Computer education : Ireland : a case study

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ABSTRACT

"COMPUTER EDUCATION: IRELAND, A CASE STUDY"

by

MICHAEL D. MOYNIHAN
COLAISTE AN SPIORAID NAOIMH.
BISHOPSTOWN,
CORK, IRELAND

The research described in this thesis is born mainly of the author's experience within the Executive Committee of the Computer Education Society of Ireland (CESI) in trying to get computing onto the curriculum of Irish Second level schools. The author has been a member of the CESI Executive Committee since 1976, and is currently serving his second term as its Chairman, having previously held the position from 1978 to 1981. The author has been involved in the teaching of computer Studies at Second level since 1973, and has conducted teacher training courses since 1977. He is keenly aware of the need to provide adequate structures that would support the evolving (and constantly changing) needs of the teacher of the Information
Age, and to this end was responsible for the setting up of a Schools' Computing Centre in Cork.

Problems associated with the promotion and introduction of Computing into the rigid centralised Irish Educational System over the last twelve years led to a certain awareness that the resources, expertise and the type of initiative that the Irish education system requires of the Department of Education is totally inadequate. This, in turn, led the author to the conclusion that, taken in its widest context, Information Technology is so vast a topic that it cannot be tackled under the existing structures of the Department of Education alone. (For the purpose of this thesis, Information Technology is taken to mean the inter-related technologies of telecommunications, video and the computer). The computer, although vital, is but a component of Information Technology.

The situation in Ireland is that Computer Education came up from the 'grass-roots', and not as usually happens in a centralised education system from the top down. The centralised Irish education system does not easily allow for change. It is difficult to get a new subject onto the curriculum. When a
subject is not on the curriculum, structures do not exist whereby finance can be allocated for its establishment, except under the umbrella of another subject. In Ireland Computer Studies was put under the umbrella of Mathematics. It must be added that the bulk of the financial allocation goes towards the financing of five day inservice courses, usually held during the summer. When we consider the rapid changes which computer related technologies are making and the consequent needs of teachers such courses are by no means sufficient. When one realises that, in the present recessionary climate, even these courses may not always be held, their value pales to insignificance. The Department of Education has not got the personnel, the structures or the expertise to provide the framework for the proper introduction of Computer Education into schools. The wider concept of Information Technology is simply not understood at official level.

With this in mind, the author discusses the need for creating new structures and how such structures could be created whereby Information Technology, in its widest sense, could, in the author's opinion, be best fostered in Irish schools.
The second chapter contains a discussion of the computer’s role in education and research into its potential as an agent for change in the educational process. This chapter also contains a brief discussion of the Irish educational system and discusses some of the constraints associated with innovation in the Irish Educational system. There is a discussion of current Irish industrial policy with regard to microelectronics. In Ireland, unlike most other countries, training is completely divorced from education.

Brief analyses of the development in Computer Education in Australia, Ontario Province (Canada), the United Kingdom and France are discussed in chapter three. France, which like Ireland, has a centralised educational system is given special treatment. These countries were chosen so that possible lessons and directions for Ireland could be signposted. Ireland’s membership of the European Economic Community (EEC) is also borne in mind throughout the thesis.

Chapter four contains a discussion of the development of Computer Education in Irish schools and the role of CESI in this development. In this aspect, Ireland can be set up as a model
for developing countries. It also high-lights the inadequate resources and structures within the Department of Education for innovation in education.

The final section is devoted to the author’s own ideas as to how a National Plan with regard to the introduction of Information Technology into Irish schools can best be implemented. This plan calls for an input into the educational system from outside bodies, such as the Government Departments of Labour and Industry, Government Agencies, the EEC, the computer industry, in particular, an amalgamation of education with the Training section and a pooling of resources for the benefit of all. What is proposed is a co-operative approach to enhance Education and, at the same time, to provide for the economic well-being of the country. To an extent, this is the type of approach adopted by those countries discussed in our comparative study. The author also discusses the need for the setting up of Resource/Support structures for teachers and courseware development programmes and discusses hardware requirements and suggests how these problems could best be tackled. Teacher training, which is of fundamental importance, to the implementation of any Plan is specifically discussed in Chapter VII.
The thesis concludes by formulating general guidelines as to why Information Technology should be introduced into the Schools Curriculum. The author insists that, only under the terms of a National Plan and adequate funding can Computer Education, or, in its wider sense, Information Technology, become a viable proposition in Irish schools. A number of recommendations are made and some areas of further research are indicated.

Keywords

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Professor A.C. Bajpai, Director of C.A.M.E.T., Founder President of the Computer Education Society of Ireland and project supervisor was the visionary who foresaw the importance of Computer Education in the early 1970's. His computer courses conducted under the auspices of the Department of Education at University College, Galway, his encouragement and support led to the establishment of the Computer Education Society of Ireland (CESI). He deserves special credit for his continuing support for the advancement of Computer Education in Ireland. As research supervisor, he has been a constant source of assistance, guidance and motivation.

Dr John O'Donoghue, Thomond College of Education and Director of
C.A.M.E.T. (Ireland) deserves a special word of thanks. Through him Irish teachers may now obtain academic status in computer related areas. As Director of C.A.M.E.T. (Ireland), he has been a constant source of help and support throughout the project and was at all times enormously generous and kind.

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CHAPTER I

1 AIMS AND SCOPE OF THE RESEARCH PROJECT

The author's experience within the Executive Committee of the Computer Education Society of Ireland (CESI) in trying to get computing onto the curriculum of Irish Second level schools forms the basis for the research described in this thesis. The author has been a member of the CESI Executive Committee since 1976, and is currently serving his second term as its Chairman, having previously held the position from 1978 to 1981. The author has been involved in the teaching of Computer Studies at Second level since 1973, and has conducted teacher training courses since 1977. He is keenly aware of the need to provide adequate structures that would support the evolving (and constantly changing) needs of the teacher in the Information Age, and to this end was responsible for the setting up of a Schools' Computing Centre in Cork.

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When we consider the rapid changes which computer related technologies are making and the consequent needs of teachers such courses are by no means sufficient. When one realises that, in the present recessionary climate, even these courses may not always be held, their value can pale to insignificance. The Department of Education on its own, has not got the personnel, the structures or the expertise to provide the framework for the proper introduction of Computer Education into schools. The wider concept of Information Technology is simply not understood at official level.

The author has examined and analysed developments in computer education in Ireland with a view to chronicling these developments, identifying positive and negative and features possible new developments in this important area. This is done against a backdrop of international activity in Information Technology.

With this in mind, the author discusses the need for creating new structures and how such structures could be created whereby Information Technology, in its widest sense, could, in the author’s opinion, be best promoted and fostered in Irish schools.

The second chapter contains a discussion of the computer’s role in
education and research into its potential as an agent for change in the educational process. This chapter also contains a brief discussion of the Irish educational system and discusses some of the constraints associated with innovation in the Irish Educational system. There is a discussion of current Irish industrial policy with regard to microelectronics. In Ireland, unlike most other countries, training is completely divorced from education.

Brief analyses of the development in Computer Education in Australia, Ontario Province (Canada), the United Kingdom and France are discussed in chapter III. France, which like Ireland, has a centralised educational system is given special treatment. These countries were chosen so that possible lessons and directions for Ireland could be signposted. Ireland's membership of the European Economic Community (EEC) is also borne in mind throughout the thesis.

Chapter IV contains a discussion of the development of Computer Education in Irish schools and the role of CESI in this development. It also highlights the inadequate resources and structures within the Department of Education for innovation in education, especially computer education.
The final section is devoted to the author's own ideas as to how a National Plan with regard to the introduction of Information Technology into Irish schools can best be implemented. This plan calls for an input into the educational system from outside bodies, such as the Government Departments of Labour and Industry, Government Agencies, the EEC, the computer industry. It also calls for an amalgamation of education with the Training section and a pooling of resources for the benefit of all. What is proposed is a co-operative approach to enhance Education and, at the same time, to provide for the economic well-being of the country. To an extent, this is the type of approach adopted by those countries discussed in our comparative study. The author also discusses the need for the setting up of Resource/Support structures for teachers and courseware development programmes. He discusses hardware requirements and suggests how these problems could best be tackled. Teacher training, which is of fundamental importance, to the implementation of any Plan is specifically discussed in Chapter VII.

The thesis concludes by formulating general guidelines as to why Information Technology should be introduced into the Schools Curriculum. The author insists that, only under the terms of a National Plan and adequate funding can Computer Education, or, in its
wider sense, Information Technology, become a viable proposition in Irish schools. A number of recommendations are made, a model for developing computer education in developing countries is presented, and some areas of further research are indicated.

The thesis is possibly one of the first to concern itself with computer education in Ireland. Therefore, in this respect it is significant as a case study. As little research has been done into this area in Ireland, the thesis must, of necessity, be specific in identifying past efforts, immediate and future needs and the structures that are needed to cater for them, but general with regard to their implementation. Much more research is needed into many of the areas which are touched in this thesis, in order to produce a comprehensive policy for the introduction of Information Technology to schools. However, the author is convinced that Irish experience in computer education has considerable extra value for researchers because of its potential as a model for development in other countries especially third world countries.

