues and sub-issues discussed. The issues of overlap and interplay between form, content and perceived impact increased the difficulties involved. The authors intend to present the findings in a way that reflects the richness of the data, while at the same time highlighting the key issues.

PART 2

Main findings

Main findings

INTRODUCTION

The findings are presented in four sections.

- The respondents' views in relation to the formal introduction of a computer-based subject to the Leaving Certificate (established) are presented first.
- The perceived importance of basic computer skills for all. While not included among the original research questions, this issue emerged very strongly from the research data.
- The research findings in relation to the nature of a computer-based Leaving Certificate (established) subject, its form, content and assessment.
- The perceived impact of the introduction of a computer-based Leaving Certificate subject on school resources, both human and technical, and on curriculum and students. The issue of equity, which emerged clearly from the data, though not explicitly included among the research questions, is included in this section.

Views on the formal introduction of a computer-based subject to the Leaving Certificate (established)

The perceived importance of 'basic skills for all', because of the pervasiveness of computers, led respondents to stress the importance of putting current computer skills provision in post-primary schools on a more structured and formal basis. There was a general view that basic skills provision for all should take precedence over the introduction of a Leaving Certificate computer subject. Respondents argued that the effective integration of ICT across the curriculum would not happen until students acquired a certain level of basic skills.

In their previous report on this general topic, O'Doherty et al (2000) found that an overwhelming majority of principals, teachers, educational partners, third-level academics and industrialists surveyed felt that there was a need for the introduction of a computer-based subject to the Leaving Certificate (established) programme. The promotion of computer literacy, a phrase introduced by respondents themselves, was the main reason for the adoption of this position. Agreement on the nature of this subject was much more problematic, just as in the present study.

The participants in the present study who strongly supported the formal introduction of computers to the post-primary curriculum, including the Leaving Certificate (established), were not surprised at these earlier findings. As in the previous research, they were far less assured in relation to the form and content of such provision.

Members of the HFE group and parents were strongly in favour of the introduction of a computer-based subject to the Leaving Certificate (established) while NCCA education officers, ICT co-ordinators, UCSD group members and staff in the two schools were generally positive as well. Ninety four per cent of first year university

computer science students considered that a new computer-based subject should be introduced to the Leaving Certificate (established). Some 90% of fifth year students surveyed in the two schools were also very strongly in favour of the introduction of a new subject, while over 80% of teacher respondents in the school-based studies agreed or strongly agreed. More than 90% of the respondents to the business questionnaire, sent to a random sample of businesses in the mid-west region with more than ten employees, believed that a new subject should be introduced.

Asked if they would have taken an undefined computer-based subject *if* it had been available to them as a Leaving Certificate option, some 80% of fifth year students in schools A and B responded in the affirmative. First year university computer science students were asked a similar question and 92% of them said they would have taken a computer subject *if* it had been available at second-level, either because of their personal interest in computers or because they were interested in studying computers.

An interesting contrast emerged between the business/industry questionnaire respondents who were randomly sampled from the mid-west region, and those members of the business/industry discussion group who were identified by IBEC to represent the view of that organisation. While questionnaire respondents were strongly in favour of the introduction of a computer-based subject, members of this latter group were strongly against the introduction of a formal computer-based subject at Leaving Certificate level, although they were in favour of ECDL and the integration of ICT into existing subjects. They expressed concerns that the introduction of a computer-based subject to the Leaving Certificate (established) would deprive students of a broad and general education in an attempt to service the potential needs of business/industry:

> I can't see any argument that would justify the creation of an exam-based Leaving Cert subject in terms of education in the broad sense, and the value of that to industry in the broad sense.
>
> I don't think people should go to schools to become tools of industry, they go to become better or fully developed people, after that they can stream themselves, with some help. However, the life skills element isn't being dealt with properly.
>
> I don't want them to learn the 'trick de jour' to save me one month of teaching them how to do something ... [to] railroad [them] and hijack their education to teach them a skill that is short-term (business discussion group).

One member of the group felt that such a computer-based subject would require a considerable level of depth to make it viable, and that this level of depth is not appropriate for students at the given age and level of development:

> I cannot see ICT as a subject that would rank with core subjects such as languages, maths, physics and biological sciences. It is not a fundamental subject for study but an applied subject. It would not be particularly helpful in developing the mind… Some level of abstraction is needed to make it viable (logic, information theory), this would make it very deep and not at the level of applications.

A majority of the principals' discussion group also expressed opposition to a new subject. While at the beginning of their discussion four of the five principals favoured the introduction of a new subject, only one remained strongly in favour by the end. One member of the NCCA group (also a school principal) was very concerned that a computer-based subject would be elitist. While school principals felt that computers should be formally introduced into the curriculum, the attention should be focused on addressing

ICT skills. Three members of the principals' group, as well as the principal of school A, also had concerns about elitism:

> Will we get the high flyers or the others that are limping along looking for a subject?
>
> I would be very anxious that it would be a subject accessible to students of all levels of ability that it wouldn't just be for the high flyers.

Some research participants expressed reservations about the introduction of an ICT-based subject because of what they saw as the paucity of ICT resources in some schools. Concern was expressed by some teachers that student uptake of other subjects would suffer if a computer-based subject were introduced.

It should be noted that participation in the various discussion groups established for purposes of this research affected the views of individual participants in all groups, most notably in the case of the NCCA education officers and the principals.

However, the overall response was generally in favour of the introduction of a computer-based subject to the Leaving Certificate (established). Certain considerations emerged as strongly influential and kept recurring during the various discussions and interviews. The following points were identified:

- the need to develop students' basic computer skills because of the pervasiveness of computers in society and the workplace. One of the NCCA education officers recalled a similar response when the NCCA had previously considered this issue: 'there is no opinion as to form or content but just a feeling that kids must do computers'.

- the related perceived need for a more planned approach to ICT that would enable formal recognition of existing computer courses, leading to the regularisation of current provision.

- the need to enable post-primary students to make informed third-level choices in relation to computer science and information technology, and to provide an outlet for students with particular talents in the ICT area.

The perceived importance of providing 'basic skills for all' in a planned, coherent manner, involving formal recognition of existing provision, will be developed in the next section. The arguments relating to third-level education have implications for the content of a possible computer-based subject and for students and will be developed in the sections on subject content and impact on students.

Summary

With the exception of the participants from the business and principals' discussion groups and a few individual members of other groups, discussion group participants and questionnaire respondents generally saw a need for the introduction of a new computer-based subject in the Leaving Certificate (established).

The primary reason for the need for such a subject was the perceived need to provide for the computer literacy needs of young people because of the pervasiveness of computers in society and in the workplace. Another reason cited in favour of this development was the need for students to make informed choices about third-level courses. Many participants also referred to the inadequacy of recognition for existing computer courses in schools and saw the need to place these courses on a more formal footing. The need for

a computer skills course at junior cycle for all students was raised in several groups as part of the discussion on rationale.

One of the main reasons against the introduction of a new computer-based subject, outlined by the business discussion group participants, was that ICT skills were basic life skills and should be included as part of general education, and not as a Leaving Certificate subject. These participants also felt that a new computer-based subject would be to the detriment of students' general education and might mean the removal of another more important Leaving Certificate subject.

Basic computer skills for all

Skills for life

The pervasiveness of computers in society was one of the main reasons for favouring the introduction of a computer-based subject. This pervasiveness in daily life and work was seen as pointing inexorably to the need to formalise ICT provision in the curriculum. ICT co-ordinators were to the fore in recognising this inevitability:

> I think it is like a runaway train – I don't think we have a choice really because it has taken up so much of our lives and will do so more and more and more. So I think it is an inevitability (ICT co-ordinator).

> So many people are interested in IT now and see its benefit that you don't have to be an IT teacher anymore to recognise the need for something like that (ICT co-ordinator).

Similar opinions were reflected by the members of the other groups:

> Computers are our future – unless the bubble bursts (parent).

> It is now a required life skill (HFE discussion group).

> Computers and ICT are just new and there is nothing there in the Leaving Certificate as such that reflects that whole area of life (teacher discussion group, school A).

> Because they are in all our lives and becoming more predominant and we need to have the skills (fifth year student, school B).

Almost two-thirds of respondents to the business questionnaire cited the role of computers in society or in the workplace as the main reason for supporting a new subject: 'No matter whether you are a student, professional, housewife or other, everybody should have a basic understanding of computers'.

Many participants in this study considered computer literacy as an essential part of general education and believed this issue should be dealt with as a matter of urgency:

> Computer literacy is a must. An absolute. A computer science subject is then obviously optional – it's a different issue altogether (parent).

> The whole idea is using it as a tool for learning – every student in my school should have a certain level of skills and they need those skills, basic level skills, when they leave (ICT co-ordinator).

The Computer Education Society of Ireland (CESI) policy was cited:

> CESI had as its policy the idea that there should be *literacy* at the end of fifteen + ... but the question was "what is literacy at fifteen +".

Members of the business discussion group saw basic ICT skills as a life skill which needed to be accommodated in some form at second-level, but should not constitute a formal subject at Leaving Certificate level. They drew analogies with driving and the use of the telephone, which they also perceived as 'life skills', but which do not constitute part of the second-level curriculum. Basic ICT skills are seen as being alongside basic literacy and numeracy, and as something that all students will grow up with eventually:

> I think it's an inevitability, frankly, that technology is taken as read. Unless it becomes a form [discipline], it would be my fear that we would end up with a course on telephones, why would we do that?

As already noted, the group members felt that the introduction of a computer-based subject would be to the detriment of students' general education, and would possibly require the removal of something else from the school curriculum to facilitate it.

Preparation for work

More than one-third of the first year university computer science student respondents felt that ICT skills are now essential life skills and a quarter considered that the new subject would benefit students' career prospects. Basic computer skills were seen as a prerequisite for employment by research subjects from most sectors included in the current study:

> Familiarity with a common workplace tool (parent).

> Computers are playing such a major role in almost all jobs today [so] I think students should be more skilled with computers (fifth year student, school A).

> Because computer skills are what's needed for jobs nowadays, plus they are what's making everything work at the moment (fifth year student, school A).

> Computers are playing an active role in all career paths in modern society and any advantage given to students before they enter the workforce is of tremendous benefit (fifth year student, school B).

> Computers are needed in all professions (teacher respondent, school A).

> In everyday business life it is imperative that people are able to use computers (business respondent).

> My business generally employs young people/school leavers with basic qualifications. Most are not computer literate. This subject is a must! (business respondent).

While school-based respondents made little reference to the promotion of national economic well-being, members of the HFE discussion group recognised the economic benefits of such a subject:

> Our economy will live or die on this set of skills. I see this as more important than religion, more important than physics, more important than anything. If we don't get more and more kids to adopt this technology, to go to college and study it further and deliver into the economy, we have horrendous problems.

> I believe that it is desirable from an economic point of view, I think it is also desirable from a third-level point of view and I believe it is desirable from the end user – in other words the students out there will demand it. The market will demand this type of subject eventually.

Economic reasons were also cited by members of the school A discussion group:

> Computing is very much part of Ireland's development and should be included in the second-level curriculum.

Apart from the HFE group members, respondents generally made little reference to the economic arguments in favour of the introduction of a computer-based Leaving Certificate (established) subject.

Members of the business/industry discussion group highlighted the importance of teaching skills that are transferable and adaptable, and which will not become obsolete very quickly. The possible obsolescence of a computer-based subject was one of the main concerns raised by representatives. Skills of adaptability are more valued by employers than specific, non-transferable skills:

> There's a lot of cars around but we don't study cars and how they work. All of what we are talking about will have a different relevance in five years' time. We need to teach transferable skills rather than teaching people how to do one thing.

But the overall response was well summed up by one member of the NCCA group:

> I think that there is a definite agreement that every child in the state needs computer skills as much as they need English and mathematics skills in terms of their general entitlement to education.

This sense of inevitability led discussants to express their views as to how this lacuna might be filled.

When to make provision for 'basic skills for all'

Respondents were most anxious to express their views as to where the need for basic skills for all should be addressed in the curriculum. It was felt that the content and form of any proposed subject would depend on how the basic skills issue was addressed. The NCCA's three strand approach was introduced to group members. Nevertheless, the importance of developing students' computer skills prior to undertaking a Leaving Certificate programme was emphasised by most respondents. Many spoke of the need to formalise and standardise provision of computer skills and knowledge outside or in advance of the Leaving Certificate programme. This would ensure that senior cycle students were capable of pursuing a computer education programme at a more advanced level as well as providing skills essential for the integration of ICT in teaching and learning across the curriculum: 'All the students should have access to some level of ICT pretty much from the beginning' (principal, school B).

Participants in the ICT co-ordinators' discussion group asked: 'are we limited to talking about Leaving Certificate because there is reasoning … [to] suggest that there is a sort of basis in computers which should be taught before that?' All participants agreed with the questioner and spoke about the need to teach basic skills to all students at both primary and second-level education. Recognising that the junior cycle is currently overloaded, participants were of the opinion that students needed 'exposure to computers' at junior cycle and that a computer course during Transition Year might be more easily accommodated within schools.

Many of the school B discussion group participants highlighted the problems at Leaving Certificate level, particularly within the LCVP, as reasons why a skills-based course should firstly be introduced at Junior Certificate level:

> A lot of the computer use requires skills and there are no programmes being followed and what we're all actually trying to do is simply get things done. We've got a project, a brief that has to be typed, we're not concerned about the students acquiring particular skills, we're not even bothered in three weeks' time whether they even remember what we've just done.

> People that typed a letter as part of the LCVP haven't actually learned any IT skills, they just typed up a letter ... they're not gaining anything from it.

The school principal in school A also recognised the problems caused at Leaving Certificate level by a lack of basic skills:

> In terms of Junior Certificate one needs to begin doing the thing properly as distinct from having no programme at all ... At Leaving Certificate level, with more and more projects coming in a range of subjects…. having certain keyboard skills and certain other computer skills would be useful to them.

There was general acceptance in the NCCA education officers' group that the introduction of a new Leaving Certificate (established) computer-based subject is the wrong place to start insofar as ICT is primarily a cross-curricular matter. Members of the group felt that the issue ought to be considered in the broader context of skills' development at primary level and junior cycle:

> One of the models that we always worked with was that the children... should have some basic word processing skills by the end of junior cycle.

> In looking for it to be a stand-alone subject catering for a minority interest it's essential that the life skills element of using computers is in place elsewhere, as we said earlier on.
>
> There was the idea that there could be a modular course in the junior cycle. People could take the modules if they needed them; hopefully they would actually have acquired those skills before they ever came in, maybe they could be tested with or without the teaching, and therefore could get their certification (position of CESI).

Even the strongest proponent of a stand-alone subject in the NCCA group still saw it as: 'essential that the life skills element of using computers is in place elsewhere'.

Members of the NCCA group stressed the importance of guidelines to overcome the current dominance of an ad hoc approach. It was felt by members of this group and others that Transition Year has an important role to play in computer skills and a version of long and short courses was proposed:

> You could investigate the option of it being on … a par with link modules in enterprise education, for example, where the students would get a credit for having done it but it's separate.

The importance of developing skills on an ongoing basis was highlighted by the members of the NCCA education officers' group. As one member put it:

> The skills that people require are going to change. So prior to this I would have thought, "get the skills done by the end of junior cycle, use it as a tool in Leaving Cert and then for those who want it [as] an optional Leaving Cert subject, make it available". But I now accept that you must top up the skills to keep them fresh.

While members of the HFE discussion group were strong advocates of a computer science subject, they were concerned that computer skills would be adequately addressed in the junior cycle: 'I think it is fair then that we can take as a baseline that they will have from the Junior Certificate some basic computer literacy'. They saw room for a separate skills course at Leaving Certificate level that would be appropriate for a broad range of students:

> I would expect that all Leaving Certificate kids would get to the stage where they are au fait with basic computer applications, Word, Excel etc and it is a question then after that of the programming … to ECDL level basically.

Participants in the principals' discussion group also expressed the view that all students should have the right to acquire basic computer skills without having to study computing in depth. In the event of the introduction of a specialised computer-based subject in the Leaving Certificate programme, they argued for the introduction of a common ICT certificate to provide basic skills (separate from the Leaving Certificate).

In the school A discussion group it was again suggested that the skills element should be covered at junior cycle:

> That way they'd have the skills to integrate with whatever project work in the Leaving Certificate Applied or the LCVP or whatever [from] junior level and then [you would] have your optional Leaving Certificate subject in computers where you have your programming element to it, have your theory element, have your architectural element to it, take it deeper down into the whole subject.

Two teachers in school B discussion group who favoured the introduction of a computer science type Leaving Certificate subject wanted a skills-based course at some other level for students not taking computer science.

The absence of a formal skills-based course in Irish schools had a significant bearing on teachers' responses in the school B discussion group where members kept returning to the issue of basic skills. While the concern with basic skills served to deviate discussion away from the focus of the current study, the introduction of an additional Leaving Certificate (established) subject was acceptable to this group as long as provision was first put in place for basic skills.

Overall, this overriding concern that provision of 'basic skills for all' must be prioritised has some important implications for the content of a stand-alone Leaving Certificate (established) subject.

Basic skills as a prerequisite for integration

The argument that basic skills have to be addressed before the integration of ICT can take place was made in a number of discussion groups. Within the NCCA education officer discussion it was agreed that:

> you just can't go the integration route and assume they're going to have those skills. You can't leave it to the modern languages teacher to teach them ICT. The modern languages teacher, or the business teacher, or the home economics teacher, is using ICT to better teach their subject but you can't be sure then that that is going to address the needs of students in terms of ICT.

Another education officer also voiced the opinion that increased levels of students' skills would reduce the barriers to integration across the curriculum:

> I think if there is more emphasis on computer skills among the students that it would actually improve the use of IT in other subjects. As a ... teacher I would be much more inclined to bring my group in to use a programme if I thought that I wasn't going to have to spend five or six classes showing them how to get into the programme to use it in the first place.