As was pointed out at the European Economic Community Seminar (Bologna 1985)

"The issues are education and teacher training. But it does
not stop there. For them (the teachers), the computer is the unfolding of a never-ending story of continuing education. And that is what will bring about changes in both method and content of what is being taught. The computer in the classroom will not only impinge on technical and scientific subjects. Quite the reverse. Even a philosopher may understand the soul of the machine........ The priority must be to offer educators favourable conditions to enable them to get maximally acquainted with computer technology* [1 (P36)]
It is likely that education will be more and more permeated by Information Technology as an aid to the teaching/learning processes. Whatever aspects of these processes we consider, it is difficult not to see ways in which the appropriate use of Information Technology could contribute to, and enhance, what is being done. This may have far-reaching consequences and is likely to call into question a number of important assumptions about the nature of the educational system. For example, learning opportunities for all will be enhanced if education is progressively liberated from its dependency on level, time, place and age, so that the concept of life-long education becomes more within reach. From the EEC comes the opinion that "new information technologies will completely revolutionise pupil/teacher relationships and will call into question existing teaching methods, if they do not render them entirely obsolete."
Integrating Information Technology into the curriculum and administration of schools will, needless to mention, be highly expensive and will involve a large commitment of human, physical and financial resources over a long period. There is also the important consideration that changes in the educational system, especially those of a far-reaching nature with consequent implications for the children concerned, need to be pre-examined and monitored very carefully. All these factors counsel caution. There however, is little evidence to suggest that we shall rush head-long into irresponsible educational change, but rather, that Ireland will concentrate too closely on relatively limited areas of development and ignore the wider implications of Information Technology.

2.1 INFORMATION TECHNOLOGY — SOME GENERAL CONSIDERATIONS.

The impact of Information Technology on society is bound to affect the educational system in several ways. The Association for Teacher Education in Europe (ATEE) have identified four main areas which concerns education. [3]

Pupils have to be prepared to live and work in a rapidly changing society. Therefore schools have to teach about Information
Technology and about its influence on society. Information Technology implies a new way of handling information. Consequently Information Technology involves schools in granting (or refusing) the pupil a new ability: literacy in Information Technology, which will change the contents and methodologies of practically all subject matters. Information Technology can serve as an aid in the teaching process, either as a tool or as a medium. Finally, Information Technology may be used as an aid for school management.

From the EEC perspective the new Information Technologies offer an opportunity of expanding our intellectual horizons and transforming Information Technology into a source of knowledge. The feeling is that it is in these terms that we should view their influence on the teaching process. [4] Within the EEC there is also an awareness of the need for a greater investment in the new technologies, of the need to spread those technologies over all levels of education and to interlock the new technologies ever more tightly with the training process. [5]

Mackey in his discussion document (1983) [6] developed and adapted these ideas for Ireland and makes the point that we have failed to recognise the impact that this new technology will have
on Education. The computer should more correctly be called an Information Processor. The emphasis on its Computing functions has lead to a number of misconceptions, not the least of which has been the overemphasis on its association with Mathematics which is to blame for its being regarded as an elitest subject matter.

The volume of information, available to man, doubles, we are told, every seven years. Given that the capacity of the human brain is limited, we are reaching the stage when man will be hard pressed to simply acquire the available information in any discipline, without either improving or acting on it. This phenomenon is generally referred to as the Information Explosion. The implications of the Information Processor for our education system are all very significant.

In the computer or Information Processor man has developed a machine that can store vast quantities of information rapidly and efficiently. However, like all new developments its success depends on how well we understand it, and use it for the benefit of mankind, making the machine work for us not the other way around. The computer of the Information Age should extend man's brain-power in the same way as the machines of the Industrial Age extended his muscle-power. It was developed for that purpose and it is important
that we bear this in mind when implementing technological change. The computer was intended as an extension of the human brain, not as a replacement of it. We live in the Information Age. Information is the raw material of education. Therefore it is vital that people involved in education, both teachers and policymakers, grasp its implications. We must see technology as an extension of the human resource, not the replacement of it.

At present, the increasing volume of information and the pressure of an inflexible examination system, has meant that the best an education system can now offer is the acquisition and retention of a limited amount of the total available information. As the volume of information increases, we are less and less able to improve on, or even apply that information. The improvement and application of information should be considered to be more valid educational objectives than the mere acquisition and retention of it [7]. The transmission and storage of information can in themselves be described as educational processes as they fall into the category of 'boring repetitive' tasks which a computer was designed to handle, thus freeing the human mind to concentrate on the more creative areas of studying, applying, and improving information.

2.1.1 INFORMATION TECHNOLOGY AND THE SCHOOL
When we talk about Information Technology within the EEC context, we must bear in mind the influence of the ATEE in this area. The ATEE has worked under contract to the EEC Commission in the preparation of research documents and Reports which provide an overview on the impact of the new Information Technologies on education, mainly within the EEC Member States. It is for that reason that the author places special emphasis on the Reports produced by Rhys Gwyn [8] because they present the most thorough examination of the impact of the Information Technologies on the educational system.

Gwyn [9] maintains that the Information Technology phenomenon affects the school in virtually every aspect of its functioning. The simplest way of expressing this complexity is to say that, so far as the school is concerned, Information Technology is uniquely both a medium and a message.

2.1.2 INFORMATION TECHNOLOGY: CURRICULAR IMPLICATIONS.

The rapid evolution of Information Technology has implications for the CONTENT of what is taught. For example, it leads to the introduction of a new subject variously called Computer Studies, Computer Science or Informatics. This, in turn, breaks down
into, for example, information processing (e.g. systems analysis, representations of states and processes, planning and programming, configuration of systems), and applications studies (e.g. control technology, business applications). It can also lead to the modification of existing subject areas since the new technologies offer new ways of structuring the enquiries traditional to some subject areas, the introduction of utilisation skills which can be applied across a wide spectrum of activities both in school and beyond (e.g. keyboard skills, terminal use, data banks, viewdata) and a need to teach about the WIDER SOCIAL IMPLICATIONS of Information Technology (e.g. impact on work/leisure, nature of employment, data protection, democratic control). In all of these different ways, Gwyn asserts, Information Technology modifies the message, the content of education.[10]

Additionally Information Technology offers modifications to the ways in which learning can be made available: it ALTERS THE MEDIUM. Thus Information Technology makes Computer Assisted Learning (CAL) possible, in forms such as Computer Aided Learning and assessment, the use of simulations and games to create learning models (e.g. of economies, of experiments) which might otherwise be too large-scale or too dangerous to handle and the use of new study
skills (e.g. the use of data banks) in both specific and general areas.

This much is relatively straightforward, and is also within the realms of the known. Gwyn identifies two further major dimensions of the Information Technology/school phenomenon, which pose questions far more challenging than those of the medium/message cluster. Indeed, when examined, these further dimensions may well contain threats to the existing theory and practice of education beyond our present capacity to respond, so far-ranging are their implications. Nonetheless, if any kind of meaningful responses are to be made to the new technologies, then all such challenges must be acknowledged. The two dimensions of Information Technology to which Gwyn refers are those of its impact upon the organisation of learning and, secondly upon the societal function of school. Taken together, they are a measure of just what the so-called 'Information Revolution' may mean for society in general.

While many uncomplimentary comments have been made about existing CAL, we must not, however, underestimate its potential importance. Properly developed, CAL has a boundless capacity for
providing a resource which could allow, at any time, learning experiences appropriate to any given subject and for any given class or for any given CHILD. For the theoretical schema is one of an endless store of tried, tested and effective learning programs, from which could be plucked at any time exactly the right program suited to the particular needs of a particular child.

This picture of the individualisation of learning is an enormously powerful one. The assumptions which it makes are certainly within our present conceptual grasp. They include the notions that (1) given the time and resources, we could put into computer store (then constantly refine and update) all the learning programs that pupils will ever need, and (2) that our communications networks (satellite, cable, viewdata, telesoftware) will make these programs available to the child (in any school, in any country, in hospital, at home) at his own terminal and (3) that computer monitoring of pupils' progress will determine what programme will be offered next, and when.

There is nothing whatsoever in this picture, as painted by Gwyn, which goes beyond the existing bounds of the TECHNOLOGICALLY commonplace.
At the First International Federation for Information Processing (IFIP) WORLD CONFERENCE ON COMPUTERS IN EDUCATION (Amsterdam 1970) [13] it was recommended that Education Authorities provide an early introduction to Informatics as an integral part of general education in secondary schools and primary schools. In view of the profound social and political implications of the widespread use of computers, it recommended that authorities should provide general education in Informatics for all. It was also recommended that Governments and National Authorities provide or actively support endeavours to provide Informatics education for all students.

Current thinking within most EEC member states emphasises the that computing must not be put on the curriculum as a science subject, but rather used as an aid to learning. It is felt that initiative must lie with the education authority and that all teachers without distinction must be trained given that "the New information Technologies is not an ordinate of culture, but rather a bedrock". [14]

In an ATEE Report [15] Gwyn makes the point that, while it is easy for EEC Member States to engage in analyses of each other's national approaches to Information Technology, it is much more difficult to arrive at the synoptic European analysis of the
directions which a policy should be taking and of the actions which should be initiated. Yet, it is precisely this analysis which interests the Community and the ATEE working group. He feels that it is therefore, worth dwelling on the nature of the difficulty inherent in this analysis and in so doing, we may obtain a clearer picture of the difficulties with which the formulation of policies at national levels are beset.

Gwyn [16] gives four random illustrations of the kinds of problem encountered (1) there is a great deal of work to be done on the ESTABLISHING OF STANDARDS and on the PRINCIPLES to be observed in the construction of CAL programs. Secondly, if we look at the teaching of what is variously called 'Computer Studies' or 'L'Informatique' as a discipline we find a problem associated with THE TEACHING OF PROGRAMMING. Existing languages are many, but in the main, they have not been developed for educational purposes. Only two (France's L.S.E. and COMAL from Denmark) have any pretensions to be orientated towards education. There is a clear need to identify languages which would truly serve to educate pupils into the habits of thought demanded by the new technologies. A third problem relates to the last. The PRODUCTION OF SOFTWARE is very costly indeed, and there appears to be strong prime facie arguments for the sharing of resources in this field. Yet co-operation and
software transfer is hampered by the multiplicity of languages and their dialects. It is clear that one need arising from the emergence of Information Technology in education is a demand for massive programmes of teacher re-training in service as well as for an extensive re-think of pre-service training. To bring about the necessary re-orientation of training, it will be necessary for many thousands of man-hours to continue to be spent in planning and discussion.

These are but four of the many and complex problems facing the world of education in the face of the Information Technology revolution. Yet, with some planning, discussion and foresight, each, to a greater or lesser measure, is capable of solution. The solutions will be expensive, and much time will have to be found in arriving at them.

The need to retrain teachers in service and to re-orient initial training is of quite a different order of magnitude to the other three and he contends that the challenge facing teacher education reflects THAT FACING THE EDUCATION SYSTEM GENERALLY. Thus, it is perfectly simple to mount courses of pre- or in-service education to answer specific needs, such as the introduction to CAL or to teach BASIC, it is far more difficult to see WHAT IN TOTAL the
Information Technology phenomenon means for teacher training. Is it a matter of teaching teachers a few new skills? making sure that they know how to switch on (and off) a useful support tool which will fit, a part of the time into the normal classroom situation? Or are we just possibly facing an educational future in which the roles of teacher, of pupil and of school will be radically transformed by new technologies into something we cannot yet glimpse?

Thus the problems of teacher education encapsulate the whole spectrum of the Information Technology/education possibilities.

Gwyn concludes

"But what is a clear cause for concern at present is that, such national policies as exist, and grassroots developments generally, seem to assume that this will be so. As a consequence we appear content to tackle the phenomenon piecemeal and to engage with specific problems only (to experiment with CAL, to tinker with Basic) rather as though we realise we are engaged in a great many local skirmishes but are not asking (cannot afford to ask?) whether or not this might mean we actually have a war on our
Gwyn acknowledges the danger of being facile, but considers that the reverse may also be true, which is that those with some power to influence what happens in and to school may underestimate the element of truth in the last paragraph and to be satisfied with partial answers to a very large problem. Either way, he contends, we shall not begin to know until we make a more coherent effort to stand back and attempt, at least, to define an overall strategy. But to do that we need to know, or begin to know, what it is we are dealing with. It is only in the light of TOTAL analysis that we can begin to do anything more than skirmish.

Researches at European level indicate that no national Government is facing up to the need to define such overall strategies. Where national policies for Information Technology exist they tend to show the partial approach which has just been identified. This is true of even the most far-reaching examples, namely those of France and the UK.

It is vital to recognise that the whole Information Technology phenomenon offers education not just some exciting possibilities.
but a serious challenge to some long-established views of the role of school in society. Thus, the problem for school systems is not merely one of funding an expensive new resource, serious though that problem is. It is more a problem of facing up to the full implications of the possibility that we MAY be facing a social re-orientation as drastic as that which took place in the change from agrarian to industrial society in Northern Europe in the nineteenth century, but the pace of change may be much more rapid. Faced with such a problem, it is scarcely surprising that national education systems, deeply rooted as they are in existing social and bureaucratic structures, should be disinclined to face fundamental questions.

The ATEE, Gwyn concludes, has neither the power nor the wish to dictate policy to EEC Member States, but feels that here is a field in which the European Community could most usefully supplement and support thinking at national level.

2.2 THE ROLE OF THE COMPUTER IN EDUCATION

If computers are to be used in schools, one must be very careful to outline educational objectives at the outset. Since there is very little experience around, it is imperative that whatever structures
evolve will ensure that teachers develop a critical and discriminating attitude towards the new Information Technologies. This would no doubt, evolve over a period of time and must be a basis for further experiment and research. The full-scale adoption of half-developed ideas will not further the advancement of either education or technology. In order that Information Technology reach out to all students, it is important that teachers from ALL existing subject areas become involved to a greater or lesser degree immediately.

The computer has the ability to break down barriers that currently exist within school subject areas. It is, therefore, vital that all teachers in a school be encouraged to have, at least, a minimal familiarity with computers and be able to apply computer technology to their own subject areas. Current teacher training courses should be organised in such a way as to cater for the reluctant user. This could be done by including quality Computer Assisted Learning packages on all subject areas as an essential element of all courses. It would be better and more beneficial if properly structured courses were provided, and, after the French model, to build up a body of teachers who would be able to conduct future teacher training courses.
Twenty years ago the school was perceived as the authority on education and parents backed that premise fully. In the last ten years parents are beginning to actively participate in the education process. This trend is worldwide. In Ireland we have seen the participation of parents representatives on the Boards of Management of Primary and Community Schools. The last decade has also seen the establishment of Parents Committees in the traditionally Religious run Secondary schools. As is the trend elsewhere, it is to be expected that parental involvement will become more commonplace in Ireland as central funding from the Department of Education becomes scarcer, thus, perhaps, giving parents a greater role in the day to day running of schools.

Let there be no doubt but that we are fast reaching the stage where a gulf is becoming more evident between school and home. What will the Junior infant teacher do when the child learns how to read before he comes to school? What will the teacher do when Little Professor or Dataman has taught a 4 year old how to come up with the division, multiplication, addition and subtraction sets and Speak and Spell has taught him spelling? The teacher can feel useless OR educators can recognise the inevitable and plan now for a new mode of instruction. We must stop trying to justify the system, spot the ills and attempt to cure them. Computers should calculate, help in
decision making and do all those menial tasks that they can possibly accomplish so people can participate in what is enjoyable. If the instructional system does not meet the needs of the twenty first century, students will grow up with an outdated method of instruction to live in a modern world of technology that will not only overwhelm them, but perhaps control them. If they are going to be effective leaders in future society, then we had better start now to show them the way and equip them with the tools necessary to make decisions based on this reality.

Personal computers will be dominant in education. But it is a mistake to believe that the computers currently around are the ones we are talking about. We are only at the earliest stage of computer development, particularly with regard to the personal computer. Today's microcomputers, however sophisticated, are hardly a shadow of the types of machines which will dominate learning. Central processing units are becoming cheaper and more sophisticated and memory of all types is dropping in price. The integrated circuit technology is only at its beginning, and we can expect a long steady decline in prices, increase in capabilities, and decrease in size. Going along with this will be increased educational capabilities such as sound, much better graphics, alternate media, such as those provided by the
videodisk, and a host of other rapid developments. In planning for computers in education we must give full attention to this dynamic situation rather than focusing on today's hardware. We should however remember that technology is not learning. We must not get too carried away by the technology at the expense of learning. Therefore, we should not give primary attention in education to the new hardware developments. The real interest in the computer in the learning situation lies not in its decreasing price and increasing capabilities, but rather its effectiveness as a learning device. If Information Technology is properly used in Education both as an aid and a resource, the emphasis will much more on learning than on teaching, especially on the development of learning skills. At least two factors are critical in considering the effectiveness of the computer in aiding learning, (1) the interactive nature of computer-based learning and (2) the ability to individualise the learning experience to the needs of each student. Olds [19] sees the computer as significant to education because it places within one total environment that teaches (the school) another total environment that teaches (the computer) and therefore believes that it exponentially increases the learning possibilities. It does not merely add on.

2.3 Teachers and the Computer
Another barrier that needs to be broken is the one that currently exists between some teachers and the computer. The computer as instructional tools may be perceived by some teachers as a threat. The teacher unions may see it as a replacement—and consequently a loss of jobs and security for their members—by an inhuman element. Education in this area has been minimal. We need to overcome these fears by showing the teacher that the computer is no more a threat than the slide projector. The computer is the greatest technological advance in years—particularly the microcomputer. It can release the teacher from oppressing tasks so that time can be used to further humanise education. There is an urgent need to plan now. It is important that teachers develop sound educational uses for computers. If unsound, faulty or unstructured uses are allowed to develop then the effective use of computers will be far from reaching their potential and could go the way of Educational TV of the 1960's.

The microcomputer can go some way towards helping citizens of the twenty-first century. It is available to the school and the home, to the experienced user and the novice, to industry and education. It comes in attractive outfits, is comparatively inexpensive, and causes less threat than ever before. According to Crawford, "It is
wonderful, marvellous, challenging, frightening, and overwhelming, but it is not a fad. It is here to stay and if used properly, it can change the entire approach to education.

Computers in the past have been perceived as a threat in most instances. The micro miracle changed all this. People are shopping in computer shops. Computers are becoming less frightening as people now see fun, games and real aids to running their lives in these marvelous machines. They are bringing them home. Many children will come to school with a knowledge of what a micro can do.

The computer is unique. It is destined to play a part in all areas of life, without exception—to increase our capabilities, to facilitate or eliminate tasks, to replace physical effort, to increase the possibilities and areas of mental effort, to turn every human being into a creator, whose every idea can be applied, dissected, put together again, transmitted, or changed.

By exploiting the real potential of computers, we are on the verge of a major change in how people learn. This change, driven by the personal computer, will affect all levels of education from earliest childhood through adult education. It will affect most subject areas and most learners. It will affect both education and training. It
will bring about a major revolution in the way people learn. The impact of the computer in education could lead to entirely different learning systems. This massive change in education could occur over the next ten to twenty years and schools could be quite different from what they are now. Any powerful technology carries with it the seeds of good or evil, and that applies to educational technology. The important thing is that those in positions of power take steps to nudge us towards a desirable educational future.

The full long-range implications of the computer in our world of education are seldom discussed. Many people are too overwhelmed by the technology and delighted by each new toy which they receive. Yet, these implications must be considered if we are to move towards an improvement in our educational entire system.
"The significant impact of the new technologies in our economy and society highlights the need to provide appropriately designed educational programmes for young people. Through the process of curriculum review and improved methodology the innovative and entrepreneurial skills of our young people must be developed. The co-operation of industry and business will be sought in providing opportunities for post-primary school pupils to familiarise themselves with developments in technology."