All teachers participating in the discussion group in school B also believed there was a need for a computer-based subject; however, all felt that a structured approach to ICT skills was firstly required at Junior Certificate level:

> The reality is when we look at subjects [in which there are] computers at present, it hasn't really worked. Engineering is a clear example, drawing is another one and the reality is that in Junior Certificate, if they could get the basics skills and be brought up to a certain standard, then I feel that integration would be a good idea.

Teachers in schools A and B were conscious of the educational potential of integrating ICT in various subjects but were aware of the conflict between what was desirable and practicable. Without the appropriate student skill base, teachers who currently use computers in their programmes feel that an integrated approach is of little benefit:

> Computers are used a lot in CAD and LCVP. The problem is there's no proper programme involved ... all we're trying to do is to get something done. If there was a proper programme, something structured to follow, students will have an opportunity to learn something. At present they're learning nothing (teacher discussion group, school B).

Some of these teachers believed that ICT use in other subjects would be increased if students were able to acquire basic computer skills: 'It would make engineering much easier if they had skills and access to computers'.

Curriculum planning issues

The need to give recognition to existing computer courses and to place them on a more formal footing was highlighted by several groups. One member of the principals' discussion group expressed the following view:

> I think to some extent we have tried to compensate in education for the lack of such a course over the years, and the introduction of transition year in the nineties gave us some opportunity to incorporate ICT at some level or another into the curriculum. Certainly one of the major difficulties currently is that the pressure on the timetable means that we cannot really give ICT serious time in fifth and sixth year [because] it isn't recognised as a state examinable (sic) subject.

The principal of school B outlined the disadvantages of the current ad hoc situation:

> In terms of junior cycle, one needs to begin doing the thing properly as distinct from actually having no programme at all, just having computers on the menu where one teacher will see that as an opportunity for letting the students play games … and another will see it as an opportunity for developing keyboard skills and another teacher will see it as an opportunity for introducing students to software packages. So by the time you would get to Junior Certificate at the moment, even if they had computer studies as a subject, you would have no way of knowing what they would be likely to actually have learned or covered in it.

> There's no structure to what they're doing. There's need for a structured subject to give the basics (teacher discussion group, school B).

The need to formalise current provision was also noted by members of the business/industry discussion group:

> There is no general direction to what is being done in relation to computers in primary or secondary schools. There is no set programme or formal structure, the ECDL is adopted by some, typing skills have a low profile currently, this should have a higher profile … There is need to create more consistency and evenness on what is being currently done. Computer-aided learning is not being promoted to the extent it should be across subjects. The redesign of subjects is needed to promote this.

Parents would welcome a formal programme as they feel the current provision of computer education is ad hoc and uncertified:

> At the moment it's kind of vague. How good a course a child gets in computer use in secondary school depends on the individual school and how committed they are to this. Every school will have computers, how they actually use them is another thing. So if you had a subject with guidelines laid out, with the curriculum laid out that you could pick various modules from or whatever, but you had a defined thing to be done, then you are sure that all secondary school kids will leave with a certain competency in computers if they have passed an exam in it (parent).

Another parent expressed the view: 'It's already a subject so why not have it recognised in their certificate'. The view was also expressed in the ICT co-ordinators' discussion group: 'needs to be put on a broader footing – to establish a subject'.

A participant in the HFE discussion group cited the need for greater uniformity between schools as a reason for introducing a subject: 'CS [computer science] is now available but only on an ad hoc basis. The more progressive schools offer the subject but others do not. Uniformity of provision [is] needed'.

Respondents tended to associate state examinations with official recognition of what may be already in place. Two-thirds of respondents to the business questionnaire disagreed with the view expressed in the business/industry discussion group that essential ICT skills should *not* be included as a formal subject in the Leaving Certificate (established). The questionnaire respondents were of the opinion that an examination was needed for the subject to be taken seriously:

> It needs to be validated as an exam in order for the subject to receive serious attention.
>
> There should be a Leaving Certificate exam to assess proficiency. Also, in the absence of an exam there is a danger the computer course would be ignored because of the pressure from other subjects.

This view was reiterated by one of the NCCA education officers:

> I also feel, and it's an awful thing to say, but if this is not assessed, if it's a subject and it's not assessed, then it's not going to be done properly or it's going to be very difficult to get it off the ground.

Summary

The primary concern of research subjects was the development of basic computer skills for all young people. The principal factors that influenced them included the perceived need to respond to the pervasiveness of computers in society generally, including work settings, and to afford formal recognition to the various courses currently being provided in schools. However, views differed as to how this goal would be best achieved and as to how and when the relevant provision should be included in the post-primary curriculum. Practitioners felt that the development of basic computer literacy would provide a solid platform for the integration of ICT across the curriculum.

The nature and assessment of an optional computer-based subject in the Leaving Certificate (established)

This section deals with the interrelated areas of form and content of any proposed subject. The researchers asked contributors to give their views on the possible form(s) a subject might take. The discussion process allowed participants to share opinions and expand their ideas and to explore the opportunities and limitations of a variety of subject forms, before ultimately opting for one. Similarly, in relation to the possible content of any new computer subject participants were invited to propose content they felt would be appropriate. The policy of the researchers was to initiate discussion and allow it to develop freely, intervening only to seek clarification or to proceed to a new issue.

Form

The question of form, as to what shape a new subject could or should take was discussed by all school-based participants, whether in discussion groups or in school studies. Given that discrete, stand-alone subjects are the norm on the Leaving Certificate programme, the research group, in consultation with the NCCA, generated a number of alternative types of subject to initiate discussion and trigger ideas (see Appendix A). Some groups discussed these suggested forms in greater detail than others, depending on the willingness of the participants to engage with the material, the time available and the familiarity of members with curriculum issues.

A plurality of meanings emerged from discussions in terms of 'modular', 'core plus extensions' and 'cross-curricular'. In the light of data from the school-based studies, where particular school factors were highlighted, it became evident that the impact of a proposed subject was mainly influenced by whether it was discrete or integrated, rather than by the details of specific options. For this reason it was decided to represent the findings through the two polarities of discrete and integrated, rather than focusing on the specifics of the different options.

Ideal versus feasible

School-based participants were favourably disposed to alternatives to a discrete subject. While their opinions on their preferred form of provision were at times based on their beliefs about the most educationally appropriate approach to take, they were also influenced by what they deemed to be practicable within the Irish setting. For example, with one exception, members of the principals' discussion group favoured an integrated rather than a 'stand-alone' approach,

though it was felt that a discrete subject may be easier to implement in view of teachers' lack of confidence in ICT, i.e. that it would be easier to find one competent teacher than a larger number. As one principal put it:

> Everyone needs ICT as a tool for learning … While we have a base line of skills from Phases 1 and 2 of *Schools IT 2000* we may have to look at the stand-alone due to lack of manpower. But as training develops the ideal would be the incorporation [of ICT] across the board into subjects.

Similarly, although the staff in school B were aware of the potential of a cross-curricular approach, because of the logistical difficulties involved teachers came down on the side of a discrete subject:

> Subjects where computers are at the moment, engineering, it hasn't worked. Integration – it's everybody's responsibility and it's no one's responsibility and it is forced on all the students. Ideally it should be integrated, click into something in history, really bring it to life. This is where computers is at its best. Or in science - but you're flattened by the amount of work you have to do … At present they are trying to teach the kids the skills as well as the tool (teacher discussion group, school B).

Teachers in school A argued for the introduction of a discrete subject as they felt it would be easier to implement:

> You could bring it in as part of all the subjects but you certainly can't see the Department of Education changing all the subjects. Whereas, initially, if it was brought in as an independent subject then you could maybe phase it in with the other subjects, I think.

This was echoed by an ICT co-ordinator:

> This brings us to logistics – how do you now structure a timetable in such a way that a single subject involves a number of modules and six to seven teachers – there's a real problem trying to do that in an already crowded curriculum.

Practical difficulties were also cited by the principal in school B: although he favoured a modular approach for pedagogical reasons, he accepted that greater flexibility is needed within the system before it can be achieved. He also acknowledged that a stand-alone subject with a designated teacher would be an easier form to integrate into schools:

> From a management point of view the single subject standing alone, where you have the IT person dealing with the IT …It would certainly solve my problem to have one designated area.

The recognition and status associated with Leaving Certificate subjects was a further issue raised in discussions on form. Within the context of Irish second-level education, teachers in school A felt that any new subject should be accredited for entry to third-level: 'the big question is, is it going to be a subject that is recognised by all colleges from the word go?'. The awarding of equal status with existing subjects was perceived to be important if the subject were to be taken seriously and appeal to students:

> As I see it, if you want ICT to appeal to everybody, it will have to have a full subject status from the beginning, negotiated in advance … If it wasn't a course in its own right then the danger is it becomes a diffuse course where you have ICT supporting this subject, that subject and the other subject. Then you're really talking about changing the syllabus of every subject to incorporate ICT and not making an ICT subject or a computers subject at all (teacher discussion group, school A).

The issue of subject status is referred to again in later sections of this report in relation to the perceived impact and assessment of a new computer-based subject.

Problems associated with integration

While the educational opportunities and logistical difficulties of an integrated form were discussed by many groups, the NCCA education officers discussed the complexities of integration in detail. In general, they were strongly committed to the principle of integration; however, the group ultimately agreed with the introduction of a discrete subject. Some members of the group came to this decision with great reluctance, while others were more positive towards a stand-alone computer-based subject. During the process by which the group members came to their conclusions participants were alive to the notion that integration is problematic. Initially, they raised the difficulty in defining 'integration' and identified the different meanings it has across the curriculum:

> Sometimes they [people] mean a tool for teaching and learning [that] comes out of pedagogy, sometimes they mean the subject knowledge or skills spread across the curriculum.

Although the distinction between cross-curricular and the 'body of ICT knowledge' came to be accepted, some difficulties remained and while there was a strong commitment to integration, the group members found difficulty in defining the concept. Their discussion explored forms of integration on two basic levels, looking at computers mainly as tools for teaching and learning and, secondly, as modules within existing subjects.

A second problem associated with integration is the identification of subjects that comfortably facilitate integration within their syllabuses. Group members felt that some subjects were more suitable to a form of integration than others:

> There are subject areas [such as business] where teaching "about" information technology is maybe important… Business is the most logical, maybe little bits of circuitry in physics, well they're already there, I dare say.

One education officer was unhappy about the integration of ICT into physics:

> In physics we use computers as tools to measure and the focus is the measurement. In business, computers have actually changed the nature of business, they've changed the process, the action. They haven't done that in physics, it's just made it faster and, while we'd use data logging, I'm not going to be interested in the computers around it.

As can be seen in the previous section, there was general agreement among research subjects for the need to prioritise basic skills for all students. The NCCA education officers' discussion reflected this view and members maintained that the development of basic skills would provide a platform for the promotion of integration. In this context they welcomed the NCCA's three-strand approach: 'I've got an appreciation that … we need all three [strands] and get on with them'. It was agreed that the various options were not mutually exclusive:

> I like the idea that you have integration. You could [also] have the specialist subject, the rigour of the computer science subject …The danger with it is that development of that subject becomes a replacement for something else.

It was felt that the issue of basic skills in ICT has to be seen in the wider context of primary, junior cycle and third-level. There was a realisation that the issue regarding the possible form of a new subject was only the tip of a very large iceberg: 'the task we were given is actually formally opening up a much bigger set of issues about coherence in senior cycle curriculum and integration'. There was a prevailing sense that the introduction of a discrete subject would not constitute an adequate response on its own.

In summary, although many of the participants recognised the potential benefits of an integrated subject, most favoured a stand-alone approach as it was perceived to be the most practical option within the post-primary system.

Content: computer skills versus computer science

As already noted, the research team was aware of the danger of leading the discussion by defining or giving precise descriptions of possible subject content. Although the term 'computer science' was not defined it was generally understood that a computer science-based course would provide a greater theoretical background to the use and operation of computers, including programming, computer architecture and related technologies. Many participants were not familiar with the terminology used in computers and it was felt that detailed definitions would not benefit the discussions. The researchers introduced terms such as 'mainly computer skills' or 'mainly computer science' to represent participants' views. Within the ICT teachers/co-ordinators' group, modules from A-Level computing programmes in the UK (Appendix B) were provided to stimulate discussion. They, as well as members of both higher/further education discussion groups, were asked to give in detail the type of

content they would like to see included within a new subject. While attempts were made to clarify the distinction between a computer skills-based and a computer science-based subject, the lack of clear definitions may have resulted in individual interpretations. Therefore, in the following section the terms 'computer science' and 'computer skills' are used in their broadest sense.

Although there is clear distinction between computer skills and computer science, participants located the content of a new subject on a continuum, ranging from a strong focus on computer science to a focus on the acquisition of essential ICT skills. Participants spoke of a mix of both skills and science *along* this continuum, moving from one focus to the other, while a number of participants favoured a blend of both elements.

Mainly computer science

Respondents from outside of the school sector were more in favour of a computer science type subject than school-based participants. Parents, while advocating the introduction of an ECDL type basic course for *all* students, also favoured the introduction of a computer science subject. Over one-fifth of members of the business/industry community who responded to a questionnaire suggested that a new subject should be mainly computer science or a blend of computer science and skills.

These respondents identified a computer science approach as providing greater depth for a *minority* of students:

> If you introduce difficult subjects it may eliminate the students.

> Only those with a future interest in computer science would benefit from this detail, whereas all students would need some level of keyboard skills and application literacy (business respondent).

The four members of the HFE group favoured the introduction of a computer science subject, provided the broader ICT needs of students were addressed in a planned, co-ordinated manner. All participants agreed that the subject must be a 'hard-nosed subject' in order to be classed and weighted similarly to other Leaving Certificate subjects. Some questioned whether this could be achieved within a two-year period. Others argued that the resources and training needed to deliver such a hard-nosed subject would not exist and that the course could become 'fluffy':

> It needs to be a hard-nosed programme which I don't believe will be delivered. I think it will be a soft, easy, watered-down subject and when it's delivered it will be all over the place … I don't want to sound cynical, what's going to happen is it is going to be under resourced, it is going to be under managed from a training perspective, and it will get too fluffy (HFE discussion).

The HFE participants were very much against a broad course that would attempt to incorporate into one subject, the skills, applications and theory of computer science:

> If you start talking about woolly subjects that are "reader's digest" treatments of stuff, I will walk away, it will be just a total waste of effort. It has to be a real subject.

Members of the group felt that the content should be similar to a first year course in third-level computer science. This would ensure consistent standards entering third-level courses: 'some of the stuff we do in our first year courses down into second-level in response

to economic needs'. It was accepted by the group that a new subject should have a large programming focus, a substantial practical element (as high as 50%) and be platform independent. It should also have a strong communications component with theoretical and historical aspects.

The UCSD discussion members agreed that a Leaving Certificate programme should *not* be limited to underlying concepts and scientific content but should focus on skills and applications as well. While one member advocated a subject that would be fundamentally theoretical, most of the other participants favoured a broader blend of theory and practice. All members of this group considered that an introduction to programming should be included: 'I think there should be an introduction to programming … mainly as an illustration for the young people of how we actually control this hardware'. The importance of computer communications, networking, problem solving, data representation, algorithm design, the history of computing, and the social implications of computing were suggested as possible components of a subject.

Some participants of the UCSD discussion group considered that a new computer-based subject should be called computer science, though more participants favoured computing or computer studies. The term 'computer science' was seen as slanted too much towards the theoretical, with a focus on *mastery* of a limited set of concepts, whereas computing would have a strong emphasis on *awareness* of the different issues surrounding computers.

The NCCA education officers felt that the new stand-alone subject should go beyond skills to include its own 'body of knowledge'. This would include programming as a basis for taking ICT at third-level even in areas such as multimedia:

> You've got those students of that age [who would like] some programming, some analytical logic and networks, some basic nuts and bolts of computers that they're actually realising what is software, how is it constructed, that the machine is a lot more complicated, how the thing works. I certainly would see it in that way. That's probably due to my background in exposure to computers …. if you're going to engage with computers in multimedia you still end up having to programme, you still end up having to know how the machines work (NCCA education officer).

Blend of computer skills and computer science

The possible content of a new Leaving Certificate subject provoked considerable debate in the teacher discussion groups in both school studies. The relative merits of a skills-based programme, compared with a more theoretical approach, were raised. In school A the general consensus was reached that any new programme should include both skills and theory. In school B teachers highlighted the need for both theory and project-based work. However, responses from the staff questionnaires from both schools suggested that teachers tended to favour a computer skills subject rather than a computer science subject.

When asked about subject content, ICT co-ordinators placed emphasis on applications (word processing, database, spreadsheets, desktop publishing, internet etc) followed by practical tasks such as installing software, file management and troubleshooting. While there was mention of the history of computing, the future possibilities of ICT were generally viewed as more relevant. Some participants focused on multimedia, including animation and graphics, web design, game design, audio and video:

> If it [the course] is multimedia I would say yes go for it – if it is not multimedia, if it is going to be programming Java, all this kind of hard stuff, I think it has no place in the curriculum. The whole idea of multimedia is so creative – it's such a wonderful area – students can develop such good skills. It involves packages, and even the weaker students would be able to do it – develop their own project, present their work, I think that it would be a wonderful thing for them. But I have very big reservations about programming (ICT co-ordinator).

While this participant expressed strong reservations about programming and it was also clear that ICT co-ordinators' levels of expertise in programming varied considerably, there was general agreement that some programming should be included. Programming was not, however, seen as a priority. When the group was asked to comment on the possible inclusion of topics currently on A-Level computing programmes in the UK (Appendix B) they rejected much of the material as being too specific and unattractive for students:

> Looks as though this has a heavy programming content ... it's just the application of some of this content at second-level, even at Leaving Cert level, is unrealistic ... if you go overboard on database theory you will kill the subject.

Some ICT co-ordinators felt that a heavy emphasis on theory and programming would have a negative impact on student participation rates. One participant in the school A discussion group considered that while the subject should include both theory and skills, an apparent emphasis on theory would affect likely student numbers: 'If you give it the title "computer science" I think the students are going to perceive the subject as being a difficult subject and the take-up may not necessarily be there'. One NCCA education officer

was pragmatic about the perceived difficulty of a new subject and the resultant impact on uptake:

> If there is a computer science type subject it's likely to involve problem solving and applications. Such subjects tend to be hard. They therefore don't produce high points, except maybe for those with gifts in the appropriate direction. I think there would fairly soon be the perception that this wasn't a subject that just anybody did but rather catered for the special needs and gifts of perhaps a fairly small group – I think we probably all accept that.

Although one school principal was in favour of a 'hard-nosed technical subject' this view was not generally shared. While principals agreed on a blend of computer science and skills, a fear was also expressed that one subject would not be able to contain both foci:

> You're asking too much from this subject – to be on the one hand a specialist subject and then on the other hand to be a framework in which people learn the importance of IT and social settings …and how you can use it in your everyday life and all that kind of thing, you wouldn't ask that of physics, you wouldn't ask it of chemistry (principal).

There was a general acceptance by contributors that any proposed subject would have to find a balance between computer skills and theory within its programme. A subject completely focused on computer skills would not constitute a body of knowledge worthy of accreditation at Leaving Certificate level:

> If you make a programme entirely skills-based what you're looking at then is a course that would be similar enough to what the ECDL are offering … there is absolutely no way that [it] could possibly ever be a full blown Leaving Certificate subject (ICT co-ordinator).

This view was reiterated by parents:

> The time element, the input in ECDL is very small over a two-year Leaving Certificate course, it's about thirty-six hours (parent).

> I would probably say that the ECDL is so basic that our kids would have it already (parent).

Staff of school B, while proposing that a new subject should develop students' computer skills, acknowledged that some sections of the student population would not be interested in, or capable of, progressing beyond an elementary skills base. They became conscious of the unacceptability of this limited approach as the basis for a credible Leaving Certificate subject and suggested a possible solution documented below:

> If it's skill-based you'd wonder could you weight it as much as other subjects? Could you justify giving it equal points? … If it's a very scientific subject you're going to limit it to the number of students going to third-level, which might have very small percentages which would have a very expensive resource. But I feel that would give it the weighting to see it as a Leaving Cert stand-alone subject. On the other hand if you leave it as a more applications open-based, open course, more accessible, you get more students, but how can you call that a similar course to Leaving Cert maths?

> Any subject can be offered to any student at a higher or lower level.

> Computers should be a core subject like maths and offered at three levels, at Foundation, Pass and Honours.

> What would be wrong with having your computer science and skills subject alongside it? Science is branched at Leaving Cert, physics, chemistry. Why not branch it? Two subjects, at different levels? (teachers' discussion, school B).

Within a stand-alone subject teachers were willing to accept a number of parallel programmes, designed to meet the needs and interests of students at various levels of attainment.

Obsolescence

The view was expressed in the ICT co-ordinators' discussion group that balance should be achieved between the theoretical aspects of ICT and practical skills, particularly in view of the rapidly changing nature of ICT which would make current requirements for computer skills obsolete in a very short period of time:

> Because *changes* happen so rapidly in IT that it can render the skills that we might value highly today a bit obsolete next year or six months' time. And it happens here more than any other particular subject. That's a difficulty with zoning in on the practical skills element and defining our syllabus according to those. I think the balance, then, has got to be right first. And I feel a bit cagey about specifying the skills element as the core part of the programme (ICT co-ordinator).

Fears in relation to obsolescence were also expressed by the NCCA education officers. They felt that constant review was required to guard against syllabus obsolescence. Principals were equally concerned about the changing nature of computers:

> The trouble is it's changing every week. Even in the world of computers now, what was the latest and greatest yesterday is going to be out of date tomorrow. So what you put into a syllabus of specialist knowledge is going to be out of date very shortly. So should you try to keep it up to date and relevant? But I would worry that the system just wouldn't cope with that (principal).

Similar ideas were expressed by the participants in both school studies. In school B the principal felt that if computing were to become a stand-alone subject it would need to focus on the fundamentals of computer science, which remain constant:

> I think, in terms of having a safe subject, it is likely to be dull and boring because the content of an exciting subject will be fluid and will change as the technology changes. The science will remain static (principal, school B).

The possible obsolescence of a computer-based subject was a primary concern of the business discussion group. This group rejected the use of school time for 'training' pupils in current computer software in preference to giving more emphasis to existing subjects which provide for a broad education. Respondents to the business questionnaire did not share the concerns of the business discussion group. Almost two-thirds of respondents disagreed or strongly disagreed with software obsolescence as an obstacle to introducing such a subject stating:

> In all probability it would, but it should not be beyond the bounds of the profession to keep abreast of such developments – the basics won't change.
>
> Technology is rapidly changing, but this could be reviewed at appropriate intervals.

Another issue raised was that *all* syllabuses need to be constantly updated and that flexibility was important: 'The design of the syllabus, or any other syllabus, must be flexible enough to cater for updating and revisions as things change' (business respondent).

Assessment

Several participants stressed the need for assessment in order to give the subject sufficient weight and standing: 'unless it can be assessed it is really of no benefit other than just a flavour of something' (parent); 'it's essential that it's assessed ' (parent). A similar view was expressed by respondents to the business questionnaire: 'It needs to be validated as an exam in order for the subject to receive serious attention'; 'they should be formal subjects in the Leaving Cert which should be scrutinised by examination ' (business respondent).

This view was echoed by some of the NCCA education officers: 'I also feel, and it's an awful thing to say, but if this is not assessed … then it's not going to be done properly'. This view was endorsed by another member of the group who stated: 'for students to devote time to that in senior cycle it's got to be both assessed and credited in some shape or form' (NCCA education officer).

Types of assessment

In response to an open-ended question on assessment, just over half of the staff respondents in school A favoured continuous assessment, followed by: 'a combination of theory and practical/project plus formal exam' favoured by about one-quarter of respondents, with a much smaller number favouring examination only. Possible approaches given included: 'continuous assessment in the form of project', 'some project work', 'problem solving using computer'.

There was support within the school A discussion group for a modular approach: 'So I would be going along with [N] that it would be stand-alone, it would be examined and I think you would have an accumulation of credits'. Another participant suggested:

> It could be done over a two-year cycle, if you had your skills in year one and theory in year two. You're sharing the use of your resources as well, or the access that you need. It's an option. Again, I would still think that you should have a written-based and a skills-based assessment (teacher school A).

There was a general feeling among these teachers that the introduction of a new subject might be a time for a review of assessment issues: 'As it's a new subject it might give the whole area of assessment a whole new meaning. There are problems about that that need to be addressed'.

In school B teachers proposed a variety of forms of assessment. The majority favoured continuous assessment while others proposed an 'exam only' type assessment, a theory and practical-based assessment, and *all* practical assessment. Teachers in the discussion groups also felt that it could be assessed in a number of ways.

Project/portfolio assessment

Project work was seen as important by participants in the NCCA education officers' group, the ICT co-ordinators' group and the discussion groups in the school-based studies:

> I would envisage the assessment of a subject like this being at least in part through project work and that, for example, a student might design a learning package in a certain subject area using quite a lot of skills (NCCA education officer).

> You can say to your students … you can take it in music, you can do it in science, you can do it for English you can do it for Irish, but you must produce then a finished product, maybe a web-based project, a video, or something along those lines (ICT co-ordinator).

The principal in school A considered that it was crucial that the assessment be assignment-based though he expressed concerns about the disruption caused to schools by this mode: 'It should not be examined on paper'. He also suggested that examinations should be put on the web and referred to the use of the NCVA modular structure which provides the option of taking modules depending on one's needs.

Although the project/portfolio approach was seen as valuable, ICT co-ordinators anticipated practical difficulties in this:

> Any portfolio would have to be externally moderated, certified by the school, with the school stamp standing over it. It's not an ideal solution – but at least it's a halfway house.

ICT co-ordinators expressed fears in relation to digital plagiarism and the possibility of: 'presenting someone else's work for assessment'. It was suggested that: 'there should be a possibility for an interview – even if they are externally assessed, the children can still get somebody else to do the project'. It was agreed that the existing project/portfolio model for the LCA programme could be applied.

One ICT co-ordinator considered that the danger of obsolescence would present difficulties in terms of practical assessment:

> I am very well aware of the very real difficulties of trying to assess a subject based on IT – it's a nightmare – when do you draw a line in the sand and say up to this point we'll assess and beyond it we won't continue to assess, having regard to the software changes mentioned.

The amount of work for teachers involved in project work and the impact of such projects on the school was a concern for the deputy principal in school A:

> I shudder when I hear any more subjects that are going to be examined by having project work and practical work because the amount of hassle that goes on – for the last week … they're preparing projects in construction studies, in engineering … as if there was no tomorrow, they have no maths, no Irish, no English, they don't come to class, and this I would fear would turn out to be exactly the same thing again, and I would oppose it on that ground. I would oppose any subject that introduced more project work.

The extra burden on teachers due to project work was reiterated by another school A teacher, who stated that this assessment should be regulated by the Department of Education and Science, rather than by the school, as this would make administration easier; this participant also pointed out that the paperwork involved in the Leaving Certificate Applied was extremely onerous and not

welcomed by teachers. Overall, the message from the school A discussion group was that a new approach to assessment would be required, with more emphasis on a continuous modular-based/project approach; however practical issues in the implementation of such an approach would make this problematic.

Summary

While many of the participants recognised the potential benefits of an integrated subject, most favoured a stand-alone subject as it was the most feasible option within the post-primary system.

There was no consensus regarding the content of such a programme: parents and some third-level participants favoured a computer science approach, while principals, teachers and some third-level participants and business questionnaire respondents preferred a broader computer studies subject, with a strong emphasis on practical skills as well as on theory.

Concerns were also raised regarding the possible obsolescence of such a programme and the need for constant updating of content.

Several participants stressed the need for assessment in order to give the subject sufficient weight and standing. It was felt that this form of validation/accreditation was needed to ensure consistency and enable the subject to 'take off'. Several types of assessment were suggested, including continuous assessment and modular assessment; however there was consensus that assignment based/project based assessment with practical elements was required in this subject. Portfolio assessment was also suggested by participants.

Perceived impact

The responses of principals, teachers, NCCA education officers and, where relevant, students, all revealed that the introduction of a new computer-based subject would have a considerable impact on computer resources, on the human resources in the school, on curriculum and on students. The responses from the school-based studies are of particular significance, representing as they do the realities of school life.

The findings are presented in terms of perceived impact on school resources, curriculum and issues affecting students, such as equity and informing third-level choice.

As can be seen from the previous section, the resource implications vary, depending on the preferred form and content. For the purposes of this section, the main focus will be on the perceived impact of a discrete subject. It emerges that the content of such a subject also has significant resource implications.

Perceived impact on school resources

A new computer-based subject was seen as having a major impact on resources, no matter what form this new subject would take. The resource implications are discussed under two main headings:

- computer resources
- human resources – implications for schools.

Computer resources

Teachers in both school-based studies considered that computer resource issues were crucial. In response to an open-ended question on possible problems arising in the school in implementing such a subject, more than half the staff respondents in school A cited 'resources/access to computers'. Such issues included: 'lack of facilities'; 'not enough hardware/PCs'; 'lack of room'; 'poor quality internet connections'; and 'resourcing maintenance', with the interlinked question of 'availability of computer room'. Only one respondent stated that the computer resources already existed, with adequate access, and that timetabling would be the only issue. Respondents in school B cited resources, difficulty in funding and access as the most problematic issues.

These views were confirmed by the discussion groups in both schools. In school A it was generally agreed that this new subject would impact on computer resources, particularly if students were required to undertake computer-based project work as part of a new Leaving Certificate subject. School B teachers recognised that such a subject would increase the levels of use of the computer room in a context where computer resources were currently insufficient to facilitate such a subject. As school B is awaiting the construction of a new dedicated computer room it had not invested in recent times in up-to-date computers. The principal felt that the school required at least two new computer rooms to run such a subject successfully within the school without affecting current levels of use.

There was a general agreement in the ICT co-ordinators' discussion group that it would be very difficult to bring in such a subject within the framework of existing computer resources:

> In terms of existing facilities, as far as my own situation is concerned it just couldn't be on. You couldn't fit one period in for fifth and sixth years at the moment.
>
> Very difficult to perceive how this could be worked within the famous Department concept of within existing resources.

The principal of school A described the setting up of an ICT room as 'ferociously expensive'; the cost factor was also a concern for the school B principal. In contrast to these views, most members of the principals' discussion group were much less concerned about cost and computer resource implications of a computer subject. For example, one principal pointed out that: 'it costs £50,000/60,000 to fit out a [computer] room … that wouldn't buy half a lathe … it's not enormously expensive.' However, principals also considered that they needed expert advice before spending large amounts of money at the set-up stage. One principal also expressed the view that a new computer-based subject might necessitate a second computer cluster.

The fact that schools A and B are small to medium-sized vocational schools in mainly rural settings, while the members of the principals' group came from large, urban schools (some recently built) may help to explain this divergence of views.

These computer resource implications were clearly related to the content. Where the main emphasis was placed on theory, access to computers was perceived as less problematic:

> Of course it would put demand on your existing resources, there would be some demand, but I would think that it might put less demand than the LCVP does

> at the moment because all that has been discussed – computer architecture, that's a theoretical subject; programming – anyone that writes programmes knows that the last thing you do is sit in front of a computer to write a programme because it's one sure recipe of it never working (teacher discussion group, school A).

> If we just look at all the topics that might be on the course, how many of those do you actually have to be sitting down in front of a computer for? (teacher discussion group, school A).

Human resources – implications for schools

Availability of suitable staff to teach a new computer-based subject was a key issue. For example, one NCCA education officer made the comment:

> I'm not 100% sure that you wouldn't have a problem with [getting] specialist teachers in. I know some schools would be able to offer the option but I'm not quite so sure that it wouldn't be a problem.

Respondents' views in relation to staff availability varied considerably, depending on the possible *content* of a new subject, and on whether this subject would be taught by *one* ICT teacher, by a *small* group of ICT teachers in a school or by *many* different subject teachers across subjects.

Availability of staff to teach a new computer-based subject

Teachers' perceptions of their own ability to teach the subject varied considerably depending on the content. While seven out of the twenty-nine teacher respondents in school A and three out of the seventeen teacher respondents in school B felt prepared to teach a programme where the main emphasis was on skills, the situation was different when they were asked about providing a more theoretical programme.

The staff questionnaire administered to teachers in the school-based studies asked teachers about their ability and willingness to teach a new computer-based subject. The reactions of school-based respondents to providing a mainly skills-based programme will be considered first. More than two-thirds of school B staff respondents felt that the expertise to teach such a subject was present in the school. However, only one fifth of these expressed a willingness to teach the subject themselves, with the remainder unwilling to teach it, for reasons to do with lack of qualification and/or in-career development.

While all respondents to the staff questionnaire in school A considered that the school had the teaching expertise to deliver a computer-based subject, their comments revealed that they saw this programme focusing mainly on computer skills, rather than on a hard-nosed computer science subject:

> Most staff have completed IT 2000 stage 1 and 2 and the Intel course.
>
> Yes it does [have the expertise] – all teachers have [undertaken] the Intel course so all would now know how to teach computing (teacher respondent, school A).

One respondent expressed some reservations: 'to begin with yes – as subject gets established need to train others'.

Almost two-thirds of school A respondents expressed their own willingness to teach a computer-based subject, though some of these considered that they needed further training. Of the one-third who were unwilling, many mentioned lack of training or qualifications. Five teachers who were already teaching ICT said that they would love to teach the subject, one of whom added that she: 'would not have a problem teaching the computer skills [but] would prefer not to teach computer science'.

The limitations of what a questionnaire can glean were highlighted in the course of the group discussion in school A. Group members agreed that if this new subject were to include both skills *and* theory, the availability of suitably qualified teachers would be problematic. Participants were in agreement that no *one* member of the current staff could teach *all* aspects of such a subject. Observing that: 'schools at the moment do not have suitably qualified people to deliver such a course in general', staff in school A expressed concerns as to how graduates in computing could be attracted into teaching in the climate prevailing at the time (May, 2001).

While the discussion in school B focused almost exclusively on provision of a mainly skills-based programme, the school principal felt that he could not staff a course that was predominantly based on computer science.

The difficulty of finding staff to teach all aspects of a new computer science type subject was echoed in the principals' discussion group, whose members were dubious about the availability of computer graduates with postgraduate teaching qualifications to teach in schools. Some of these principals dismissed the possibility of a discrete computer-based subject on the basis of difficulty in recruiting staff:

> It's very hard to find a person with all those skills ... unless you're going to have a whole teacher training programme that won't allow the subject to be introduced for six years. I would think that the modular approach might be best (principal, discussion group).

Content and impact are therefore inextricably linked when one comes to consider staffing implications. Based on the data from schools A and B, doubts expressed by several research subjects about the availability of specialist teachers would appear to be well grounded.

In-career development needs

Relevant in-career teacher development was seen as essential by many participants: in an economic environment where ICT graduates are highly employable it was considered necessary to up-skill current teachers, rather than expect to recruit new staff. It was suggested that a nation-wide teachers' skills audit within the existing teacher population would have to be undertaken to establish the viability of any computer-based subject and any new programme should be predicated on the results of such an audit.

In both school-based studies concerns were expressed about how provision for in-career development would be made. In the discussion group in school A, for example, it was felt that this could not be done through the present approach to in-career development, where teachers are removed from schools to train other teachers. The deputy principal suggested that the only way to undertake such training was to pay teachers to do a postgraduate programme during the holidays:

> So far, at the moment, when something new is introduced people by and large train themselves or seek training. It costs them both personally and financially whereas maybe for *once* the Department would decide, okay we will run a proper graduate diploma or whatever is required and you'd need at least that level … we will *pay* people to attend it … For *once* the Department should hold their hands up and say: "this is going to cost us but we're going to do it".

If these conditions were met, the deputy principal believes that: 'you would probably have a problem stopping people coming. And not for the money, they would love to do it'.