PROGRAMME FOR ACTION IN EDUCATION 1984-87 (JANUARY 1984)

5.13 [21]

The Minister for Education in her Programme for Action in Education 1984-87 sets herself many laudable targets, but the constant reference to the fact that ‘the Programme must be realistic and must take into account the financial situation of the country’ [22] and that ‘effective planning cannot be undertaken without having regard to the availability of resources’ [23] would confirm the view that Education alone, with its limited
resources cannot adequately provide support structures for the introduction of Information Technology into schools. Of more immediate concern is the fact that, despite the Minister's hopes for more business and industrial involvement in Second level schools, it is not generally realised at official level that this would be beneficial. Certainly, in the area of Information Technology, it is vital.

The period ahead in education for the foreseeable future is one of tremendous turmoil and strife. The present recession will bite deeply into the financial resources of educational establishments particularly schools. Resources will be scarce. This may have the effect of motivating school managements to search for ways and means to make their schools more efficient and cost-effective. They may, in effect, be more prepared to look at newer more effective ways of running their establishments both in management and in the distribution of learning. The school of the future may have to be run on an efficient business basis if it is to survive as a viable proposition in these dark days of the recession. This new business-like approach could come with the more widespread use of the new information technologies.

Schools of the future may also have to show greater
accountability than heretofore. Schools will have to become more mindful of the needs of the community and this, in turn, may mean that the community, particularly parents, may have an increased say in the day-to-day running of the school. Whether this is good or bad is a matter for debate, but this trend is becoming more apparent with the establishment of parents' councils and Boards of Managements. The traditional methods of maintaining the status quo in education are gradually being eroded and may be even more so in the near future. Often changes will be generated by financial decisions which lead to less money for the schools.

2.4.1 THE PRESENT CURRICULUM IN IRISH SECOND LEVEL SCHOOLS

Ireland has a centralised educational system, which is administered by the Department of Education. The Department of Education produces a comprehensive set of Rules and Regulations for Secondary Schools (24). These rules and regulations govern all aspects of the running and organisation of such schools. There are, at present, twenty-six recognised subjects for Junior cycle (12-15+) and thirty-one at Senior cycle (15(+) - 18). The curriculum of a secondary school must include instruction in a syllabus approved by the Minister in Irish, English, History and Geography, Mathematics, Science or a language other than Irish and
English, or a subject of the Business Studies Group and Civics.

The approved course for recognised junior pupils must include Irish, English, Mathematics, History and Geography, at least two other subjects from the approved list of examination subjects and Civics. The course recognised for senior pupils must include not less than five of the subjects specified in the Department's list of subjects of which one must be Irish.

Where the Minister of Education regards the circumstances as exceptional, a subject not on the Department's Programme may be accepted as one of the seven subjects at Junior Cycle or one of the five subjects at senior level, provided that a syllabus is submitted to, and approved by the Minister. With one possible exception, no Minister for Education has made use of this power. (This is the Transition Year Project, introduced by Mr Richard Burke, T.D., Minister for Education, 1973-1977).

The present day curriculum provides a subject with a nice defined inflexible syllabus to be followed, an examination is set at the end and that is it. The author feels that to take a section of the Information Technology area and create a new subject EXCLUSIVELY would be to misinterpret the potential and all-pervasive nature of
the technology. The danger is that unless moves are made very soon that, the Irish educational system, being what it is, may attempt the easy solution and opt for the 'subject only' approach. If we are serious about educating ALL our children to be able to take their place in the Information-based twenty-first century this approach must be avoided. In schools where computing has been introduced, the subject has tended to gravitate towards the brighter pupils and has thus become an elitist subject. By creating say, computing, as a 'subject only' exclusively will only serve to reinforce the idea that computers are only for the elite, whereas all members of our society need to be literate in the Information Technology area. We have also to banish the notion that to be good with computers one has to be good at Mathematics. In Ireland, the computer in schools has become too closely aligned with the Mathematics. If this is not countered, computing will become, like Higher Mathematics at Leaving Certificate, a minority elitist subject. The 'subject only' approach also tends to ignore the relevance of computing to practically all other subjects on the present curriculum. It also provides a study of the computer in an artificial, uninteresting environment. Computer Applications must form part of any course. Yet applications will often contain material which is more relevant in other subject areas. There is also the fact that once a subject is put onto the Irish curriculum, it is difficult for this subject to
blossom forth into other subject areas.

It is only by introducing Information Technology across all subject areas in the curriculum that we can hope to get teachers of all subjects to become literate in Information Technology. This will necessitate a massive teacher training, which, if not handled in a proper professional manner could put serious strains on teacher morale and public finances.

2.4.2 COMPUTING IN IRISH SCHOOLS

Computer Studies appears as an optional extra on the Mathematics syllabus at Senior Cycle and from the 1985/86 school year as a component at Junior Cycle, again under Mathematics. This is a very unsatisfactory situation as it, at once confirms the opinion that computers only have relevance in a school’s Mathematics Department and, thus, ignores the potential of the computer in business, science and in the humanities. As well as that the Department of Education does not have sufficient staff to monitor the scheme fully which has meant that pupils of unknown standard have been receiving certificates of competency from the Department of Education for some years now, which, in turn, makes mockery of the whole situation.
If we are serious as a nation about bringing Irish education into the technological age, there is an urgent necessity to introduce Information Technology into the education system at the earliest possible date. There has over the last twelve years been a movement, spearheaded by the Computer Education Society of Ireland (CESI), to make those in authority aware of the importance of computers and technology in the Irish education of the future. To say that this call has gone unheeded, and almost ignored, would be an understatement, as we shall see later in the thesis. The work and contribution of CESI has, by and large, been ignored by officials of the Department of Education, who, for now at least, will ultimately make the decision as to when and in what form, Computer Education will appear in the Irish schools curriculum.

There is, however, the possibility of change. A Curriculum and Examinations Board (CEB) was set up by the Minister in January 1984 on an ad-hoc basis. The CEB is to be established as a statutory body in the near future. [27] This Board will have the task of reviewing curricula in both Primary and Second Level education and of examining the need for reform in examinations and assessment. It remains to be seen how its functions will interact with those of the Department of Education.
The Minister for Education has made some encouraging statements regarding the introduction of computer related technology into schools, but resourcing to back up to these statements has not been so forthcoming. In 1983, for example, there was a severe cut-back in the number of courses in Computer Studies for Second-level teachers, and by May 1984, CESI had received no indications as to the numbers, venues and levels of such courses for that year. In her Programme for ACTION in education 1984-1987, the then Minister stated that the review of curricula and assessment procedures to be undertaken by the Curriculum and Examinations Board, would require to be supported by an appropriate range of in-service courses, but that in the interim, the main thrust of in-service courses would be directed towards those areas with revised syllabuses and/or changed teaching methods, e.g., Irish, Modern Languages, Construction Studies, Chemistry, Physics and COMPUTER STUDIES. This did certainly did not happen in relation to Computer Studies. [28]

There is little evidence to suggest that plans are afoot to provide a rationale/policy for the introduction of computer related technology to our schools. Computers have been provided at second
level and there is a pilot scheme on computers involving thirty schools. But there is little else happening. We should not have to accept that no major moves or planning can be done because of the present economic recession. If one adopts that defeatist attitude then there is no way forward.

Information Technology will play an important role in any future developments both within education and without. It is time, therefore, for Ireland to develop a national policy with regard to Information Technology. We must be one of the few developed countries which has, so far, failed to provide an even partial policy towards the introduction of Information Technology into education. Although many teachers have, over the last twelve years, been trying, to the best of their ability to get some movement at official level, their efforts have been largely unsuccessful. Gwyn [29] argues that if the development of policies for educational response to Information Technology is ever to become meaningful, both policy-makers and those initiating development at grass-roots level must raise their sights from their present pre-occupation with limited attacks on the problem and that they must OPERATE IN A WIDER CONCEPTUAL PERSPECTIVE.

There is an urgent need for a policy with regard to Information
Technology in education. The most logical thing that the Minister could do would be to set up an independent Board immediately to examine what is being done at present and make use of the personnel currently involved in computer education around the country. Such an examination would, of course, familiarise her, at first hand, with the teacher training effort being undertaken by various bodies and institutions throughout the country. Among other things, it would also bring her personally to a realisation of the tremendous voluntary effort being put in by CESI in the area of computer education since 1973. It must be emphasised that the Minister PERSONALLY must be made aware of the work that is going on. Officials of the Department of Education are, no doubt, aware of the work of CESI, in particular, for many years but do not appear to want to have them involved in the planning process, even though, ultimately, it is they, as teachers in the schools, who will be affected by any decisions made. Any decision to implement courses in Information Technology in schools must be accompanied by a comprehensive policy, plans for teacher training and the involvement of practicing teachers in the teacher training effort, development of curricula and the development of courseware materials. IT IS WRONG AN UNJUST THAT BUREAUCRATS IN THE DEPARTMENT OF EDUCATION SHOULD HINDER THE INTRODUCTION OF TECHNOLOGY INTO OUR SCHOOLS.
Any moves towards the introduction of Information Technology into schools that ignores the needs of teachers cannot succeed. The framework of support needed must involve practicing teachers. Ireland must be one of the few countries where the educational establishment is reluctant to fully utilise the expertise of the body representing the needs of practicing teachers. It is to be hoped that the new Curriculum and Examinations Board will take this into account and develop a line independent of the Department of Education when it comes to the new Information technologies.

2.4.3 IRELAND and INFORMATION TECHNOLOGY : INDUSTRIAL POLICY

Ireland, mainly through the efforts of the Industrial Development Authority (IDA) has succeeded in attracting a great number of high technology industries, especially those related to the computer/electronics field. These firms were first attracted to Ireland because of the lucrative grants and tax concessions offered. The presence of these firms, while welcome, may not prove to be as permanent means of employment for our people as was first envisaged. The latest figures (Ira C. Magaziner, Today Tonight, screened May 3, 1984) show that almost 95% of the firms involved in these industries are multinationals, who have no particular loyalty
to the country.