Teachers in school B expressed concerns in relation to current forms of in-career development:

> The Department would need to get its act together and give us in-service if it's to be done properly.
>
> Teachers need to be trained. They're self-taught. There's some in-service but that's a joke.
>
> Resources are needed to get teachers to a decent standard, two or three days' in-service is a joke.

The NCCA education officers considered that the introduction of a stand-alone computer science subject was less problematic than an integrated approach, from an in-career development point of view:

> If an integrated approach to ICT education were to be adopted then this would require that many teachers within each school be equipped with basic computer skills. This would involve significant investment in teachers.

Concerns were also raised as to how such in-career development would be staffed: 'who is going to train the teachers to be involved in it?'

Maintenance/technical support

Principals, ICT co-ordinators and teachers in both schools raised their concerns about maintenance and the need for technical support.

ICT co-ordinators were acutely aware of the necessity of providing technical support for schools. At present they generally provide basic technical support within their schools:

> Look at the whole technician area at the moment – I'm very stretched as the IT person in my school … there isn't a contract to maintain it – it's very much down to the school … who's responsible – who's going to fix it?

ICT co-ordinators considered that the provision of computer resources alone was not enough to facilitate a new subject. These resources would have to be maintained and updated:

> Maintaining it, that's the difficulty. When times are good people can agree to doing it, but when three years' time comes it could be completely different. And we're talking about a subject then that will flounder with obsolete equipment. And as time moves on and the Department isn't able to support it, the replacement and upkeep of that, it could mean the death of the subject.

Principals also recognised that the introduction of such a subject would have an impact on the technical support required to maintain the computers.

> We cannot expect teachers whose job it is to teach to also be IT managers and technicians … nor can we expect out of our own budgets to take inordinate maintenance costs on these things which we don't do with any other subject.
>
> The big costs are about managing and maintaining the system.

Maintenance/technical support was seen as a major implication of a new subject in both schools. In school B the teachers felt that this problem would be further exacerbated by the budgetary constraints of a small school. School A was comparatively well equipped in terms of computer resources; however, maintenance was already a highly demanding task for the teacher who undertakes the main technical support, involving time after school, including mid-term breaks and holidays. Further technical support would be required to facilitate the implementation of a new subject.

Perceived curriculum implications

Two main areas were identified and discussed:

- curriculum overload/timetabling
- perceived impact on subject provision allocation and choice.

Curriculum overload/timetabling

Curriculum overload, with resulting difficulties for timetabling, was seen as a problem associated with the introduction of a new subject to the Leaving Certificate (established) programme, regardless of whether a discrete or integrated form would be adopted.

The difficulty of timetabling another Leaving Certificate subject was raised in the school-based studies. For example, more than one-third of staff respondents in school A cited curriculum overload and timetabling as likely problems: 'overloading of the timetable'; 'there is only a limited number of subjects a school can offer'; 'no place on timetable for another option'. Parents also acknowledged this problem: 'Schools can only cope with so many subjects'. The alternative view was also put forward: for example NCCA education officers felt that, within a context where already a large number of subject options exist at Leaving Certificate, the inclusion of one more subject would not be an issue.

Concerns relating to curriculum overload and timetabling were not confined to a discrete subject. Some discussion group members who favoured an integrated approach considered that curriculum overload of existing syllabuses would result. For example, teachers in school B were concerned about excessive demands on their time and pressure within syllabuses if computers were integrated

into their subject or used as a teaching and learning tool in other subject areas:

> I don't want to see it inside my door because the curriculum is so broad it's so hard to get it finished. I do not need more work – I can't finish it in the time I have … I'd be very worried if I heard it was part of my course. It would enhance it definitely, they could use programmes themselves, but I wouldn't let them use them in class time.

ICT co-ordinators also expressed the view that an integrated approach would place heavy time demands on them: 'is the IT teacher expected to have all the ideas and skills to support the music teacher and data logging in science and all these different areas?'

Perceived impact on subject provision, allocation and choice

Curriculum overload and possible timetabling difficulties are inextricably bound up with questions concerning the perceived impact on other subjects. Staff in both school-based studies were asked whether a new computer-based subject would affect uptake in their own subject areas. The responses in both schools were broadly similar with roughly a quarter of respondents considering that it would affect their subject. Analysis of responses in school A showed that virtually all those who stated that it would not affect their subject area were teaching at least one subject taken by large numbers of students (e.g. English).

The perceived impact on other subjects was explored in discussion groups. Increased competition between subjects was the main reason for considering that a new subject *would* affect uptake in other subjects: 'more subjects to choose from so fewer students taking each subject' (teacher discussion group, school A). 'If my students were to take this new subject they'd have to drop some other subject and that's a huge negative impact on the whole curriculum – and on the

staff' (ICT co-ordinator). The view was expressed in school B that it would be a popular subject: 'students would be mad for it, it would really suit them'.

Teachers in both school discussion groups expressed the view that the impact on other subjects would be heavily dependent on the subject option system within the school (how subjects are timetabled against each other): 'It's all down to the timetabling. An extra subject is going to take from most other areas'. For example, school A operates a 'basket system' with the result that their problem would be:

> what basket to place ICT in … they will go for ICT if they see it as part of their career-path. For students it's a six-year gamble and the old safe reliable subjects might be more tempting (principal, school A).

Views differed on the specific subjects which would be affected most by a new computer-based subject. In school A the deputy principal observed: 'I could see some subjects that are already shaky and I'm talking possibly more on the humanities area, and history is under serious pressure', while the guidance counsellor felt that the more technical subjects would lose out: 'a lot of students [currently] opting for engineering or for both engineering and construction would take either engineering or construction'.

The principal in school B felt that subjects with existing computer applications in the syllabuses would be affected more than others, as he would probably timetable these concurrently with computers:

> I would be very much inclined to think the subjects that would bite the dust here would probably be drawing and business studies. They run at the same time and I could give the excuse that there are drawing packages there and that in the computers they will do CAD at a level and they will do business at a level … so I could actually say to people: "let's get rid of the drawing and lets get rid of the business" and pretend that I'm managing both of

> them within the framework of this new subject … and if it comes to that that is probably what I'll do. … I am clear in my mind that it will kill off at least one other subject.

Members of the principals' discussion group agreed that the introduction of a stand-alone subject: 'will have an adverse effect on minority subjects at the moment'. For example, a principal of a girls' school felt that the introduction of a computer science subject would impact on the numbers taking physics in her school. This view was also expressed in the NCCA education officers' discussion group – the physics representative was clear in her mind as to the impact of a computer subject: 'Any form of a stand-alone [computer] subject would be detrimental to physics'. On the other hand, the physics teacher in school A, who favoured the integrated model, saw benefits for his subject if a computer-based subject were introduced: 'it could help physics because the numbers have been dropping, so at least [participation might increase] if they see some relevance of doing physics as a computing subject as well'.

Perceived impact on students

This section includes a discussion on the profile of students likely to take the proposed computer-based subject, followed by the main findings in relation to two principal issues: equity and perceived impact on students' third-level education choices.

Student profile

Several research subjects believed that student profile would depend on programme content: 'hard to speculate until course content is more specific – a skills-based programme would attract a different section of students to a computer science programme' (teacher respondent, school A). For example, a teacher in school A who favoured a skills-based subject felt that it would be 'good for weaker students' and most school A staff respondents who considered that a

new computer-based subject would be open to all students, regardless of ability, favoured a skills-based approach.

Proponents of a more computer science approach thought that this subject would be taken by a minority of academically able students. During the principals' discussion group the female principal of a girls' school ('I come from the background of a girls' school and computer illiteracy') expressed concern about the elitist nature of a discrete science-based subject – 'it will attract either high flyers or people who are just looking for another subject'.

There was no indication from students, teachers or parents that gender would be a factor in the uptake of this new subject. For example, parents, when asked if they had concerns in relation to gender equity under the umbrella of a new subject, stated: 'We don't think in terms of gender, we think in terms of students'.

Some second-level students in schools A and B and some first year computer science students in one university were asked to identify the subjects they would have dropped, in order to accommodate a new computer-based subject. Because of the strong influence of school contextual factors and third-level entry requirements on the data, the researchers decided not to include these findings.

Equity

While the researchers did not generally introduce equity, it emerged during discussions as a concern. Many groups participating in this research voiced their concerns that the introduction of this subject could exacerbate existing inequalities within and between schools.

Those who emphasised computer literacy for *all* were concerned that a computer science-based subject would be elitist. For example, one NCCA education officer, who is also a school principal, wanted to ensure that the subject appealed to a broad section of the student population:

> [I am] very anxious to draw away from it being a minority subject. It must be developed, if it's a stand-alone subject [so] that it can aim … to get as high a percentage of the cohort as home economics or business or any of the other subjects. I don't think it should be developed as a subject directed only at the people doing honours maths and physics or whatever.

This view was echoed by another member of the group who felt that the subject should be open to anybody who wanted to do it and: 'not just the low percentage who are in the very high bracket of intelligence and learning' (NCCA education officer).

Inequity within schools

Equity concerns relating to computer access within schools focused mainly on the needs of students who would *not* be taking the subject. However, the view was also expressed within the principals' group that access for all, *prior* to Leaving Certificate, would need to be increased, as a result of the introduction of a computer-based Leaving Certificate subject: 'if it was to become a subject. well then you would have to increase the general usage in order to allow people, I suppose, to dabble really, if you wanted to see what could be involved' (principal, discussion group).

Many principals and teachers highlighted the resulting *decreased* access to computers for the majority of students, arising from a computer-based Leaving Certificate subject. For example, concern was expressed by a principal that the introduction of a discrete subject would seriously impinge on access to computers in her school: 'It would mean ten class periods less per week in the computer room for the remaining students, those not taking ICT'. Teachers in both school-based studies also echoed this view; they felt that students not taking the subject would be seriously disadvantaged, particularly if they did not have home access and that

they would be further marginalised: 'It's [students] that haven't got them [computers] that need them more. And we're not catering for those at all' (teacher discussion group, school B).

The principal and most members of the teachers' discussion group in school A were concerned at the likelihood that students taking a Leaving Certificate computer-based subject would receive preferential access to schools' resources:

> It's a life skill, so by introducing it as a subject we shouldn't be reducing the availability for those that aren't taking it as a subject (teacher discussion group, school A).

> Any students coming into the computer room during a free class to get project work done [for current subjects] are the ones that are going to be hit because the computers just won't be there for them. And these are students that won't have computers at home (teacher discussion group, school A).

> The provision of a dedicated room, giving a disproportionate amount of the resources of a school to a class, would have a negative effect on those not taking it (principal, school A).

Many teachers in school B felt that such an expensive resource should not be limited to a small number of students. Their concern was such that they considered that the subject should therefore be skills-based or even compulsory.

Some research subjects also expressed concern in relation to the impact a new computer-based subject would have on students' overall access to ICT as a tool for teaching and learning in other subject areas:

> I think that there would be huge demand on current resources. I think what would happen is that you'd have to start filling up the room for a computer subject, the

> integration of IT in other subject areas would suffer (ICT co-ordinator).

Teachers in school A shared this concern because they believed that the Department would not provide adequate additional resources to support a new subject.

Home access to computers

Many contributors felt that inequity within schools, between students who have and students who do not have personal access to computers would be problematic, even if a school had adequate computer resources.

In school A questionnaire data revealed that seven in ten students had home access to computers, and that in total approximately half of all fifth year students had home access to the internet. In school B students reported similar personal access rates to both computers and internet facilities, although in this case teachers felt that, across the school, home ownership was significantly lower than reported.

Home computer access is already giving an advantage to students preparing project work in other subjects, according to some teachers:

> [In the PLC secretarial programme] you certainly see a discrepancy between the results of those who have access at home and those who don't, from a skills point of view. They have access to practise, to experiment, and they don't have the same fear facing into it either (teacher discussion group, school A).

Similarly, in school B access to computers and adequacy of computing skills is already an equity issue for teachers involved with the LCA:

> It's been obvious to us for a while that if you're out examining Leaving Cert Applied projects that people who have home access to computers are actually achieving higher grades. The same way with the Junior Cert projects. They're actually getting better grades because they have the finances at home to get these things. So that kids that are badly off or in some financially deficient bracket are [losing out] (teacher discussion group, school B).

Given the already existing inequities in terms of home access, teachers and principals felt that the introduction of a new computer-based subject would further exacerbate this problem. For example, the guidance counsellor in school A stated: 'I think we also have to look at the factor of home computers – there's a huge imbalance there between those who have and those who have not'. An NCCA education officer expressed the concern that students from schools in disadvantaged areas might not have computer access at home, and that this might result in the subject being available to 'an elitist cohort'.

Parents were also concerned about access to computer resources for students who did not have a computer at home. One parent, when asked whether the introduction of a subject would improve the situation and lessen disadvantage, gave an unequivocal response: 'How could it improve the situation if they haven't got a computer at home? That is the beginning'. This was echoed by other parents: 'there are so many families who just wouldn't have a computer at home and, unless the government are willing to provide large bias to families who wouldn't have it, it's just not going to happen'.

Some teachers held that the school *should* provide whatever was required for a programme:

> When we ask students to do maths we give them maths books. We ask them to do English and we give them English books. We give them what we perceive to be the requirements of the course. So if a computer is a requirement of the course you just have to give it to them I think (teacher discussion group, school A).

Inequity between schools

As already indicated, the introduction of a computer-based subject will impact significantly on the availability of resources, both computer and human, within schools. Teachers and principals were aware of the current unequal resourcing of schools. One ICT co-ordinator suggested that if a computer-based subject were to be introduced:

> certainly every single school would want to be adequately equipped – there would have to be a level playing field in the sense that you know some schools at the moment I mean – the VEC sector would be better off – and comprehensive and community would be better off [in terms of IT equipment] than the voluntary secondary schools – there would have to be a level playing field and it's not always the case.

This concern was echoed by another ICT co-ordinator: 'You'll have a two-, three-tiered system, schools who can afford it will have the best hardware and will move ahead and you'll have those other schools who just don't. That will be a reality'. The principal of school A was aware of the potential of a discrete, optional subject to promote hierarchies between schools: 'it will be offered in a small number of exclusive schools that can afford this – the material and infrastructure that can go with it. It will … be wonderful for the students that do it'. Parents welcomed a subject: 'on condition that it would be funded. There are a lot of disadvantaged schools'. One parent also commented:

> You can't cater for all those subjects in any particular school, so what will happen is some schools will take it on board as listed and some won't, and you choose your secondary school then to tailor what you think your child might want.

Perceived impact on students' third-level education choices

The introduction of a new, computer-based subject was seen as beneficial to students in making choices for third-level education, on the understanding that the subject included a strong element of computer science and was *not* just based on ICT skills. This strong dependence on content was emphasised by staff in school A, who recognised that if a new Leaving Certificate subject focused too much on skills, there was a danger that this would *increase* the risk of students being misinformed about the nature of third-level computing courses:

> The more technology that's introduced to second-level the more the students are getting the impression that: "oh we're *good* at this, we can do word processing, we can do spreadsheets", it still doesn't give them one clue as to what the computer science course in third-level is (teacher discussion group, school A).

The view was expressed in several groups that students needed to be aware of the nature of computer science *before* enrolling in a third-level course:

> I find at […], one of our problems in teaching first year is that we get huge incoming classes, and within two or three months, a lot of people realise, oh this is not what I wanted to do after all. They realise that this is a lot more hard-nosed, concrete, and it takes a clear head, patience, right, than what they had been sold on … I would still be delighted to see it in secondary school, [so] that when they are coming into third-level they could make more informed choices (HFE discussion group).

This view was echoed in the UCSD discussion group: 'From our perspective here, and this is my own opinion, I think a number of students do not realise what it is they are coming into as they do come in'.

The guidance counsellor in school A felt that a new computer-based subject would help students to find out whether computer science would suit their talents: 'It would be maybe a very good filtering mechanism for people going onto third-level to do something that's appropriate to their interests and abilities'.

As well as assisting students in making choices, the opinion was expressed by several participants, including three of the principals' discussion group, that this knowledge about computer science would also help to reduce attrition rates in third-level computer science courses:

> The number of students who sign on for computer courses without any real knowledge of what's involved, there's a huge drop-off and a huge failure rate. The highest failure rates would have been in computer courses or computer-based courses. So I think it is a necessity if our students are to progress.

This same positive feature of a new computer-based subject was expressed by parents:

> I'm thinking of the drop-out in third-level and the choosing of subjects on the CAO form, they don't realise the maths content. If they had it in secondary school, where they're more cushioned, more spoon-fed by teachers … they might know ahead of time the content of the subject at third-level and they mightn't be making these false choices and you might get ahead.

The view was expressed that knowledge about computer science would help to prepare students for third-level computer science courses, by providing an introduction to the discipline: 'It will give students an easier start for third-level' (parent). 'The student will have to understand the science and architecture of computing to prepare him/her for the next level' (business respondent).

In the questionnaire responses, very few fifth year students mentioned preparation for third-level courses as a reason for the introduction of a new computer-based subject. These students cited the need for computer skills in everyday life and in the workplace as the main rationale for the introduction of a subject. Some school B students felt that such a subject would be relevant to all third-level entrants:

> Most people will have to know how to use a computer if they go to college.
>
> Computing is in every course in college some way or another.

Summary

There was general agreement that existing computer resources are insufficient if schools are to provide a new computer-based Leaving Certificate (established) subject, as well as sustaining and extending existing activities, particularly if such a subject has an emphasis on practical project work.

It was generally felt that schools do not have staff who are suitably qualified to teach theoretical aspects of 'computer science' and that computer science graduates are unlikely to be attracted into teaching in the current climate. Adequate opportunities for relevant in-career development would therefore be necessary. The adoption of an integrated approach to this new subject was seen as requiring the

preparation of larger numbers of teachers to enable them to incorporate ICT into their own subject areas. Principals and teachers were in agreement that teachers could not provide the levels of technical support necessary to maintain the computer resources required to provide a new computer-based subject while continuing to meet existing needs.