As Information Technology and its related areas of communications, video, and microelectronics are to play an increasingly dominant role in our lives, it is time for our policy makers to provide the basis for a native computer/electronics industry. While, it is realised that some small steps such as the setting up of the Microelectronics Applications Centre at the N.I.H.E, Limerick, the National Software Centre in Dublin and the National Microelectronics Research Centre at University College, Cork, have been made, there is an urgent need for a National Policy or Plan with regard to the whole area of Information Technology and its role and importance in every aspect of the life of the nation.

The majority of these multinational firms provide mainly assembly-type employment. They contribute very little to the country by means of Research and Development, and by and large have not yet provided the basis for an indigenous computer industry. The Government is at present concerned about the continuing increase in the unemployment rate and is seeking ways to remedy the situation. Nathan [30] states that the Government can cause improvements in the delivery of technical assistance since it, itself fosters, through semi-state bodies and the
universities, most of the technology driven mechanisms. If high-tech industries are to be the focus of industrial policy, it cannot be emphasised enough that science and engineering education must be strongly supported under such a policy. The fact that Irish universities will graduate double the number of graduates in electronics, engineering and science in 1985 as they did in 1981 is impressive, but is only part of the need. It is significant, but not surprising, that Primary or Second-level education do not figure very prominently, if at all, in any of the Government planning reports.

Hardiman [31] maintains that the needs of industry and society for scientific and technical development represent a major challenge to educational policy. The challenge lies largely in producing the technically competent personnel required, while, at the same time ensuring that the basic purpose of education is maintained. Economic growth depends on new technological opportunities and these opportunities abound. The grasping of a technological opportunity requires a technological development at all levels in society but particularly among decision takers in industry and in Government.

Ireland, like France, experienced a shortage of personnel for the
computer industry. In order to counter this many third level colleges mounted additional courses in this area. In Universities, for example, Post-Graduate conversion courses in the computing/microelectronics area have been held. While places were limited, these courses were available to graduates of any discipline, on passing an aptitude test. But courses such as these can only be but a short term answer to a long term problem. The key to a solution is to provide an education, especially at Primary and Secondary level, which would provide each student with the technological competence and skill for the Information Age.

In order to create a base of people, with sufficient skills to take their place in the high-tech society that is just around the corner, it is vital that we formulate a national policy with regard to the Information Technologies without delay. It is only through education that we will be able to provide these skills. Schools, therefore, have a grave responsibility to provide their students with the skills necessary to take their place in the age of technology. It is hoped that schools will be given the resources necessary to fulfil this role. It is only through the provision of second-level students, educated to a high standard in information technology skills, that our third level colleges will be able to turn out graduates of the quality and quantity needed for
the Information Age.

2.4.4 EDUCATION AND TRAINING

Professor Tom Stonier, in the television series The Mighty Micro, expressed the view that Education would be the number one industry of the twenty-first century. He went on to say that he was not only referring to the formal school-based system, but to the wider concepts of Continuing Education and Distance Learning. That is, that education will be a life-long process and will not end, as it does now between eighteen and twenty-two. The rapid march of technology will ensure that people will have to be continually re-trained throughout their working lives. Modern information technologies offer a tremendous potential for improving education and could revolutionise the education process. In the past decade, computers have become universal devices with applications in numerous areas. The microprocessor, in particular, is likely to affect education as dramatically as it has every other facet of our lives. Television, via satellite, cable and closed circuit, now provides unprecedented flexibility in the transmission of information to almost any location. Interactive communications, coupling television with microprocessors and videodisks, and computer graphics are offering new and exciting
possibilities for the improvement of teaching and learning. Technology has the ability to take the source of learning to the student, rather than the other way round. In Ireland, the Distance Learning experiment from the National Institute for Higher Education (N.I.H.E., Dublin) provides an insight into this method of learning.

In Ireland, it is unfortunate that the potential benefits to be derived from the Information Technologies have not been realised. This is particularly so in the area of education. One of the greatest problems that Irish education faces is that, alone among European countries, we maintain a rigid demarcation between EDUCATION and TRAINING. Recent communications from the European Commission refer to the great need for both 'EDUCATION and TRAINING' in the new technologies (32) and this has been followed in most European countries by an effort to integrate these technologies into the formal education system. It is a much bandied cliche that the youth of a country are its most valued asset. Yet, in times of recession, the schools and the education system are the most severely hit. Education should be one of the priority areas for expansion, particularly when one takes into account the fact that Ireland has one of the largest proportion of people under twenty five in Europe. The problems that beset our country cannot be
remedied by this generation. It is vital then that we try to ensure that the next and future generations reap the benefit of forward planning.

Ireland is unique in that it makes a clear distinction between education and training. Education policies are the responsibility of the Department of Education. Training is the responsibility of the Department of Labour, while the manufacturing sector is under the Department of Industry. The pressure for jobs and the very nature of the new Information Technologies will provide no option but to combine resources from these three Departments for the good of all.

Hardiman [33] speaks of the need to see Science and Technology as part of the process of economic and social planning. He is emphatic that we should not look on science in isolation. He suggests that the country needs Civil Servants with experience of industrial work in science and technology. That would mean provision for later entry, for interchange between industry and administration, or between Civil Servant and agencies such as the National Board for Science and Technology. This practice, he points out, is well established in other developed countries. The fact that the national news media and RTÉ, as the national broadcasting service do not employ a full-time specialist in science and
technology makes the process of creating an awareness more difficult. Therefore, the projection of developments in science and technology in the media tend to concentrate on the sensational aspects, rather than identifying the scientific progress behind it.

In their Report (1981) [34] The National Board for Science and Technology make the point that the world of the 1980s and 1990s will be influenced increasingly by microelectronics, and that it is, therefore, an essential part of every education that experience be gained with the technology and its application. Education should be concerned that future generations should have a broad understanding and appreciation of the technology and the opportunities offered by it. Unfortunately, this has not happened to any large extent in Ireland, nor is it likely to happen while the existing structures exist.

2.4.5 FUTURE NEEDS

Ireland must produce a National Plan in relation to Information Technology. It must do so, without delay. Our education system must cater for dual needs: 

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1) The provision of Engineer/Computer Scientists and
2) The provision of a knowledgable population who will be able to live and work in the Information Age.

There is an urgent need in Ireland for the provision of more engineers who would lay the foundations of native Information Technologies industries. As we have pointed out already, we cannot depend fully on foreign multinationals to guide us into the Information Age. We have seen that, in too many cases, that these firms have little commitment to Ireland and can leave at any time. If we need an example, we need look no further than MOSTEK hailed as a major coup for the IDA in 1980, which closed down in 1985, with a loss of over 400 jobs.

In Japan, for example, on a per capita basis, there are four times as many engineers as in the USA and, as a result, far more people in business, education and government have a technological background. It should be pointed out that Japan is one of the most technologically advanced countries in the world [35].

On the other hand, there is an even more urgent need to provide the framework whereby the vast majority of students will learn to live
and work in the Information Age. This can only be done under the
terms of a National Plan, by providing Information Technology
modules across all areas of the curriculum. Whereas the courses for
future engineers/computer scientists would be a specialised subject
at Senior cycle, there is a need for all students to obtain a
familiarity with the technology that will shape their lives.

Later in this thesis, we will attempt to outline the structures
which, in the author's view, need to be established if Ireland is to
gain maximum advantage from the Age of Technology.
3 A COMPARATIVE STUDY

In this section we examine the introduction of Information Technology into the Educational system in Ontario Province, Canada, in the States of Western Australia and New South Wales (Australia), in the United Kingdom and, finally, in France. While acknowledging that each country has developed its own educational system, nevertheless there are lessons to be learned for Ireland. Firstly it helps to place current Irish practice in international perspective and, secondly, it makes distilled international experience available for use in Ireland.

3.1 COMPUTER EDUCATION IN ONTARIO, CANADA

Developments in the field of educational computing in the Canadian Province of Ontario are worth considering as they provide a novel and unique philosophy and approach to the problem of providing an educational environment for the Information Age.

In October 1981, the Ministers of Education and Industry and Tourism jointly announced a major initiative aimed at moving both industry
and education more firmly into the microelectronics revolution and the Information Age.

The Government of the province of Ontario issued a set of functional specifications for the CANADIAN EDUCATIONAL MICROCOMPUTER (CEM) which was to be manufactured by a consortium of Canadian companies. While it was generally recognised that the CEM project was a good idea and would help Canadian manufacturers develop their high technology capabilities, nevertheless there were fears among educators that the industry view of education would prevail with token consultation with educators. The uncertainty existed because the original group had only one member with an educational background and the specifications were in terms of functions for a family of computers and were expected to evolve over a period of time.

The Minister for Education outlined specifications of an educational microcomputer to be supported by major Ministry funding beginning in 1982. Simultaneously in Toronto, the Minister of Industry and Tourism announced that sixteen member companies of the Canadian Advanced Technology Association (CATA) had decided on a new joint venture entitled Canadian Educational Systems Partnership to develop and build a family of products that meet these specifications. The philosophy behind this was to give Canadian high
tech hardware companies the opportunity to develop a world standard microcomputer. (36)

In a memorandum to School Boards, the Minister for Education, Dr Bette Stephenson, outlined the importance of this development. It meant that in the future, equality of educational opportunity would mean in part that every student must acquire an understanding of computers and the ways in which they affect their lives and that this understanding was best achieved by teachers and students using microcomputers and related devices in their day-to-day work. (37)

The Minister cited the hope that the present practice of using microcomputers built to differing standards and incompatible with each other would be replaced by acquisition of "equipment specifically designed for educational use and capable of increasingly sophisticated applications..." (38) The appropriate equipment would interface with the Ministry's Educational Computing Network (ECNO) and TELIDON (a text and graphics specification) and provide a uniform market for educational publishers and authors.

As a part of a comprehensive plan the Minister announced funding details:-
"beginning with the 1982 and subsequent General Legislative Grant Regulations, purchases by school boards of microcomputers meeting these specifications will be recognised as Extraordinary Expenditure (averaging 75%). The Ministry will evaluate microcomputers against these specifications, taking into account Canadian manufacturing content, and identify specific models eligible for grant recognition" [39]

The Ministry would proceed to foster the production of computer-based learning materials and data bases which will be compatible with the hardware. The Minister stressed the benefits of curricular relevance and Canadian industrial participation. While no specific prohibition on further acquisition of microcomputers was given, she did ask that these considerations be kept in mind at the planning level. [40]

The announcement of the Canadian Educational Microcomputer (CEM) plans by the Ministry had the unintended effect of creating a slow-down of many computer activities planned for 1982. The Ministry then had to clarify the position: grants would be available to help in the purchase of standardised microcomputers by late 1982, but in
Boards should continue to purchase microcomputers as they did previously and buy whatever type they could afford. The computers presently in schools would continue to be useful for the purposes for which they were bought until they wear out. The schools would not likely have enough micros until the year 2000. So nothing would be wasted.

As time went on, the views of educators were taken more into account. Numerous meetings were held with interested teacher groups and CEMCORP (the consortium set up to manufacture the Canadian Educational Microcomputer-CEM) was anxious to see how the various discipline-based teachers' organisations might represent their interests.

There were many delays in the development of CEM for a variety of reasons, the major one being financial and it is not until early 1984 that the project got underway in test sites around the Province.

In March 1983, the Ministry of Education made public announcements about Computers in Education, including release of policy documents and funding plans for stimulation of the CEM.
The announcement included refined specifications for the educational microcomputer, details of the long-promised funding through the "recognised extraordinary expenditure" grant process, as well as an overview of the Ministry's accomplishments and initiatives in stimulating Computers in Education. The programme also included the establishment of policy and procedures to guide the development and distribution of software to Ontario schools, with the initial expenditure of about Can$5 million in 1983 for software development, and special grant assistance to help School Boards acquire the new computers. (The Government paid a grant of up to 75% of the cost)

Ontario was to purchase $2 million worth of prototypes directly from CEM Corporation and guarantee the purchase of a further $8 million in production models on verification that the company's product meets Ontario's standards. The software development plans called for an administrative framework to generate quality Canadian-authored educational software.

While there was still a great deal of uncertainty among Ontario educators regarding the CEM and what they could do with it, there has, nevertheless, been a steady increase in input from educators so that the initial fears have been abated somewhat. The Ministry's
specifications signify more than a machine. They represent the culmination of nearly two years of announcements, objections, advice, and general turmoil in computers in education in Ontario. The Ministry's specifications for a microcomputer now exist. They combine a philosophical commitment with a tangible enumeration of properties of technology suitable for fulfilment of a contract.

It is not easy to specify a computer for educational purposes. Such attempts are seen either academic exercises with no obligation to deliver the result, or tendering documents designed to fit a general purpose product already offered by a manufacturer.

Ontario is therefore unique in that the Ministry has produced a document that represents the results of extended advice of their consultants, negotiation with a supplier, and an over-riding concern for the educational task.

Robert S. McLean [42] outlined why he considers the CEM project to be a significant step forward in Educational Computing for the following reasons.
It provides EDUCATIONAL MOTIVATION. The fundamental criterion used by the Ministry for including any item in its specifications was the educational potential it offered. While visions of the potential of computers in education may differ, this is a unique instance of educational intent in guiding the development of specifications. Specific consideration of the school setting and physical characteristics of children guided both the specifications and their implementation. The Ministry emphasised the way the student will interact with CEM. By requiring integrated provisions for pointing (the trackball and mouse) and listening (voice synthesis), these time-honoured educational behaviours have been promoted from computer curiosity to educational tool. The Ministry announced its expectation that user interaction would conform to state of the art conventions suitably adapted for education activities. CEMCORP promised to provide significant programming support that should make a major contribution in this area. The CEM is virtually the first school microcomputer to operate with an operating system. The UNIX-like system especially offers CONCURRENCY (several programs operating at once, serving one user) and MODULARITY (clean separation between software elements). Concurrency supports the user interface and, for example, allows a "help" program to offer assistance in the midst of use of another program. Modularity greatly simplifies the software.
development effort. (UNIX is an operating system originally developed at Bell Laboratories and used for many years in university environments on minicomputers. It is one of the major standard operating systems for the larger (16-bit, big memory capacity) microcomputers). Besides its cost and efficiency implications, general purpose local networking provides new opportunities for sharing and group activities central to Ontario's educational philosophy. The Telidon T-500 presentation standard offers a higher level of text and graphics functionality to the programmer and instructional designer. T-500 is independent of the particular characteristics of the display it is using, giving potential transportability of educational materials to other machines. It has the facility for PORTABLE IMPLEMENTATION OF LANGUAGES. How programming languages are implemented is only important when the next generation of computers comes along. It is equipped with the STATE OF THE ART PROCESSOR. To make software and user interface easy requires considerable hardware power. The Ministry and CEMCORP express their determination to harness the increased processing power now available in 16- and 32-bit technology for educational purposes.

The specifications were released in stages, with indications of the directions likely in future stages. This indicated that the Ministry
intended to devote additional continuing support to the evolution of the educational microcomputer, its support and understanding.

McLean [43] concludes that the hardware and software tools suggested promise more effective use and development of educational materials with the CEM. In the opinion of Irvin Rubincam [44], the designers of the CEM could have taken three different approaches to the new machine. They could have designed for 1) low cost, 2) portability or 3) computing power. The market, he concludes, is currently filled with low cost and portable micros and it is hard to envisage a CEM that would stand out in this crowd. The designers chose the third option, computing power and this, he believes to be the correct decision although it may be misunderstood in the short term. Rubincam accepts that the Ministry has taken a gamble in their decision to emphasise power over cost or portability, but is hopeful that the gamble will pay off. The issue is not really one of two micro-seconds versus one micro-second. Rather it concerns the additional features that must be included in the software to create a supportive and effective environment for the developer, teacher and student. 8-bit micros with a maximum of 64K memory do not have sufficient capacity to run the new more powerful languages, operating systems and supportive software. The LOGO language is a prime example of this limitation.
LOGO, through a major programming effort, has been made to fit on 8-bit machines, but as a result the space remaining for user programs is severely limited. Some will argue that for the present, 8-bit versions of LOGO (or BASIC or PASCAL) are adequate for most purposes. Rubincam counters this argument with an analogy from the history of motion pictures:

"When movies first appeared in the 1890's, people flocked to the theatres to see such exiting scenes as pedestrians walking, carriages moving down streets, and landscapes from moving trains. As new techniques of motion picture production were developed, people soon lost interest in such simple use of the film medium."

The same evolution in technique is occurring in microcomputer software, and what seems acceptable today will seem outmoded in a few years time. Just as it was hard for most people in the 1890's to imagine what films would be like in a few years, it may be difficult for the current educational microcomputer user to appreciate the added usefulness of the software which 16-bit micros such as the CEM will make possible. It is apparent that CEMCORP and the Ontario Ministry of Education appreciate the key role that software will play in the success of the CEM. The Government of
Ontario has committed enough money over the next few years to produce the required high quality of software and courseware.

What we see in Ontario is a positive step by the Provincial Government to provide Computer Education for all students. In doing so, they identify the dual aim of modernising the Educational system and, at the same time, providing the basis for a Canadian microelectronics industry. At Ministry level, it is considered important to have courseware sourced in Canada and that the material be Canadian and of the very highest quality. The project is also a joint effort on the part of the Government Departments of Education and Industry (and Tourism), with support from the private industrial sector. The attempt to produce the Canadian Educational Microcomputer (CEM), despite the difficulties involved, is unique in the sense that it provides students access to a powerful machine, with high standard educational courseware. It also acknowledges the importance of the availability of support structures at Governmental level.

3.2 COMPUTER EDUCATION IN AUSTRALIA
Australia is a vast country divided into six States and two Territories. Its total land-mass is 7.6 million square Kilometres, but its population is less than 15 million.

The development of computer education has occurred at different times and in different ways in each State and Territory. Therefore a variety of approaches have been adopted. In 1983 the Australian Government initiated a Federal programme to provide an Australia-wide focus on computer education. We will briefly examine this programme later.

Australia has two extremes in population distribution. On the one hand, large urban populations concentrated mainly in the capitals of each State and Territory and, on the other hand, a mostly rural population scattered over the more hospitable parts of Australia, generally around the coastal fringe. Any national programme must account for the two extremes. This must also be taken into account even within States and Territories, and particularly the larger States of New South Wales and Western Australia. We will examine the progress of computer education in each of these States.

Western Australia, although the largest State, has a population of just 1.4 million, the majority of whom are located in or around the
city of Perth. This pattern has resulted in education having a strong central focus. An export-oriented economy and proximity to the highly competitive Asian countries have lead successive Western Australian Governments to place emphasis on the adoption of advanced technology. The need to adapt successfully to Information Technology has been reflected in the education system. Since 1977 a major effort has been underway to provide teachers with the necessary skills to utilise Information technology. Centralised control means that the computing equipment acquired by schools can be standardised and preventive maintenance and repairs can be centrally co-ordinated.