There was a general acceptance from principals and teachers that participation levels in other subjects would suffer as a result of the introduction of a computer-based Leaving Certificate (established) subject. While local school variables made it impossible to reach consensus as to which subjects might suffer, schools' subject option systems were recognised as an important factor in this regard.

While a skills-based programme was likely to attract less academically able students, fears were expressed that a more theoretical computer science subject would prove elitist. Respondents did not anticipate gender differences in the take-up of the subject.

It was widely believed that the introduction of this new subject would have a knock-on effect on levels of computer access for non-participating students. Particular concern was expressed in relation to those who do not have home access to computers, who would be placed at an added disadvantage whether they were taking a computer-based subject or not.

With the notable exception of second- and third-level students, several research subjects felt that the introduction of a computer-based Leaving Certificate (established) subject would help students make more informed third-level education choices and might also alleviate third-level attrition rates in computer courses.

PART 3

Findings in context

Findings in context

Contextual issues

Cornbleth (1990, p. 3) highlights the importance of curriculum context:

> technocratic approaches decontextualise curriculum both conceptually and operationally … treating curriculum apart from its structural and sociocultural contexts. A critical approach, in contrast, assumes contextualisation of curriculum. Curriculum as social process is created and experienced within multiple, interacting contexts.

As Goodson (2001, p. 52) argues: 'to analyse sustainability of change we must understand the conditions of change, and to do this we have to develop our historical and ethnographical studies'. Some key contextual issues in relation to the Irish post-primary curriculum in general and ICT in particular include:

- the residual influence of the classical humanist tradition
- the technical nature of Irish post-primary curriculum reform (Lynch, 1989; Gleeson, 2000a; Looney, 2001)
- the related emphasis on education for human capital development (Hannan with Boyle, 1987)
- the emphasis on state examinations (OECD, 1991)
- the dominance of transmission pedagogy (OECD, 1991; Callan, 1997)

- the inattention to school cultural and development factors until very recently (Callan, 1997; OECD, 1991)
- the dominance of subjects and the neglect of curriculum integration.

During the course of collecting and discussing data for this report, it became clear that certain contextual factors influenced the views of the respondents. In view of the significance of contextual factors in curriculum innovation, some of these factors will be discussed briefly. They include:

- the prevailing 'culture of inevitability' in relation to ICT
- the plurality of perceptions, meanings and agendas in relation to ICT
- specific aspects of the Irish curriculum context such as curriculum overload and, given the dominance of subjects, varying understandings of curriculum integration
- the prevalence of a piecemeal approach to planning in general, including ICT
- teacher professional development in the context of ICT.

Culture of inevitability

Most participants in the current study said that they were not surprised at the findings of the first UL survey (O'Doherty et al, 2000) that there was a need for a computer-based subject in the Leaving Certificate (established). As one NCCA education officer recalled:

> that feeling was certainly there two years ago within the education community at second-level – there was no opinion as to form or content really, just a feeling that kids must do computers in a literacy sense.

The most common reasons given in support of a new computer-based Leaving Certificate subject included the pervasiveness of computers in society and the work place, the need to give all students basic ICT literacy and the need for recognition of existing courses. There was a definite sense that ICT must inevitably be a formal part of the school curriculum. As already reported, interviewees from the various sectors included in the study all took a similar line:

> The fact that computers are so pervasive, and some of them are going to get even more pervasive as it goes on, it would seem to be that at some stage in the educational system they should be exposed to some more formal introduction to them (UCSD group).
>
> The modern world is based on computers and microchips. A young person needs to have extensive knowledge (business respondent).
>
> The times in which we live require a substantial degree of computer literacy (teacher respondent, school A).

Goodson with Mangan (1998, p. 132) suggests that there has been a prevailing 'culture of inevitability' in relation to the introduction of computers to schools, as exemplified in this quote from a teacher in Ontario: 'computers are out there, they're everywhere, they've taken over society ... clearly we have to have them in our classrooms ... it's inevitable'. This same sense of inevitability emerged clearly from the school-based studies conducted by Gleeson et al (2001) in the context of the OECD/CERI study on the impact of ICT on schools. With all this talk of inevitability, Postman's (1995, p. 317) question is apposite: 'what is the educational problem educational technology is to solve and whose problem is it?'

Notwithstanding this sense of inevitability, studies by Gleeson et al (2001), Aviram (2000) and others highlight the key importance of school organisational and cultural factors in optimising the promise of ICT. While Aviram (2000, p. 331) takes the view that: 'educational systems cannot abstain from joining the ICT race' he states the challenge clearly:

> Despite these huge investments and grandiose expectations, ICT has not been widely integrated into educational systems throughout the post-industrial world; and to the extent that it has been integrated there is no clear evidence that ICT makes a difference to student outcomes, enhances desired modes of learning or desired social values, or brings about changes in approaches to teaching … Successful adaptation requires a radical breaking of the organisational "glass ceiling" (i.e. school's modern organisational structure) now preventing the true adaptation of education to postmodernity.

Having considered the findings from six Irish schools, Gleeson et al (2001, p. 7) found:

> The importance of the socio-cultural context of Irish schools has emerged clearly in the case of the post-primary case study schools – the dominant role of external examinations and of teacher and school cultural factors ... There was more evidence of the integrated use of ICT in the primary schools in this study.

While respondents in the current study clearly shared a prevailing sense that computer literacy should definitely be an integral part of general education, there was a noticeable uncertainty and lack of consensus in relation to the purpose, form and content of such provision. This mirrors Rudduck's (1991, p. 32) observation that the advocates of curriculum change tend to concentrate on management aspects of change to the neglect of the meaning of these changes. However, as Callan (1995, p. 101) argues: 'attempts to alter school

knowledge … confront not just technical issues but value issues relating to what is perceived worthwhile by the wider public'. Callan argues that failure to look critically at the role of curriculum in society means that: 'the traditional conceptions of "knowledge", "ability" and "achievement" were not critically examined but rather endorsed in the simple expansion of subject knowledge to include technical knowledge' (p. 104). Callan's words will prove remarkably prophetic insofar as the possible introduction of a computer-based subject is predicated on an uncritical acceptance of the culture of inevitability that surrounds ICT.

Plurality of meanings, perceptions and interests

Given the inattention to meanings in the general context of Irish education, it is hardly surprising that problems of definition came up quite frequently in the context of this research. As one NCCA education officer pointed out:

> We [in the NCCA] were always trying to clarify "what do you mean by ICT?" When the new technology subject was being introduced people tended to identify technology as computers ... there was a phenomenal range of definitions of computers, technology ... So from a non-IT person it was quite confusing trying to work out what people were talking about.

Another NCCA education officer recalled that when Minister Martin was setting up the *Schools IT 2000* initiative: 'he talked about technology and when he decoded it, it was effectively computers in some form or another'. On reflection, the members of the research team found that concepts relevant to the study e.g. ICT, computer science, were understood differently by the dramatis personae. This is hardly surprising, given the very different experiences of ICT that such a range of subjects inevitably brought with them to the research.

Different meanings resulted in differing emphases and concerns. Some respondents wanted to place the emphasis on the living and work-related aspects of ICT, for example, the acquisition of basic computer literacy for all using ECDL type programmes and/or technical competence. Others were primarily concerned with the preparation of students for third-level courses in computers. As one school principal put it, one's views [on content] were influenced by whether one saw schooling in terms of: 'preparation for life or for third-level study'. There were also those who were primarily interested in educational uses such as the internet and subject-based software as a tool for teaching and learning. Certain 'fault lines' emerged between, for example, economically motivated ICT and its social relevance, between literacy and science and between education as preparation for life or further education.

The various interests of the many individuals and groups consulted came across very clearly in the course of the research. For example, the NCCA education officers engaged in a protracted discussion around the pros and cons of integration whereas parents, business and third-level respondents did not become involved in the finer points of integration versus 'stand-alone'. Coming from their particular perspective, ICT coordinators and school-based groups were most keen to discuss problems associated with resources.

Interests naturally influenced perspectives. For example, respondents' perspectives on subject content varied depending on whether the main emphasis was placed on life/work or further study. Some respondents felt that an applications-based subject would give a false perception of computer studies to students wishing to study computers at third-level. On the other hand, those who were primarily concerned with skills development emphasised that the introduction of an optional computer-based Leaving Certificate subject would not ensure computer literacy for all.

Aspects of Irish curriculum context

The White Paper on Adult Education (DES, 2000, pp. 99-100) notes that there are:

> compelling reasons for integrating ICTs into the education and training systems. Firstly there are vocational and economic reasons … Secondly, there are pedagogic reasons … Most educational researchers refer to the high motivation evidenced in students using ICTs for learning … Thirdly, there are social benefits. It is clearly important that all people, regardless of social or economic background, should have equal access to new technologies.

While *integration* is one of the key principles of the primary curriculum, Hannan with Boyle (1987) and others have highlighted its neglect at post-primary level. The CEB proposal to move away from subjects towards Areas of Experience was not subsequently given a serious hearing, as noted by the OECD (1991, p. 68). Within this context, discussion of integration in the context of the present study was problematic. The generally favourable reaction of participants in the present study to the principle of curriculum integration is noteworthy. One can only speculate as to the reasons for it and whether acceptance of the rhetoric will ever carry over into reality. Might it be that participants' experience of SIP projects, and of programmes such as TYO, LCA and LCVP, has heightened teachers' awareness of the value of integration, suggesting a changing context for Irish post-primary education?

While the concept of integration (as in the SIP) has achieved widespread currency in education, its meaning is not as unproblematic as is often assumed. Nasta (1993) distinguishes between integration within an educational programme and integration in the context of a modular curriculum. In the case of the former, he sees cross-curricular assignments as the main vehicle

for integration and comments that designing such assignments has often proved one of the most satisfying aspects for staff. In the case of a modular curriculum, Nasta sees integration as a function of the learner's desire and ability to make links between the subject matter of the various modules. It is also possible to distinguish between functional integration, where integration occurs naturally, seamlessly, often unconsciously, through the planning, development and activity involved in the completion of tasks, and 'bolt on' integration, a conscious effort to associate learning that takes place in a number of courses.

Interviewees in the present study put forward varying views of integration – some teachers saw the use of computers *within* their subject as integration, others wanted to see ICT integrated across the curriculum as a tool for teaching and learning, while others wanted to see relevant aspects of ICT included on the syllabus for their own subject, for example, electronics in physics, systems management in business. The recent emphasis on the integration of ICT within existing subjects under the *Schools IT 2000* initiative was reflected in the views of some participants in the current research. The levels of recognition of the value of integration suggest a change in attitudes towards the use and inclusion of ICT in schools. This would appear to represent a shift in attitudes from a 'techno ghetto/keyboarding phase' towards integrated computer use in second-level schools (Buettner, 1997). While the request to conduct the current research in relation to the introduction of a stand-alone subject is understandable, it is important that this growing realisation of the importance of integration is acknowledged.

Respondents tended to be pragmatic rather than idealistic in their approach to curriculum. While some form of integration was regarded as the optimum approach from an educational perspective

to the inclusion of ICT, there was a strong sense that the stand-alone subject was a more realistic option for pragmatic reasons. The research team can only recall some four occasions where individual members of discussion groups suggested, without prompting, that the social implications of ICT should be part of any new subject syllabus – twice in the UCSD group, once in the principals' group and once in the ICT coordinators' group.

Many observers have commented on the *overcrowded* nature of the Irish post-primary curriculum (OECD, 1991; Callan, 1995; McGlynn, 1995). With more than thirty Leaving Certificate subjects now recognised, a comprehensive review of the Leaving Certificate (established) programme would be timely. In the context of the present study, curriculum overload was regarded as problematic from a variety of perspectives, both in relation to the integration of ICT and the introduction of a new subject. Overcrowding was seen as particularly problematic at junior cycle in the light of the introduction of CSPE, SPHE etc. Timetabling was one of the dominant concerns, from the perspectives of both junior and senior cycles. Concerns were expressed as to how another subject might be included at junior cycle when most pupils take nine subjects already. The 'knock on' effects of introducing another option to the Leaving Certificate (established) also provoked much comment. It was also felt that a stand-alone subject would fit most easily into the structure of the existing Leaving Certificate system because of its subject base. Concerns were also expressed in relation to curriculum coherence in terms of the impact that a Leaving Certificate (established) computer-based subject would have on computer provision in all other areas of post-primary education. The perceived impact on school staff, including technical resources, and on curriculum, will be dealt with below in the final section: Main conclusions and issues arising.

In contrast to the much-repeated social, work and education-related arguments in support of the introduction of a new computer subject above, very few participants or questionnaire respondents mentioned the value of computers as a discipline. One participant in the UCSD discussion group, who favoured a computer science approach with a strong emphasis on theoretical aspects, thought that:

> Another aspect of it was the educational aspect of design, having a design discipline. A computer, particularly computer science subject could lead, could introduce aspects of design which are not very common to the Leaving Certificate and which are intellectually exciting areas of the discipline.

Several respondents voiced concerns in relation to the possible obsolescence of subject content. There was a general sense that non-traditional assessment procedures should be included because traditional approaches would be inappropriate in the context of ICT.

Planning

Several commentators have identified the neglect of forward planning as a feature of Irish education (OECD, 1991; Cromien, 2000). The lack of a coherent state plan for the introduction and inclusion of ICT in Irish education has been noted earlier in this report. While teachers and school principals have welcomed the *Schools IT 2000* initiative, it was generally accepted that both phases to date were geared to the acquisition of basic skills rather than providing a framework for teaching and learning within schools. Despite specific computer use within a number of subject areas (e.g. technical graphics, business studies and the LCA), the absence of an overall national ICT policy, as outlined above, has resulted in a dominance of skills acquisition type courses, taught as stand-alone subjects with a strong emphasis on industry standard software

applications. The dominance of this type of computer use has been recognised in successive studies throughout the previous decade (McKenna et al, 1993; Drury, 1995; Mulkeen, 1997).

Some NCCA education officers recalled that previous attempts during the eighties to introduce computers into their subjects, e.g. business studies, mathematics, had come to nothing:

> We tried to build in IT elements into business studies because we figured business couldn't be taught without an IT element. We got it into syllabus. It never actually was examined which is even more worrying. We got the accounting syllabus sorted in 1995, we had the IT element and the software, specific software, to be taught in terms of accounting packages – we lost that as well. We wanted the multimedia approach, which is standard in business these days, in Leaving Certificate business, and that was lost as well ... not for curriculum reasons but for other reasons.

Unlike most curriculum initiatives emanating from the DES or NCCA, schools enjoy considerable freedom in relation to ICT provision. The absence of a national ICT plan in the past has enabled schools to define their own concept of what constitutes computer education. Each school addresses ICT in its own way, reacting to modern computer usage and reflecting how it sees computer education ought to be provided. In this context some principals and ICT teachers in the current study seemed to experience difficulty discussing the possible content and form of a new computer subject. They tended to revert to a description of what is currently being provided in their schools and this is generally dependent on school interest and resources.

The positive attitudes towards the introduction of a subject may well be seen as support for the certification of existing school-based courses as well as an attempt to standardise the current ad hoc provision of ICT skills at both junior and senior level. The recognition of such a course may also help elevate a 'subject' that does not currently enjoy the same status as examination subjects. This is particularly relevant in a context where subjects such as PE and RE, formerly non-examination subjects, are about to become examined Leaving Certificate subjects. On the other hand, as an NCCA education officer pointed out, the introduction of a discrete computer-based subject: 'could have a very detrimental impact [on ICT integration] because it would be seen as the answer'.

The tendency, particularly on the part of the ICT coordinators, to focus on a skills-based rather than a science-based course, highlights the lack of a structured provision of ICT skills within second-level. Participants frequently referred to what they saw as the prevailing ad hoc approach to the place of ICT on the Irish post-primary curriculum. The absence of a common, formal ICT certificate of competence at post-primary level had a significant bearing on the responses from all sectors. Similar views were expressed in both schools studied as well as by the ICT coordinators and some school principals. As one parent stated: 'How good a course a child gets in computer use in secondary school depends on the individual school and how committed they are to this'.

Participants in the present study saw the establishment of a structured approach to the provision of ICT skills throughout post-primary education as generally more important than the introduction of a computer science-based subject. This reflects the prevailing belief that a general skills-based junior cycle course for all should precede such a specialised subject. Contextual changes are at

work here too. The expansion of funding for the LCVP and the LCA as well as PLC courses has resulted in some schools becoming significantly better equipped with ICT rooms and computer equipment. This has created a felt need to: 'use the rooms a little bit more widely among the school population' (NCCA education officer). If the current practice of ring fencing of the LCA were reconsidered, the existing computer applications programme might provide a good basis for computer skills for all.

The most important contextual change is of recent origin. The White Paper on Adult Education (DES, 2000, p. 30):

> marks the adoption for the first time of a commitment to lifelong learning as the governing principle of Irish education policy, and as having a pivotal position in the overall Irish economic and social strategy … A commitment to a lifelong learning agenda as a relatively seamless progression through an educational continuum from the cradle to the grave … raises challenges not only for tertiary education but also for early life education.

The clear articulation of this policy requires that the role of ICT as a tool for teaching and learning and the implications for classroom pedagogy and curriculum design, implementation and assessment be fully acknowledged and that appropriate responses follow.

Teacher professional development

Prior to the establishment of the In-Career Development Unit, the professional development needs of Irish teachers were poorly addressed. For example, expenditure on in-service education rose from 0.05% of total post-primary expenditure during the period 1986-88 to 0.15% in 1989 (Gleeson, 1992, p. 111). Subsequent developments have been premised on a deficit model (Gleeson and Leonard, 1999). Apart from recent attempts to introduce Whole

School Evaluation, the importance of school context for the effective implementation of curriculum change has been overlooked in Ireland, as discussed by Callan (1997).