The State Government of Western Australia adopted the following policy with regard to computer education in schools: (1) computer education is essential for all students (2) due mainly to financial constraints, the major efforts were being focused on Years 8-10 (12-15 age group). There is however, an increasing involvement of Primary schools and opportunities are also available for the remaining years at Secondary school (3) the Education Department of Western Australia considers that the role of programming has been over emphasised in the past. Nevertheless, experience in programming will continue to occupy a place in the computer experiences provided to all students (4) more recently the Education Department
of Western Australia is convinced of the educational soundness of
the programming language LOGO as a first teaching language for
younger students (10-14 years) (5) as part of its policy of
standardisation the Education Department requires that the machines
approved for use in its schools must also support a sufficiently
powerful version of BASIC so as it allows principles of sound
program design to be adopted (6) the Department recognised the need
for teacher training.

The Department is of the opinion that the minority of its students
who progress to third level education are not disadvantaged by
exposure to BASIC as the current major teaching language. At the
same time, the Department is convinced of the value of BASIC as a
means for assisting in the achievement of the Department’s major
goal in computer education: that is general computer awareness for
the majority of the secondary school population. (48)

In 1977, the Schools Computing Centre of the Education Department
was established in Perth. Schools located in the Perth Metropolitan
area link up free of charge to the central computer at the
Centre. (49) As well as providing computing facilities, the Centre
provides services. It acts as a clearing house and co-ordinating
body for the development of educational computing and the exchange
of information. Staff from the Centre provide advice to schools on the purchase of equipment, publish a journal for teachers, co-ordinate maintenance and software development, conduct inservice courses for teachers, assist with curriculum development and keep abreast of relevant developments in the field of educational computing. Particular importance is attached to the role of the Schools Computing Centre staff in monitoring research and development in the field of computer and communications technology and of planning for the incorporation of this technology into the curriculum. A well equipped Microcomputer In-service Centre has now been set up within the Centre, catering for large groups of teachers undertaking courses. The permanent staff of the Centre all have had teaching experience at either Primary or Secondary level; this is considered to be most important for a successful implementation of computer education in the schools.

The Department of Education of Western Australia meets up to half of the costs of computing equipment acquired by individual schools. This subsidy is only available on equipment which is approved by the Department for school purchase. This arrangement has proved to be administratively sound and the subsidy also provided the mechanism by which the acquisition of computer equipment and the development of computer education in schools could be
guided. The equipment obtained by schools is of two types, a conversational remote-job entry terminal, or a microcomputer.

The microcomputers found in Western Australian schools are configured like a commercial computer system rather than the personal microcomputers. It was the policy of the Education Department that its students should receive a comprehensive programme of computer education incorporating a range of computing and information processing concepts and applications. The Education Department has adopted a policy of equipping new schools with computing facilities as part of the initial establishment costs.

A high priority has been given to the development of an effective system for the maintenance and servicing of the computer equipment installed in schools. Standardising of equipment has meant that it became economical to build up a stock of spare parts, and to have maintenance technicians trained in the servicing of each item of hardware. The Education Department of Western Australia offers a maintenance service to all its schools with approved equipment FREE OF CHARGE. This service has worked very well. Down time has been kept to a minimum and teachers in schools have expressed great satisfaction with the scheme.
The decision was made to adopt a central model for teacher training and set up a State Centre to provide a core of expertise which was considered necessary. This is the Schools Computing Centre in Perth, where a well-equipped Microcomputer Centre has been set up to cater for the needs of teacher training. In order to regularly upgrade the skills of those providing the training, Western Australia has drawn on the skills of international experts. The model adopted for teacher training courses has been largely based on centrally organised 'face-to-face' courses, but consideration was also given to other aspects of information technology such as television to deliver teacher training on a distance education model.

As in many countries, the number of new graduates entering the teaching profession was minimal. Therefore, the most urgent priority was to provide in-service training for teachers.

Courses have been developed to provide teachers, system administrators and educational leaders with an initial introduction to Information Technology. The structure of teacher training programmes permits an individual to commence with a short introductory course and then progress through a graduated series of courses as additional competence is acquired. Ultimately the
structure can lead to post-graduate and other degree courses in informatics education.

The support of the community and those in leadership positions in schools is considered vital for the introduction of Information Technology into schools. Consequently, training courses have been developed to introduce informatics to school principals and other influential groups, such as parent and community organisations.

3.2.1 NEW SOUTH WALES

New South Wales is the most populous State of Australia (population 5.4 million). Education has been strongly centralised, but is now adopting a regional model, devolving towards school based curricula.

Although Computer Studies courses of various kinds have been taught in New South Wales schools for over ten years, it was not until 1982 that an attempt was made to co-ordinate computer education programmes into a State-wide programme. In 1985 fully developed Computer Awareness and Computer Studies syllabuses were made available for optional implementation and all schools will be providing these courses by 1987. As an immediate priority, the training of teachers to become competent to take these courses
assumed top priority.

At the beginning of 1983, the New South Wales Department of Education set up a Computer Education Unit consisting of an officer-in-charge, a seconded academic with long experience in computer education, four seconded teachers and two clerical staff. The role of the Unit is to act as the State's focal point for all aspects of computer education within the State school system.

In 1983, a National Advisory Committee on Computers in Schools was established. This Committee immediately set up working parties to provide it with specialist advice in the areas of professional development, curriculum development, software/courseware, hardware, evaluation, support services. The recommendations which emerged from the working party reports were accepted and endorsed by the Australian Government. The final Report perceived that computer education in schools was of fundamental importance to Australia's future.

The National Computer Education Programme began in 1984. The funding available for the years 1984-87 is £12 million (sterling). Planning is currently being undertaken to establish the structures and principles and lay the foundations for
the next three years' work at both State and National level.

The programme already had a favourable effect on teacher training programmes in States like Western Australia and New South Wales. It has, for example, confirmed certain directions already being followed, such as the need for computer literacy for ALL teachers.

While it is too soon to measure any concrete results from the Australian National Programme, the announcement of the Government's intention to provide funds for computer education has given rise to much needed discussion and debate in educational circles about desirable goals and funding priorities. The status of computer education has been lifted by the announcement of a National programme.
3.3 SUMMARY OF COMPUTER EDUCATION IN THE UNITED KINGDOM

For the purpose of this thesis, we will look briefly on the events in the Great Britain and will deal, in turn, with the regions incorporating England, Wales and Northern Ireland on the one hand. On the other hand, we will look at Scotland where an independent line with regard to computer education was pursued.

3.3.1 ENGLAND, WALES AND NORTHERN IRELAND

Since the mid-1970's there has been little recruitment of staff into teacher education in the UK. Consequently, there has been virtually no intake of staff with experience in Information Technology to pass on to their colleagues. Thus in the UK, the re-training of teacher trainers has become a significant issue. The situation prior to 1981 was one which must be viewed against a background of inadequate funding, insufficient staff expertise and a lack of any shared understanding of the real needs of initial and inservice training posed by the new technologies. [52]

Britain does not have a centralised Education system. Therefore any National policy is to a great extent at the mercy of Local
Education Authorities (LEA's). However, they did approach the problem of introducing Information Technology into schools at a National level. They set up the Microelectronics Education Programme (MEP) in 1979, with a budget of £9M. [53]

The programme was primarily aimed at informatics education at secondary level. The programme at secondary level consisted of two broad areas. The first area deals with the use of the computer in Computer Assisted Learning. Certain subjects such as Mathematics, Science, Craft and Design Technology, Geography and business related courses were identified as priority areas. The use of computers to assist in appropriate developments in remedial and special education were also to be addressed. [54] The second area was the introduction of new topics into the curriculum. The six selected topics were microelectronics in control technology, electronics and its applications in particular systems, computer studies, computer linked studies, including computer aided design, data logging and data processing, word processing and other 'electronic office' techniques and use of the computer as a means of information retrieval from databases.

The MEP strategy is structured around three proposals: curriculum development, teacher training, and organisation of support.
structures. Funding was available for 'regional' projects which met 'known national' needs. The outcomes of these regional projects would have to have a high degree of transferability.

The main focus on teacher training was on in-service training as in France. The strategy adopted was:

..to stimulate an effective pattern of provision and develop materials for training in order to strengthen what already exists and assist the training institutions to make appropriate provision.

In reality, due to the extremely low levels of initial awareness and a limited time to fund courses, a recursive approach to in-service education and training for teachers was adopted. The aim was to identify and train trainers, in the hope that they will go back to their LEA's and schools and train other teachers on the 'cascade' principle.

In some cases this method worked well, but Fothergill acknowledges that for many the cascade stopped soon after it had started, which means that the situation with regard to teacher education in England, Wales and Northern Ireland is rather patchy and un-co-ordinated, unlike the French model. The MEP also developed
a centrally designed set of modules for use in the teacher training
courses. Other initiatives taken included the provision of some 30
videos for use, provision of a series of 'Reports from the
Classroom' written by good journalists, giving a broader
perspective than just teachers views and the development of
curriculum materials.

The strategy advocated a regional approach to curriculum
development as well as to teacher training. A network of regional
resource centres was established, each co-ordinating resources for a
group of Local Education Authorities (LEAs) and functioning as a
centre for the development of methods and materials for the
training of teachers.

In addition to the regional training centres a network of pilot
information centres serving groups of LEAs was proposed. The
responsibilities of the centres was to provide information on
hardware and software and other materials. They also exchanged
information, materials and computer software with other regional
centres in the network and exchanged information and materials with
in-service training centres within the region. The Centres formed
links with LEA advisory services in their area and with the Science
and Technology Regional Organisations (SATROS), and provided some.
facilities for inservice training.