Prior to 1997, ICT in-service was delivered through short-term department funded in-service courses. These courses were the predominant form of IT in-service available for teachers and focused primarily on 'introduction' type courses with an emphasis on industry standard applications software. Specialist in-service courses were also provided in relation to technical subjects where the 'new technologies' were being implemented. The launch of the *Schools IT 2000* initiative provided a framework for IT in-service provision, aiming to provide a training continuum to allow teachers to progress from novice to expert users of the technology. Basic IT skills provision was delivered through short term in-service courses of approximately twenty hours in duration, focusing on the use of industry standard applications software.

The main focus to date of *Schools IT 2000* has been on basic skills. This may help account for the strong emphasis on basic literacy on the part of participants in this research as well as for the difficulties that members of the teaching profession experienced in discussing the possible form and content of the programme. The subject orientation of teachers means that whole curriculum questions such as the place of ICT are not part of their normal discourse.

Main conclusions and issues arising

Within the broad parameters of the above contextual issues, the report attempts to draw some important conclusions in relation to the substantive issue of a computer-based subject in the Leaving Certificate (established). While summaries of each section have been included up to this point in the report, the main conclusions along with the relevant issues arising will be presented in this section under the following headings:

- subject content: the computer skills, computer science dichotomy
- subject form: the 'ideal versus feasible' dichotomy
- interplay between the main issues as reflected in the impact on school resources
- interplay between the main issues as reflected in the impact on curriculum
- assessment
- equity issues
- other issues - differences between schools; impact on higher and further education choices; inconsistencies between business and parents' representatives and individuals from each sector; the general paucity of references to the 'economic' argument
- the importance of critical curriculum discourse is the final overarching issue arising.

Some issues arising for decision makers will be identified in relation to each of the above areas. The primary issues that emerge from the data are the two clear dichotomies in relation to the content and form of senior cycle provision insofar as these have implications for many of the other issues arising.

Subject content: computer skills versus computer science dichotomy

The debate as to whether a computer-based subject should focus primarily on computer skills or computer science emerged as a key aspect of the study. Positions adopted by the research subjects varied depending on perceptions and interests. Given the opportunity to select any content of their choice, members of teacher groups consulted were reluctant to make specific suggestions about content. However, two general trends were perceptible, depending on respondents' rationale in favour of the introduction of a subject. Where social and work-related considerations were dominant, the preference was for a computer skills course with a strong emphasis on applications software. Where contributors prioritised higher and further education purposes, the preference was for a computer science subject. It was felt that a science-based programme would help reduce attrition rates from third-level computer courses and give students with a flair for computers an opportunity to gain due recognition in the Leaving Certificate (established). Contributors felt a computer science-based course may attract fewer students than a predominantly skills-based programme and they feared that it could become an elitist subject. Concerns were expressed that the syllabus content of a skills-based subject may not reach the standard expected of a Leaving Certificate subject and that the introduction of an optional Leaving Certificate (established) subject would not address the computer literacy needs of *all* students.

Suggested solutions to this dilemma of skills or science included the 'blending' of computer skills and computer science into a single subject and the provision of different levels as a means of appealing to a broad range of student interests and abilities (e.g. basic ICT skills at Foundation level, applications skills at Ordinary level and computer science at Higher level). Participants warned of the danger that the introduction of a Leaving Certificate computer subject might be treated as *the* solution to the current problem of ICT skills within schools.

While the perceived need for an accredited skills-based course for all students emerges very strongly from the data, there was no consensus as to *how* this might be achieved or at what stage such a subject might be introduced to the post-primary curriculum. There was, however, agreement on the need to accord formal recognition to current school-based computer courses. The introduction of short courses, based on the ECDL model (e.g. like those currently provided to Transition Year students) was suggested as one means of achieving this goal.

Most research subjects regarded the introduction of adequately resourced, structured computer literacy provision for all students as the first priority. They had no difficulty with the introduction of a Leaving Certificate computer-based subject involving some blend of science and skills as long as the main priority had been dealt with first. Contributors argued that the introduction of a specialised Leaving Certificate (established) course would work to the advantage of students in schools where ICT skills were being provided at Junior Certificate or Transition year level, unless there was a structured approach to the provision of ICT skills at Junior Certificate level across all schools,

Issues arising

As provided for in the relevant NCCA guidelines, formalised provision for basic computer skills for all is the main priority as seen by the research subjects. Once such provision has been made, an optional computer-based subject in the Leaving Certificate (established) is likely to include computer science but the balance between skills and science remains problematic.

Subject form: the 'ideal versus feasible' dichotomy

School-based participants displayed a willingness to consider alternatives to the traditional Leaving Certificate (established) model of discrete subjects assessed through terminal examinations. They recognised the potential of an approach whereby computer topics and skills would be integrated into a number of existing subjects so that the sum of these parts would constitute a computer-based Leaving Certificate (established) subject. While acknowledging the educational value of this approach, contributors were concerned about practical considerations such as the overloading of some existing subjects, the associated resource implications and the logistical complexity for schools. In the long run, their views on form were influenced most by what they deemed feasible within existing constraints. Teachers' decisions to opt for what is practicable, a discrete optional subject, reflects the reality that 'day-to-day survival in teaching is secured by the application of common-sense assumptions which answer the need to cope with the structural constraints of class-size, syllabuses, examinations, timetables, resources, etc.'(Cole cited in Ball and Goodson, 1985, p. 100).

While all teachers and principals engaged in discussions on form, the NCCA education officers probed the complexities of curriculum integration at greater length. Their considered discussion reflects their broader experience of curriculum debate, making their

inclusion in the study particularly worthwhile. As Cole (in Ball and Goodson, 1985, p. 100) observes: 'serving teachers are rarely required to think or talk at the level of discourse about school practices … they are surrounded by structures that generally discourage them from exercising that ability'. The fact that the majority of the NCCA group, sometimes reluctantly, opted in the end for a discrete subject on pragmatic grounds, underscores the strong influence of the pragmatic over the ideal.

Issues arising

A somewhat surprising number of contributors to the discussions recognised the value of the integration option – though in the end most opted for a discrete subject on pragmatic grounds.

The issue of formal recognition for ICT on the post-primary curriculum has ramifications for the whole system. The many permutations of form and content discussed above, together with their perceived consequences, suggest that the time is ripe for a more complete review of the Leaving Certificate (established) programme. This might include a radical review of the traditional subject-based model of curriculum construction, for example, a re-opening of the CEB debate on Areas of Experience. Since this leads into broader curriculum planning issues, the present report is timely in view of the imminent publication of the *NCCA discussion paper on senior cycle education*.

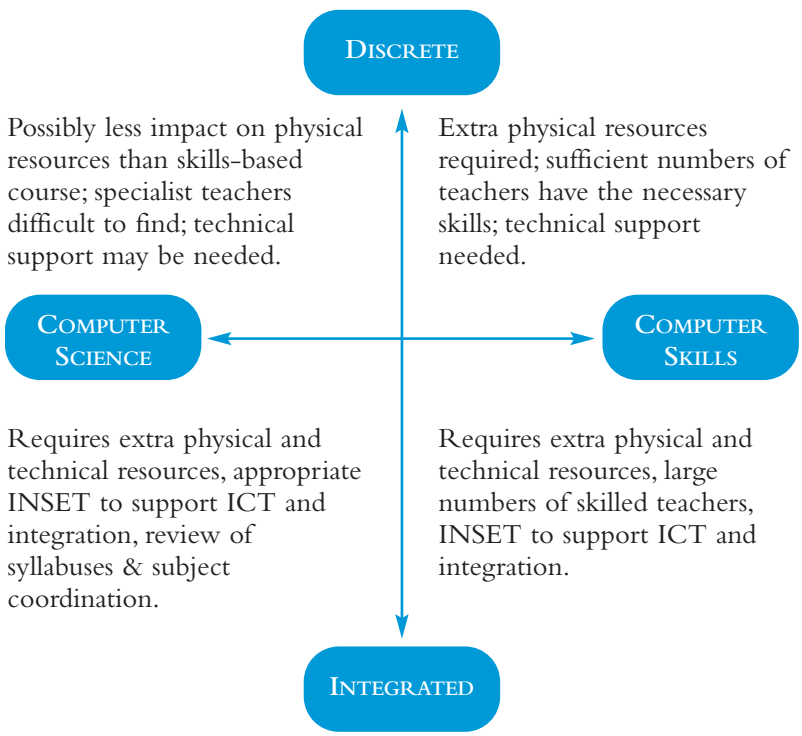
The preference for a discrete subject has curricular implications for other subjects and these are developed below.

Complexity and interplay: impact on resources

One of the clearest findings of the present study is the complexity of the mutual interrelationships between the content and form of any proposed computer-based subject. The impact of such an innovation

will vary, depending on the position one adopts on each of the two dichotomies presented above. This makes it very difficult to draw simple conclusions in relation to the impact of any one of the permutations selected. What can be stated is that the introduction of a computer-based subject at Leaving Certificate (established) level has significant implications for schools and the education system and that these implications will vary, depending on the form and content of the 'subject'.

Figure 1: Perceived impact on resources of a new computer-based subject depending on its form and content



The above figure illustrates some of the issues in relation to the perceived impact of the introduction of a computer-based subject to the Leaving Certificate (established). Each axis represents a key dichotomy and each dichotomy has to be seen in terms of a

continuum. The main implications of each of the four options are presented in the relevant quadrant. Resource implications fall into two broad headings – impact on computer resources and human resources.

For example, the view was expressed that a discrete computer science subject would make lesser demands on the physical computer resources within schools because a significant part of such a course may not require use of the computer suite. Nonetheless, a mainly computer science subject would necessitate the retention of computer laboratories in schools. This would reduce the possibility of dispersing computers to classrooms, something that is essential in promoting the use of computers as a tool of teaching and learning and integration between subjects. It was felt that such a subject could not be provided unless computer science specialists were available to teach it and fears were expressed in relation to the difficulties of attracting such graduates into teaching when their earning power may be much greater in other sectors of the economy. If the appropriate in-career development opportunities and incentives were provided, it was felt that existing staff could be up-skilled sufficiently to teach such a subject.

On the other hand, a high proportion of teachers has completed computer in-service courses and may be capable of teaching a mainly skills-based programme. However, such a programme was seen as likely to make heavy demands on the physical resources of schools, making access to computers problematic and necessitating constant updating of hardware to keep abreast of the latest developments. In addition, participants felt a computer skills subject would demand greater access to computer hardware, thereby reducing access for teachers and students not involved in the subject. The implementation of this programme would depend on the availability of significant extra resources.

Some participants favoured the introduction of a programme that would develop students' abilities to use the computer as a learning tool across the curriculum. This subject, whether modular or integrated, would result in increased demand on the physical resources within schools. As most in-service programmes, such as the *Schools IT 2000* courses, have been geared to the acquisition of basic skills rather than using the computer as a tool for teaching and learning, large numbers of teachers would need appropriate professional development to enable them to use ICT within their subjects. The provision of appropriate software for various academic subjects would be problematic and the allocation of time within the school to co-ordinate ICT activities and to facilitate the demands made by a collaborative teaching model would be considerable.

As of now, computer equipment in schools is maintained and upgraded primarily by interested ICT teachers (Mulkeen, 1997). With the introduction of a computer-based Leaving Certificate (established) course, irrespective of form or content, more formal structures will be required within schools to ensure the upkeep of existing resources. The constant use of the computer resources by a large number of non-specialist computer teachers, particularly in an integrated model, would require full-time technical support. This may have wide ranging implications for schools.

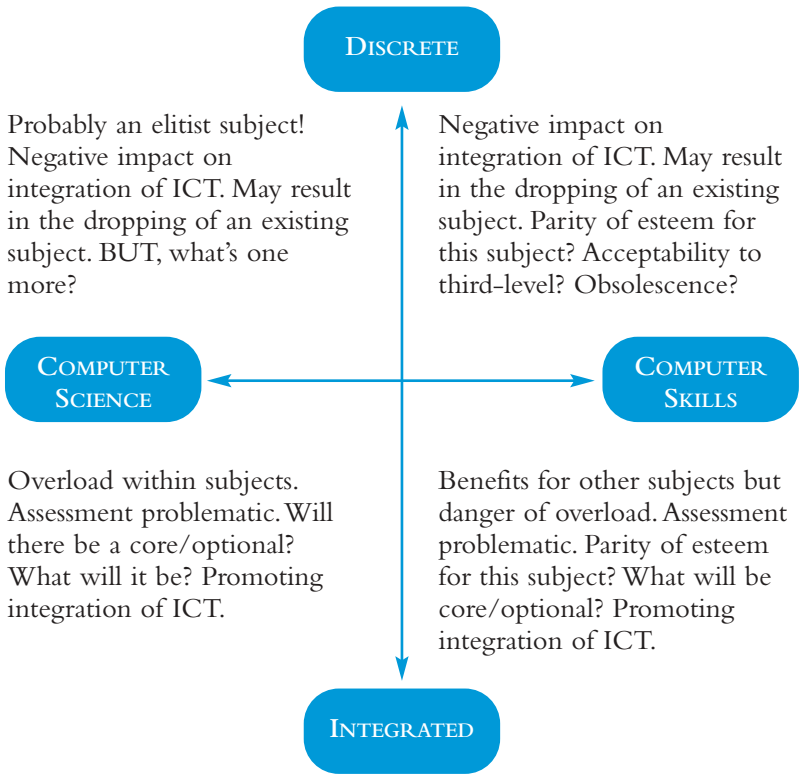
Within the two schools studied in this research significant differences in hardware resources were noted. If the majority of schools possess one computer cluster room as suggested in O'Doherty et al (2000), the introduction of a subject requiring compulsory access to computer facilities may hinder access to existing resources in schools. Issues of equality of access will be developed below.

Issues arising

The dilemmas are represented on each axis of the above figure. There is a need to recognise and be sensitive to the mutual interrelatedness of form, content and impact on resources. The impact on computer and/or human resources will be significant. Given the high costs associated with computer technology, particularly in constantly updating equipment, in what way will schools fund this subject? The selection of a specific form and/or content along these continuums will result in varying levels of impact. Can greater flexibility be achieved possibly through short, senior cycle modular courses as against the present two-year model? What about the in-career development needs of those who will teach computer science? What about the implications of all forms of provision for initial teacher education? How can the potential knock-on effects on teaching and learning be minimised? Are schools sufficiently well resourced to provide ICT courses on the two different levels?

Complexity and interplay: impact on curriculum

Figure 2: Perceived impact on curriculum of a new computer-based subject depending on its form and content



A number of other dilemmas for decision makers in relation to form and content and existing subjects emerged from the discussions that were conducted during this research. Participants feared that a new computer-based subject, no matter what form it took, would have a significant impact on the curriculum within schools. Concerns were expressed that the introduction of a discrete computer-based subject may affect schools' long-term plans to integrate ICT, particularly at a time when many schools are developing ICT plans under the *Schools IT 2000* and School Development Planning initiatives. Regardless of form, the issue of long *or* short courses arises, with associated implications for content.

Due to timetabling, accommodation and staffing considerations, most schools (especially smaller ones) are restricted in what they can provide. Students normally take seven subjects and this is unlikely to change as long as the Leaving Certificate syllabus is designed on the basis that it will take two years to complete. In a context where subjects are inevitably timetabled concurrently, with students having to select options, the attractiveness and popularity of a mainly computer skills subject may have a significant effect on subjects timetabled against it. Principals in particular were aware that this subject could 'kill off at least one other subject'. On the other hand, while a more specialised computer science subject may not appeal to large numbers of students, depending on the timetable construct it could have an equally detrimental effect on subjects that are already taken by a smaller number of students, for example physics or history. While the addition of an additional discrete subject would contribute to general curriculum overload, the data suggest that the introduction of an integrated/modular subject would result in overcrowding *within* existing syllabuses and would require the review of many Leaving Certificate subjects.

Issues arising

The dilemmas are represented on each axis of the above figure. It is important to recognise and be sensitive to the mutual interrelatedness of form, content and curriculum impact. The selection of a specific form and/or content along these continuums will result in varying levels of impact. Can greater flexibility be achieved possibly through short, senior cycle modular courses as against the present two-year model?

In the context of curriculum overcrowding, when to provide for basic computer skills is a major issue. How might the introduction of a computer-based subject affect the ability of schools to deliver computer skills courses to other students? If an optional computer subject were introduced, schools might need to cater for computer provision on two very different levels, one focusing on ICT skills provision for *all* students and a second focusing on specialised computer science/skills to a limited number of students. Are schools resourced to provide ICT courses on these two different levels? Will non-examined ICT skills acquisition courses suffer in the process?

Assessment

There was a widespread belief that national assessment would add greatly to the status of a computer-based subject. Participants believed that an external summative examination would be inappropriate for this new subject. Modes of assessment such as project work, portfolios and electronic testing were suggested, illustrating that the introduction of a computer-based subject might be a vehicle for a review of assessment procedures at Leaving Certificate level.

Issues arising

Given the current difficulties around alternative modes and techniques of assessment other than external terminal examinations, can an appropriate mode of assessment that reflects the nature of a new computer-based subject be introduced?

Equity

Issues of equity abound in education (Archer, 2001; Clancy and Wall, 2000; Hannan, 1989; Lynch, 1999). Unlike other specialised subjects, such as engineering, construction studies or home economics, all schools possess at least some computer facilities. But significant between-school differences are to be found, a point highlighted in the contrast between the two school-based studies in this research. Johnston (2000) argues that the impact of the 'digital divide' on the availability of the necessary technologies in the home will contribute to a two-tiered system between those who have access and those who do not, with the long-term implication of widening the gap between privileged and less privileged students. Those who do not have access will fall further behind whilst those who do have access will strive further ahead, the occurrence of which has both practical and moral implications. Sutton (1991, p. 494) concluded that computer use in the 1980s did not bring education closer to equal educational opportunity:

> Rather, it maintained and exaggerated existing inequalities in education in input, processes of computer learning and output. Poor, minority, and female students had less access to computers at home and in addition, less access to computers at school

The introduction of a computer-based Leaving Certificate (established) subject may exacerbate existing inequities between schools, and may be used by schools to attract students where competition exists. As the White Paper on Adult Education (DES, 2000, p. 100) points out: 'a range of reports has pointed out the danger of the creation of a two-tier society of information haves and have-nots'. Not all schools may have adequate resources to support a new subject and a hierarchy of schools may emerge. Some participants feared that the introduction of an optional discrete

subject would be elitist in that it would attract only the 'high flyers' and this small number of students would make disproportionate demands on the limited computer resources within any school. In this situation, priority access to ICT resources would probably be given to those taking the Leaving Certificate (established) subject, while other students taking LCA/LCVP programmes and teachers wishing to use ICT as a teaching/learning tool would be disadvantaged. Even within a cohort of students taking the proposed computer-based Leaving Certificate (established) subject, students with access to PCs and/or internet at home would enjoy a distinct advantage. This fear lead some respondents to suggest that each student taking such a subject should be provided with a PC. The introduction of a policy of positive discrimination in favour of disadvantaged students would represent an appropriate response.

Issues arising

The 'digital divide' is a universally recognised problem. One of the main objectives of the Education Act 1998 is to: 'promote equality of access to and participation in education and to promote the means by whereby students may benefit from education' (Section 6.c). Will the introduction of a computer-based subject promote the principle of equality? Furthermore, the Act requires that: 'the NCCA, in carrying out its functions, shall have regard to the implications of its advice for the resources… necessary to give effect to any of its proposals' (Section 41, 3, a). Will schools be adequately resourced to enable all students to access and participate in any proposed computer subject?

Other issues

The significance of school context

While the form and content of a new subject are important considerations, the emerging data in this study reflect the significance of individual school contexts in assessing the possible impact of a new computer-based subject. Participants in this study believe that the physical and human resources of each school are central to any discussion of how the introduction of a resource-intensive subject will impact on schools, students and the system.

Schools A and B were both mixed vocational schools of small-medium size in relatively rural settings. School A had benefited in the past from the establishment of a local computer company that donated the school's first computers during the 1980s. It currently has relatively good resources, along with teachers trained in ICT. Several members of staff have participated in Intel's *Teach to the Future* initiative and three members of staff have completed postgraduate courses in ICT. Computer-related PLCs are provided in the school. Only a small number of teachers, namely those with less than three years' experience, stated that they had no relevant ICT experience. In contrast, school B has very limited computer resources. The Leaving Certificate (established) was not provided in the school until the 1990s, forty per cent of teachers had no ICT training, and almost half of them rated their skills as poor or very poor.

While concern was expressed in both schools in relation to resources, there was agreement in relation to the importance of skills for all. Teachers in school A were generally in favour of the

introduction of a discrete Leaving Certificate subject that would go beyond skills and applications, while their school B counterparts opted for a skills-based subject that would serve the needs of all students. The difference between teachers' priorities in schools A and B reflects the influence of school context.

It is important to recall that both schools included in this study belong to the vocational education sector. If such divergence is visible within a single sector, it is likely that greater divergence will be present between the various sectors. An example of such divergence is evident in this report when principals gave their perception of the impact of the introduction of a computer-based subject on their schools' physical resources. While the principals in the school studies were anxious about their ability to cater for such a subject, three of the principals within the discussion group, who represented large, urban and well-resourced schools, felt that a subject would not impose undue stress on their schools' facilities.

Issues arising

School contextual differences are important considerations in any discussion about the perceived impact of a new computer-based subject. School characteristics such as size, socio-economic and local environment, access to resources, relative age of buildings etc. may influence their ability to support a new subject. Differences between school types and sector may also become evident. It has been widely documented that: 'many educational inequalities occur between schools and between students across different schools' (Lynch, 1999, p. 177). In a context where the Education Act 1998 requires 'respect for' and 'regard to' equality principles, the introduction of a subject that is heavily dependent on physical and human resources may further disadvantage some students and schools.

Impact on higher and further education

Many participants raised the potential role of a new computer-based subject in helping students make career choices. It was felt that such a subject could help inform students' third-level choices and reduce attrition rates at third-level. Concerns were expressed that the introduction of a predominantly computer skills subject, rather than aiding students, could actually mislead them in relation to the nature of computer science programmes at third-level.

The introduction of a computer-based subject was perceived, depending on its content and form, to have a potential impact on higher and further education programmes. Members of the HFE discussion group felt that if a computer science subject were to be introduced then content matter now included in Year 1 programmes at third-level could be included in the Leaving Certificate (established) programme. The ensuing need to review third-level and PLC programmes was not identified as a difficulty by group members with experience of these sectors.

Issues arising

While the possible reduction of third-level attrition rates would be regarded as a desirable outcome of the introduction of a new computer-based subject, the main issue arising has to do with the fundamental purposes of post-primary education. Should post-primary education focus on the development of generic or specific skills? To what extent should the Leaving Certificate programme prepare students for specific higher and further education courses? Is the reduction of attrition rates at third-level in computer science a sufficient reason to introduce a specialised computer subject to the Leaving Certificate (established)? If the needs of third-level education are the driving force, does not this increase the chances of having an elitist programme?

Differences of opinion

An interesting finding emerging from the data is the extent to which representatives from within sectors or groups differed in their opinions. For example, members of the business/industry discussion group who were nominated by their national organisations, IBEC and ISME, rejected the introduction of a Leaving Certificate computer-based subject. They were strong in their views on the importance of providing basic computer skills that they considered to be 'life skills' and a fundamental aspect of literacy education within schools. These group members prioritised students' access to a broad general education and an opportunity to develop transferable skills above the acquisition of specific knowledge and experience of computers. They did not perceive the introduction of a Leaving Certificate computer subject as serving the needs of the majority of students or of the economy. Their opinions were consistent with the IBEC philosophy as expressed in *Social policy in a competitive economy* (IBEC, 1996). On the other hand, the randomly chosen respondents to the business/industry questionnaire, speaking presumably on behalf of their own organisations, while wanting computer skills for their future workforce, welcomed the introduction of a Leaving Certificate (established) subject. They thought that such a subject would increase the status of computer education in schools and would provide an indication of levels of attainment among the student population.

Differences also emerged between parents' opinions as expressed in this study and those expressed in earlier research (O'Doherty et al 2000). In the initial study the representatives of the National Parents' Councils (primary and post-primary) were unhappy with the introduction of a computer-based subject to the Leaving Certificate (established) programme for reasons to do with paucity of resources (post-primary) and the importance of focusing on liberal rather than

vocational education. In the present study all parents who attended the group discussion, representing the various parent organisations, were in favour of the introduction of a new Leaving Certificate (established) subject. These parents had been nominated by their national bodies and in some instances had been in a position to discuss the question with the members of their national executives prior to attending the discussion group. While this difference in opinion may reflect a change in parents' attitudes since the previous report, it may also reflect the impact of ongoing social changes.

Issues arising

These differences highlight the complexity of the current issue and the difficulty in reaching consensus about the introduction of a computer-based subject. They also highlight the potential for differences between national umbrella bodies and their component parts.

Paucity of references to the economic argument

While members of the HFE discussion group offered the opinion that a Leaving Certificate (established) subject was essential for national economic prosperity, this issue was hardly mentioned in any of the other groups. Members of the business discussion group favoured the provision of a broad educational platform for all students that would enable them to be flexible and to transfer skills during their working life. Neither the business group members nor the questionnaire respondents raised the issue of national economic welfare as the rationale for the introduction of a computer-based subject. Both groups supported the development of young people's computer skills in terms of social and work-related literacies.

Issues arising

This observation highlights the existence of a plurality of meanings and perceptions in relation to computers and curriculum as noted earlier. It sounds a cautionary note for administrators who may wish to justify the introduction of a computer-based subject in terms of its benefits to the national economy.

Importance of critical curriculum discourse

A strong feature of the discussion groups was that they raised awareness of issues participants might have not considered prior to the meeting. It became clear that teachers, ICT co-ordinators and principals had not given the issue of a computer-based subject much thought prior to attending the discussion groups. While this may reflect the low level of critical discourse in Irish education in general, it may also indicate the low priority placed by school-based participants on this issue.

Research participants were encouraged, in the context of the group interviews, to reassess their positions and to consider alternatives. For example, those consistently in favour of, say, a discrete stand-alone subject, could also comment on the advantages and disadvantages of other forms. Through this process the opportunities, limitations and perceived impacts of each form were aired. Some interesting shifts in opinion occurred as a result, particularly in the discussions involving principals, the NCCA education officers and in the case of one school-based group of teachers.

Parents' reactions to the invitation to participate in the group discussion were remarkably positive. They made it clear that they greatly appreciated the fact that they were being consulted and the opportunity to discuss this educational issue with their peers.

Issues arising

The lack of genuine opportunity for curriculum-related debate has been highlighted in this research. Notwithstanding the adoption of a partnership model at the National Education Convention and within agencies such as the NCCA, opportunities for such critical curriculum discussion and debate at local level have been rare since the days of the Interim Curriculum and Examinations Board (Crooks, 1987).

At the macro level, this study raises many big curriculum questions demanding a response that transcends the mere addition of another entity to the Leaving Certificate federation of states. These questions include the nature and implementation of partnership, ownership of the curriculum and the importance of raising levels of critical debate among teachers. The recent adoption by the DES of a systemic approach built on: 'commitment to lifelong learning as the governing principle of Irish education policy' (DES, 2000, p. 30) makes a broad-ranging review of existing post-primary curriculum values, structures, strategies and relationships inescapable.

As for the introduction of a Leaving Certificate (established) computer-based subject, the adoption of a clear position in relation to the two dominant dichotomies of content and form, as identified at the beginning of this section, would seem to offer the best prospect of breaking through the fog that currently makes it difficult to see clearly.

Bibliography

Bibliography

Archer, P. (2001). Public spending on education, inequality and poverty. In S. Cantillon, C. Corrigan, P. Kirby, and J. O'Flynn, (eds.), *Rich and poor perspectives on tackling inequality in Ireland*. Dublin: Oak Tree Press.

Aviram, A. (2000). From "computers in the classroom" to mindful radical adaptation by education systems to the emerging cyber culture. *Journal of Educational Change,* 1(4) 331-352.

Ball, S.J. and Goodson, I.F. (1985). *Teachers' lives and careers.* London: Falmer Press.

Buettner, Y. (1997). In-service teacher education – a way to integrate information technology into secondary level curricula. In D. Passey, and B. Samways, (eds.), *Information technology: Supporting change through teacher education*. London: Chapman & Hall.

Callan, J. (1995). Equality of learning in quality schooling: a challenge for curriculum implementation. In J. Coolahan, (ed.), *Issues and strategies in the implementation of educational policy.* Maynooth: Education Department.

Callan, J. (1997). Active learning in the classroom: a challenge to existing values and practices. *Issues in Education,* 2, 21-28.

Clancy, P. and Wall, J. (2000), *Social background of higher education entrants*. Dublin: Higher Education Authority.

Cornbleth, C. (1990). *Curriculum in context*. London: Falmer Press.

Cromien, S. (2000). *Review of Department's operations, systems and staffing needs.* Unpublished report prepared for the DES.

Crooks, T. (1987). The Interim Curriculum and Examinations Board 1984-87. *Compass,* 16 (2), 7-26.

Department of Education (1981). *Clár agus rialacha do mheánscoileanna.* Dublin: Stationery Office.

Department of Education (1997). *Schools IT 2000.* Available at: http://www.irlgov.ie/educ/it2000/chap1.htm [Accessed 21 November 2001].

Department of Education and Science (2000). *Learning for life: White paper on adult education.* Dublin: Stationery Office.

Drury, C. (1995). *Implementing change in education: The integration of information technology into Irish post-primary schools.* M.Sc. Thesis, University of Leicester.

Gleeson, J. (1992). *Gender equality in education in the Republic of Ireland (1984 - 1991).* Dublin: Stationery Office.

Gleeson, J. (2000a). Sectoral interest versus the common good? Legitimation, fragmentation and contestation in Irish post-primary curriculum policy and practice. *Irish Education Studies,* 19, 16-34.

Gleeson, J. (2000b). *Post-primary curriculum policy and practice in the Republic of Ireland: Fragmentation, contestation and partnership.* Unpublished PhD thesis submitted to University of East Anglia.

Gleeson, J. and Leonard, D. (1999). Rhetoric and reality in the implementation of education policy: teacher professional development. Unpublished paper read at ISATT Bi-annual Conference, Dublin.

Gleeson, J., O'Grady, D., Johnston, K. and McGarr, O. (2001). *ICT and school improvement*. Available at: http://bert.eds.udel.edu/oecd/cases/casesframe.html [Accessed 21 November 2001].

Goodson, I.F. with Mangan, M.J. (1998). Computer studies as symbolic and ideological action: the genealogy of ICON. In I. Goodson, C. Anstead, and M. J. Mangan, *Subject knowledge: Readings for the study of school subjects.* London: Falmer Press.

Goodson, I. (2001). Social histories of educational change. *Journal of Educational Change,* 2 (1), 45-63.

Government of Ireland (1998). *Education Act,* 1998. Dublin: Government Publications Office.

Hannan, D. (1989). Irish poverty, inequality and state policy. *The New Nation,* February 1989 (4), 8-10.

Hannan, D. with Boyle, M. (1987). *Schooling decisions: the origins and consequences of selection and streaming in Irish post-primary schools.* Paper No. 136. Dublin: Economic and Social Research Institute.

IBEC (1996). *Social policy in a competitive economy.* Dublin:IBEC.

Johnston, K. (2000). *An investigation of students' use of IMS software in Irish second-level schools: A case study.* Unpublished Master's Thesis, University of Limerick.

Kelly, J. (1984a). Working towards a syllabus in computer studies. *Education Ireland,* 1 (3), 49-52.

Kelly, J. (1984b). Why Comal? *Education Ireland,* 1 (4), 23-25.

Looney, A. (2001). Curriculum as policy: some implications of contemporary policy studies for the analysis of curriculum policy, with particular reference to post-primary curriculum in the Republic of Ireland. *The Curriculum Journal,* 12 (2), 149-162.

Lynch, K. (1989). *The hidden curriculum: Reproduction in education, a reappraisal*. London: Falmer Press.

Lynch, K. (1999). *Equality in Education*. Dublin: Gill & Macmillan.

Mackey, B. (1984). Computer literacy – a modular approach. *Education Ireland,* 1 (3), 5-7.

McGlynn, M. (1995). A principal's perspective of implementation. In J. Coolahan, (ed.), *Issues and strategies in the implementation of educational policy.* Maynooth: Education Department.

McKenna, P., Brady, M., Bates, P., Brick, J. and Drury, C. (1993). *New information technology in the Irish school system*. Luxembourg: Office for Official Publications (EC).

Mulkeen, A. (1997). *Information technology in Irish schools.* Available at: http://www.may.ie/academic/education/SchoolsIT/index.htm, [Accessed 21 November 2001].

Nasta, T. (1993). *Change through networking in vocational education*. London: Kogan Page.

NCCA (1993). *A programme for reform. curriculum and assessment policy towards the new century.* Dublin: NCCA.

O'Doherty, T., Gleeson, J., Moody, J., Johnston, K., Kiely, L. and McGarr, O. (2000). *An investigation into the interest in and feasibility of introducing a computer-based subject to the Leaving Certificate (established).* Unpublished report presented to the NCCA.

OECD (1991). *Reviews of national policies for education: Ireland*. Paris: OECD.

Postman, N. (1995). Of Luddites, learning and life. In F. Berliner, and B. Biddle, (eds.), *The manufactured crisis.* Toronto: Addison-Wesley.

Rudduck, J. (1991). *Innovation and change.* London: Falmer Press.

Sutton, R. (1991). Equity and computers in the schools: A decade of research. *Review of Research in Education,* 61, (4), 475-503.

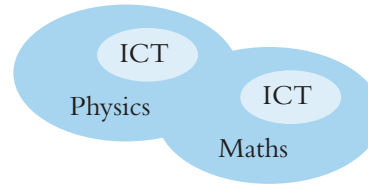
APPENDICES

Appendix A

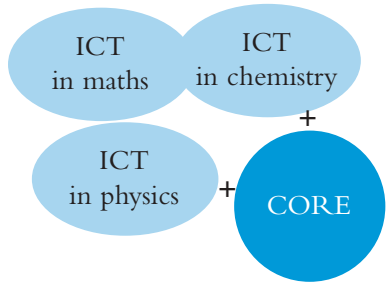
Options relating to the possible form of a computer-based subject

OPTION 1
Discrete, stand-alone subject.

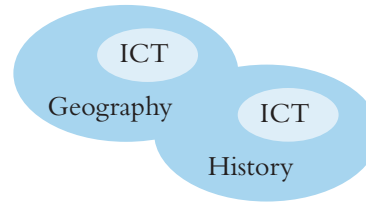
OPTION 2
Self-contained modules within various subjects such as ICT in business, mathematics or physics. Separate assessment, i.e. an examination result in a subject called ICT/IT.



OPTION 3
Core subject area plus modules in various subjects. Assessed separately, i.e. an examination result in a subject called ICT/IT.



OPTION 4
ICT integrated within existing subjects/a number of subjects. These subjects would require that ICT be used within certain experiments/procedures for example. Assessment would be part of the existing subject assessment e.g. specific modules within a subject, specific questions in an examination.



OPTION 5
ICT/IT integrated within each subject/a number of subjects and perceived as a tool for teaching/learning. While the curriculum would require the use of ICT, its use would not be assessed directly/indirectly.

OTHER OPTION

Appendix B

Examples of A-Level content (UK)

Examples of possible content

Introductory computer systems, communications and software: core aspects of computer systems	Information: nature, role and context e.g. value/importance of information, social impact of ICT, information systems and crime	Further knowledge of computer systems – for example: systems software mechanism, machine architecture, database theory and programming paradigms
ICT task – given a task, generate a solution using ICT	Structured practical computing tasks examining different phases in the development of computer-based system	Independent student project within a subject using ICT as a tool e.g. analysis of population change in history, use of internet to research and evaluate sources etc
Information: policy, strategy and systems e.g. evaluation of software, policy and strategy issues	Processing and programming techniques e.g. programming concepts assembly language	Practical applications of ICT using standard/generic software
ICT systems and systems management including management of change, advanced database systems and project management	Computing project: identify a problem and generate a solution, including programming language	Using ICT as a tool within a subject: eg datalogging in science, presentation software in developing brochures in business
Other	Other	Information: management and manipulation e.g. methods of data capture, nature of database, capabilities of software
Other	Other	Other
Other	Other	Other

Appendix C

Overview of discussion group participants

Group	Sector/School Type	No. Attending/ No. Invited	Gender
Parents	Catholic Secondary Schools Parents' Association Parents' Association for Community & Comprehensive Schools (PACCS) Parents' Association for Vocational Schools and Community Colleges (PAVSCC) COMPASS, Parents' Association for Schools of Minority Religions	Seven/ten Group comprised of two representatives from each of the first three listed and one from COMPASS	One male Six females
ICT Teachers	Secondary, male, urban Secondary, male, urban, disadvantaged Secondary, female, urban Secondary, female, urban, disadvantaged Comprehensive, mixed, urban Secondary, mixed, rural Vocational, mixed, rural Community school, mixed, suburban ICT advisor	Nine/fourteen	Five males Four females
Higher/ Further Education (HFE)	Computer science, engineering and electronics VEC	Four/ten	Four males

Group	Sector/School Type	No. Attending/ No. Invited	Gender
School Principals	Community school, male, urban, 300 students Community school, mixed, urban, 900 students Comprehensive school, mixed, urban, 520 students Secondary school, mixed, urban, 1265 students Secondary school, female, urban, 600 students	Five/twelve	Four males One female
NCCA Education Officers	Three from the broad areas of science/maths/ technology One from business studies, One from modern languages One from home economics	Six/ten	Four males Two females
Business/ Industry	Two from IBEC One from SFA One school liaison officer	Four/seven (Two each from IBEC, SFA and ISME were asked to attend, plus the school liaison officer)	Four males
University Computer Science Department (UCSD)	Computer science	Six/six	Four males Two females

Appendix D

Questionnaire sent to business/industry representatives

BUSINESS/INDUSTRY SURVEY

Please give your views, or those of your company/organisation, on the statements expressed by the representatives of business/industry on the feasibility of introducing a new computer-based subject into the Leaving Certificate programme.

1. *The members of the business and industry group said that a new computer-based subject **should not** be introduced into the established Leaving Certificate.*

   Please tick one of the following options

   I agree that a new computer-based subject **should not** be introduced into the Leaving Certificate ☐

   I think that a new computer-based subject **should** be introduced into the Leaving Certificate ☐

   No opinion ☐

   Reasons for your view

   _____

   _____

   _____

   _____

   If you think that a new computer-based subject **should not** be introduced, please skip to Q (3).

If you think that a new computer-based subject **should** be introduced please answer Qs (2)–(6)

2. *Please tick one of the following options*

This computer-based subject should focus **mainly** on computer science ☐

This computer-based subject should focus **mainly** on ICT skills (eg Word, Powerpoint etc) ☐

Other (please specify below) ☐

No opinion ☐

Reasons for your view/comments on the above question

_____

_____

_____

_____

_____

_____

3. *The members of the business and industry group considered that essential ICT skills should be accommodated in some form in second level schools but* ***not as a formal subject in the established Leaving Certificate programme.***

Strongly agree ☐ Agree ☐ Disagree ☐

Strongly disagree ☐ No opinion ☐

Reasons for your view

_____

_____

_____

_____

4. *The members of the business/industry group expressed the concern that the syllabus of a computer-based subject would go out of date very quickly.*

Strongly agree ☐ Agree ☐ Disagree ☐

Strongly disagree ☐ No opinion ☐

Reasons for your view

_____

_____

_____

_____

5. *Please add any further comments you wish to make about whether a new computer-based subject should be introduced into the Leaving Certificate programme. (Further comments overleaf if necessary)*

_____

_____

_____

6. Are the views expressed above (please tick one):

Entirely your own? ☐

Those of your company/organisation? ☐

A mix of your own, and those of your company/organisation? ☐

Thank you for your time and co-operation.

Appendix E

Questionnaire administered to first year computer science university students

First Year University Students Survey

1. Gender: Male ☐

   Female ☐

2. LC subjects and level at which taken.

Subject	Higher level	Ordinary level	Foundation level
1. Irish			
2. English			
3. Maths			
4.			
5.			
6.			
7.			

3. Should a new computer-based subject be introduced into the Leaving Certificate?

   Strongly agree ☐ Agree ☐ Unsure ☐

   Disagree ☐ Strongly disagree ☐

   Why?/Why not?

   _____

   _____

   _____

4. If this subject had been there in your time, would you have taken it?

Yes ☐ No ☐ Don't know/Unsure ☐

Why?/Why not?

_____

_____

_____

5. What subject would you have dropped?

_____

_____

6. If such a subject were to be introduced which of the following aspects should it include? (Write yes or no in the appropriate column)

	Yes/No?		Yes/No?
Computer Architecture		Operating systems	
Applications		Networking	
Programming		Social aspects e.g impact of computers on society etc.	
Computer Organisation		Other	
Internet/email			

7. Select the two most important components from the above list. 1= most important.

1. _____

2. _____

8. Which aspect from this list would you see as least important?

_____

9. What problems would you envisage if a new computer-based subject were introduced into the Leaving Certificate?

_____

_____

_____

_____

10. Which do you see as more important?
(please rank, 1= most important, 3 = least important)

1. The introduction of ICT as a tool for teaching and learning in second level schools across as many subjects as possible? A. ☐

2. The teaching of computer applications to all second-level students? B. ☐

3. The introduction of a computer-based subject to the Leaving Certificate? C. ☐

Why?

_____

_____

_____

_____

11. Any other comments?

_____

_____

_____

_____

Thanks for taking the time to complete this survey, which is being conducted on behalf of the National Council for Curriculum and Assessment.

Appendix F

Questionnaire administered to teachers as part of the school-based study

TEACHER QUESTIONNAIRE

1. Gender: Male ☐

   Female ☐

2. Please state the subject(s) you teach.

   _____

3. How many years have you been teaching?

   Under 5 years ☐ 5 – 10 years ☐

   10 – 20 years ☐ over 20 years ☐

4. How would you rate your current IT skills?

   Very good ☐ good ☐ average ☐

   poor ☐ very poor ☐

5. Do you have any relevant IT training or experience?

   IT2000 Phase 1 ☐

   IT2000 Phase 2 ☐

   ECDL ☐

   Other : _____

6. Do you believe there is a need for the introduction of a new computer-based subject as part of the established Leaving Certificate programme? Please tick:

Strongly agree ☐ Agree ☐ Disagree ☐

Strongly disagree ☐ No opinion ☐

Please state your reasons.

_____

_____

_____

_____

7. How willing would you be to teach such a subject?

Very willing ☐

Willing ☐

Not very willing ☐

Not at all willing ☐

No opinion ☐

Please comment.

_____

_____

_____

_____

_____

8. If you agree with the introduction of a computer-based subject at Leaving Certificate level please tick one of the following options.

This computer-based subject should focus **mainly** on computer science ☐

This computer-based subject should focus **mainly** on computer skills ☐

Other (please specify below) ☐

No opinion ☐

_____

_____

_____

9. What problems may arise in implementing such a subject in this school?

_____

_____

_____

_____

_____

_____

_____

_____

10. What might be the profile of students who take this subject in this school i.e. gender, academic performance etc.

_____

_____

_____

_____

11. Do you feel a computer-based subject at Leaving Certificate level would affect uptake in your subject areas?

Yes ☐ No ☐ Unsure ☐

Give reasons:

_____

_____

_____

12. Does the school have the teaching expertise to deliver such a subject?

_____

_____

_____

_____

13. How would such a subject affect current levels of computer usage in schools?

_____

_____

_____

_____

14. How should this subject be assessed?

15. Please add any further comments you consider would be important in the consideration of this curriculum initiative.

Thank you for taking the time to complete this questionnaire.

Appendix G

Questionnaire administered to students as part of the school-based study

STUDENT SURVEY

1. Gender: Male ☐

   Female ☐

2. Do you have access to a personal computer at home (not a game console)?

   Yes ☐ No ☐

3. Does your home computer have internet access?

   Yes ☐ No ☐ Don't know/Unsure ☐

4. What subjects are you currently taking?

Subject	Higher level	Ordinary level	Foundation level
1. Irish			
2. English			
3. Maths			
4.			
5.			
6.			
7.			

6. Do you think a computer subject should be introduced into the Leaving Certificate?

Strongly agree ☐ Agree ☐ Unsure ☐

Disagree ☐ Strongly disagree ☐

Why?

_____

_____

_____

_____

6. If this subject were available to you as a Leaving Cert option would you have taken it?

Yes ☐ No ☐ Don't know/Unsure ☐

7. What subject would you have dropped?

_____

_____

_____

8. What do you think should be the content of this subject?

_____

_____

_____

_____

9. If you think that a new computer-based subject **should be introduced** please tick one of the following options

This computer-based subject should focus mainly on computer science ☐

This computer-based subject should focus mainly on computer skills ☐

Other (please specify below) ☐

No opinion ☐

Reasons for your view

_____

_____

_____

_____

_____

10. What do you intend to do when you leave school?

_____

_____

_____

_____

_____

Any other comments?

_____

_____

_____

_____

_____

Thanks for taking the time to complete this survey, which is being conducted on behalf of the National Council for Curriculum and Assessment.

Appendix H

Letters to prospective participants

Letter to Principals

23rd April 2001

Dear ……

I am part of a small research team based at UL which is conducting research for the NCCA on the issue of the desirability and feasibility of introducing a computer-based subject in the established Leaving Certificate.

The outcome of Phase 1 of this research suggests that there is widespread support, in principle, for such an initiative. We are now addressing issues such as the form and content of such a subject and its implications for schools and teachers. Some of the issues that we wish to pursue at school level include:

- should there be a stand alone computer-based Leaving Certificate subject? What should the content be?
- the role of ICT in teaching and learning
- the perception that ICTs would add to the difficulties of an already overloaded curriculum
- the impact a stand-alone subject might have on teachers' own specialist subjects
- the likelihood of identifying "ICT" as being the responsibility of one teacher
- the availability of a trained teacher to teach an ICT subject

- the question of equality of access and/or treatment in respect of students (especially where computer literacy and skills form the focus; those with access to computers at home would have a significant advantage)
- the need for such a subject to be teachable, learnable and assessable
- current level of competence of teachers in the ICT area.

We have met with groups representing school ICT co-ordinators, school principals, parents, business/industry, third level education and NCCA Education Officers. We would also like to get reactions from two schools, one secondary and one vocational.

Field work would include:

- interview with school principal
- group discussion (approximately 90 minutes) with a cross-section of some seven teachers from the following 'subject' areas: Business, Career Guidance, Science/Mathematics, Technology, English, Modern Languages, Computers
- survey of the views of fifth year students (questionnaire)
- survey of views of all staff (questionnaire)
- survey of relevant school resources
- possible survey of parent opinion (e.g. through the Board of Management, Parents' Council).

It is hoped to audio-tape all interviews.

I am writing to request your school's participation in this research, which has to be completed before the Summer break. While I fully realize the sensitivity of this request at this time, your cooperation would be greatly appreciated. Please let me know as soon as you can.

Yours truly,

Dr Jim Gleeson
Department of Education and Professional Studies
Phone: 061-202760
Fax 061-202751
Email: jim.gleeson@ul.ie

Letter to ICT teachers/coordinators

17 January 2001

Dear ICT teacher/coordinator

As you may be aware members of the Department of Education and Professional Studies at the University of Limerick are involved in a research project, commissioned by the National Council for Curriculum and Assessment. The aim of the project is to investigate the possible form, content and perceived impact of the introduction of a new computer-based subject to the established Leaving Certificate programme.

During Phase One of this research we disseminated a questionnaire to approximately 25% of all second-level schools in the country to ascertain the opinions of principals, ICT teachers and/or coordinators, and non-ICT teachers in this matter. We also surveyed, in a limited way, the opinions of the educational partners. We sent questionnaires to all members of the NCCA ICT Steering Group. This group represents teachers' associations, managerial bodies, third-level institutions and parents' associations. We also surveyed a random sample of 30 representatives from business/industry in the Shannon Development region.

In Phase Two of the project we intend, through group discussions, to explore in greater depth with the educational partners the issues raised in the questionnaires. The number of participants in each group will be limited to six or seven thus giving interested parties an adequate opportunity to discuss in detail their opinions and views in relation to this controversial subject.

To this end we invite you to attend a group discussion on Thursday 25 January at 5pm at the Blarney Park Hotel. We wish to obtain the views of ICT teachers and SIP coordinators on the approach to computer education most appropriate to the established Leaving Certificate programme. During this discussion we hope to explore the perceived effect of a new computer-based subject on current ICT programmes within the school:

- What impact would it have on facilities available in the school for other computer use?
- Impact of subject on resources (number of computers, age of computers, internet access, speed of line etc. Issues of software licensing)
- Issues of upgrading
- Maintenance of equipment
- Posts of responsibility in ICT: is there a specific ICT teacher? Has the teacher been recently trained in the area? What are his/her duties?
- What use do other teachers make of the ICT resources in the school?

The session will be attended by two members of the research team and will be audio-recorded. The group discussion will take approximately 90 minutes and participants will be invited to an evening meal at the Blarney Park Hotel following the discussion. Participants' travel expenses will be reimbursed.

The decision whether or not to introduce a computer-based subject to the established Leaving Certificate programme will be a controversial one. It is important that all teachers' views are represented in the discussion phase. While I fully appreciate that there are many calls on your time I do hope that you will be in a position to attend this meeting and to contribute to the process.

I look forward to hearing from you on or before Monday 22 January to confirm your availability to attend.

Yours sincerely,

.....

Dr Teresa O'Doherty,
Assistant Dean, Research,
College of Education.
Email: teresa.odoherty@ul.ie

Letter to NCCA education officers

January 2001

Dear Mr/Ms ……,

As you may be aware members of the Department of Education and Professional Studies at the University of Limerick are involved in a research project, commissioned by the National Council for Curriculum and Assessment. The aim of the project is to investigate the possible form, content and perceived impact of the introduction of a new computer-based subject to the established Leaving Certificate programme.

During Phase One of this research we disseminated a questionnaire to approximately 25% of all second-level schools in the country to ascertain the opinions of principals, ICT teachers and/or coordinators, and non-ICT teachers in this matter. We also surveyed, in a limited way, the opinions of the educational partners. We sent questionnaires to all members of the NCCA ICT Steering Group. This group represents teachers' associations, managerial bodies, third-level institutions and parents' associations. We also surveyed a random sample of 30 representatives from business/industry in the Shannon Development region.

In Phase Two of the project we intend, through group discussions, to explore in greater depth with the educational partners the issues raised in the questionnaires. The number of participants in each group will be limited to six or seven thus giving interested parties an adequate opportunity to discuss in detail their opinions and views in relation to this controversial subject.

To this end we invite you, as an NCCA education officer, to attend a group discussion on Tuesday 30 January at 5.30pm at the Skylon Hotel, Dublin. We wish to obtain the views of teachers not involved in the teaching of ICT on the approach to computer education most appropriate to the established Leaving Certificate programme. It is hoped that with your broad experience of working with teachers in the area of … you will be able to reflect the opinions of your colleagues, and that through our discussions with you and fellow NCCA education officers, we can get a representative view of the attitudes of teachers. During this discussion we hope to explore issues such as:

- Should there be a computer-based subject? If yes, why and what form should it take? What content should be included?
- How would the introduction of any new computer-based subject affect teachers?
- Have non-ICT teachers the skills and knowledge to contribute to a new subject? What are teachers' current levels of ICT skills? What teacher training or in-career development is needed?
- Do teachers have access to the required technologies?
- What are teachers' opinions on the addition of another subject to the curriculum?
- Are teachers willing to get involved in the delivery of a new subject?

The session will be attended by two members of the research team and will be audio-recorded. The group discussion will take approximately 90 minutes and participants will be invited to an evening meal at the Skylon Hotel following the discussion. Participants' travel expenses will be reimbursed.

As follow-up to this discussion with you, we intend to undertake school-based studies which will explore the impact of the introduction of a computer-based subject from the perspective of the school as an organisation. We also intend holding group discussions with teachers involved in the teaching/coordination of ICT and with school principals. These meetings and school-based studies will contribute to building up a profile of teachers' views in relation to this issue.

The decision whether or not to introduce a computer-based subject to the established Leaving Certificate programme will be a controversial one. It is important that all teachers' views are represented in the discussion phase. Consequently I hope that you will be in a position to attend this meeting and to contribute to the process.

I look forward to hearing from you on or before 23 January to confirm your availability to attend.

Yours sincerely,

.....

Dr Teresa O'Doherty,
Assistant Dean, Research,
College of Education.
Email: teresa.odoherty@ul.ie

Letter to business/industry

11 June 2001

Dear ……..

A research team at the University of Limerick is currently undertaking a research project for the National Council for Curriculum and Assessment (NCCA), investigating the feasibility of introducing some form of a computer-based subject into the established Leaving Certificate programme.

A wide range of opinions has been sought, including those of a small group representing business and industry. In order to obtain a greater cross-section of opinions/comments from business/industry, we would appreciate your own views, as a member of the business/industry sector, or those of your company/organisation, on the opinions expressed by the small group.

The information contained in the completed questionnaire will be treated confidentially and no business or person will be named in the report. However, questionnaires are numbered for administrative purposes.

It would be greatly appreciated if you would complete this brief survey. A stamped addressed envelope has been included for your convenience.

Thank you for you cooperation.

Yours sincerely,

Dr Jim Gleeson
College of Education
Email: jim.gleeson@ul.ie

LANGLEY FREEMAN
design group limited
Telephone: +353 1 822 8970
www.langleyfreeman.ie

ISSN 1649-3362

National Council for Curriculum and Assessment
24 Merrion Square, Dublin 2.