The centres also kept in touch with curriculum development projects and disseminated software. They also provided access to any 'debugging' facilities required for computer programs, organised local group sessions and individualised support for teachers following distance learning programmes. Through the Centres links were formed with manufacturers of hardware and employers making use of microelectronics to aid their business. [59]

To complement the MEP Programme the Department of Industry, with a view to providing added opportunities for the UK microcomputer industry, made funds available to assist LEAs with the provision of microcomputers in secondary schools. The Department of Industry provided half the cost of the microcomputer on condition that two teachers from the school undertake a teacher training course. [60]

The MEP is the middle ground between the Department of Industry and the Department of Education. It provides yet another good example of the integrated approach to a new challenge. It is interesting to see the level of co-operation between the Department of Education and the Department of Industry. In providing the funding for the original microcomputers the Department of Industry recognised that
they were supporting British industry and that they had identified a potential export market. Under the MEP the resources and expertise of many Government Departments and Agencies were also co-ordinated and made available to service the development of Technology in Education, and once more dual objectives are identified - to enhance the Education system and, at the same time, to develop a new British high technology industry.

3.3.2 **SCOTLAND**

Scotland has its own system of education within the UK and generally the Scottish Education Department (SED) has adopted an independent line from the rest of the UK. Such was also the case in respect to the introduction of Information Technology into Scottish schools.

The major SED initiatives in microelectronics began in 1979 when the basic policies were determined and these have been modified, from time to time, to take into account educational and technological developments. A key feature of SED policy was the establishment of the Scottish Microelectronics Development Programme (SMDP) which is the pump priming agency stimulating developments in a selected group of schools and colleges. However, by
1981, it was realised that, with its present resources, the SMDP could not provide services to establishments outside this group except on a very limited basis. [61]

In 1979 SED funded a microcomputer programme in Scotland. [62] Educational establishments in Scotland were invited to submit proposals for microelectronics projects under which hardware could be supplied on loan by SMDP and staff and accommodation by the school or college. A condition attached was that any software produced would be on open access throughout Scottish education. Sixty eight such projects were accepted, covering almost all subject areas. Through this programme the SMDP established centres for educational software development.

In 1980, the Scottish Minister, responsible for Industry and Education announced the establishment of a £1M research and development programme over four years. A full-time Director of SMDP was appointed as were full-time staff. The main emphasis of Phase 2 was on the development of Educational software.

The SMDP strategy was concentrated on projects in several areas. Among these were the promotion of general awareness, the provision of material for pre- and in-service teacher training.
courses, and the development of Computer Assisted Learning (CAL). The projects also included industrial liaison, dissemination, collection and exchange of general information, collection, testing and evaluation of software from project sources, the establishment of a software library, and a display area. The publication of a periodical was also undertaken.

In order to simplify program transferability from one system to another, the SMEDP programmers developed programs using a dialect of BASIC. The SMEDP set documentation standards for the upper level program library. These standards involved sections directed at the pupil and the teacher and included technical and classroom management notes. Up to 1982, the emphasis in Scotland has been on the computer as a learning resource rather than on the teaching of Computer Studies. Since 1982, more attention has been paid to Computer Studies.

In 1983, the Scottish Education Department published its Action Plan for the reform of education for 16-18 year olds. This involved the replacement of individual non-advanced vocational courses by a comprehensive modular structure. The implementation of these modular programmes began in the Autumn of 1984. In particular, there is a range of computing modules. These can be
either chained together to form non-advanced specialist programmes of study in computing/data processing or small groups of computing modules can be taken on their own or as part of other vocational programmes such as technology or business studies. Short courses and Computer Awareness courses were also introduced. [65]

In 1985 the Scottish Council for Educational Technology (SCET) published a National Plan for microcomputers in Scottish schools [66], which sets out the necessary steps for the effective use of even more powerful new technological tools and their support structures. [67]

The Plan is a wide ranging one and covers the areas of microcomputers and the curriculum, hardware and operating systems, aspects of maintenance and repair systems, software development, special education, tertiary education, training, research and development structures, information, distribution and communication. Aspects of these will be referred to later in the thesis.

The plan recommends that standardisation is necessary and that this can be most effectively done by defining the the functions of the hardware and the operating system to be used. Scotland, like Ontario
which was discussed previously, are inclined to the view that UNIX would be the front runner for consideration as the standard operating system.
3.4 FRANCE - THE PHILOSOPHY OF INFORMATICS

Next we turn attention to developments in France. The treatment of events in France is much more comprehensive when compared with that of the United Kingdom, Australia or Ontario Province, Canada. There is a reason for this. We are attempting to put forward a National Plan for the use of Information Technology in Irish education. France is a country with a centralised educational system like Ireland, where Central Government played a positive role for the introduction of Informatics, or Information Technology, into the educational system. They displayed the leadership which those in such systems tend to expect and provided the necessary finance for teacher training and the establishment of support structures. Therefore, in the author's opinion, developments in France are worth considering in greater detail.

France, like Ireland, has a centralised Educational system. France, like Ireland, began to consider the relevance of Information Technology, or Informatics, to the Education system in the early 1970s. France, unlike Ireland, concluded that the introduction of Informatics into the Educational system laid the foundation for the future socio-economic well-being of the country and took steps at official level to prepare the Educational system.
for the Information Age. We will now attempt to analyse the French model and see what lessons can be learned for Ireland.

In France, as in so many countries, the literature on information technology is vast. What marks out the debate in France is the existence of keynote texts, commissioned typically at Presidential or Prime Ministerial level, and published as official reports by the government publishing house. Two such reports have been those of Bernard Tricot (1975) \[68\] and of Simon Nora and Alain Minc (1978) \[69\]. Both examine in depth the ways in which, according to their chief authors, information technology may take hold of and modify the existing fabrics of social organisation and of culture in France. Tricot has a particular concern with the danger that the growth of Informatics may facilitate the growth of the totalitarian state in the West. The Nora-Minc report sought to take a global view of the issues raised by the new technologies.

"Telematics", the fusion of Informatics and telecommunication technology is seen as occupying a position central to the economy of any developed country. The "informatisation of society" as a whole is seen as unavoidable and as desirable for any country which does not wish to sink to "under-developed" level. This has some unfortunate implications for industry and employment. The growth of
information science had been a source of unease to the general public. Now, the new technologies gave a better chance of retaining democratic control. The developmental role of the State is critical. Only at national level, it was argued, would it be possible to marshal resources in a way that would enable France to meet the new challenges. It would be at the same time the responsibility of the State to see that the growth of Information Technology did not lead to an over-centralisation of State power.

Although these points do not relate directly to education per se, they are relevant since they have implications for Educational policy.

Tebaka in his Report [70] urgently proclaimed the message that France faces an acute shortage of trained Information technologists. He estimated that 231,000 trained persons would be required by 1985. Against this, the output from French higher education was only 4,400 persons per year. Tebeka characterises the pattern of training as falling into three phases, a first phase of improvisation, with training being given by manufacturers and companies, a second phase having relied heavily on in-post training, and a third phase, urgently needing the development of an adequate provision of training via Secondary and Higher education.
A number of institutions responded as best they could. Tebeka in his report says that this is not enough and calls for the establishment also of a "grande ecole informatique" which would provide a very high level of scientific and technical training and would place such training firmly alongside the elite training provided by the French system in other disciplines. The Tebeka Report, like those of Tricot and Nora/Minc has clear implications for the demands upon schools, and consequently upon teachers and consequently upon teacher education.

Alongside these influential reports on the more general effects of the informatisation of society, considerable attention was given to another report, commissioned by the then President of France from Professor Jean-Claud Simon.[ 71 ]

Like the Nora/Minc report Simon says that the challenge facing education is socio-economic before all else. It is not defined as being primarily a need to train young adolescents to work in a productive and competitive society utilising new technologies to beat other countries, such as the U.S.A or Japan at their own game. The Simon Report contains an exposition of the author's ideas concerning the implications of informatisation for education in
general, and as such it is a key text for any attempt at constructing a national approach to planning.

One topic with which he deals is informatics as a method of teaching. This is essentially computer assisted learning, CAL. With regard to teacher, Simon feels that the new technologies will prove a supportive and liberating influence.

For this to happen effectively Professor Simon urges a "serious pedagogic training" in the new methodologies for ALL teachers, (though on a voluntary basis) He is sanguine about the time required for such training - about "12 to 100 hours" depending on the subject. The important point is that Professor Simon is here seeing the teacher as a user of CAL, not as a writer of programs.

Professor Simon identifies one area in which CAL can give the teacher a high level of support and which is susceptible to much further development. Given the feedback capabilities of computer programs, CAL is already capable of giving the teacher previously unattainable data on, for example, the number of attempts made by any one pupil to solve a particular problem. Equally says Professor Simon the teacher may be overwhelmed with such information, which will be quantitative only.
Two other topics in the report - education in Informatics for the general public and Informatics AS AN OBJECT OF STUDY - are closely linked to each other. Professor Simon noted that informatics had not as yet (in 1980) appeared in the curriculum of French schools and proposed that this deficiency be now made good, before going on to propose a basic syllabus structure built around three major themes: (1) information technology as such, (2) the use of computers, and (3) the social implications of telematics (the use of public telecommunication system for the transmission of information).

Given, however, that there were insufficient teachers in the schools qualified to teach this subject matter, Professor Simon calls for the establishment of SECONDARY TEACHING QUALIFICATIONS IN INFORMATICS. Only in this way will it be possible to prepare the generality of pupils for life in the Information Society anticipated by Professor Simon. Given the tight structure of qualifications for the teaching profession in France, his call for the establishment of informatics as a recognised discipline for both "agregation" and CAPES (i.e. the premier and second rank qualifications for Secondary teaching) is important. He sees teachers trained in this way as playing a role as advisors and
inservice trainers of their own colleagues. Similarly, he suggests that lower-Secondary teachers should have the possibility of taking informatics as a second subject.

Professor Simon also puts forward an even more interesting suggestion. Acknowledging that present human resources for teaching informatics are simply not adequate in France, he proposes that persons with professional experience in the informatics industry be encouraged to become "associate teachers" of informatics, on the understanding that they undergo a special pedagogic training. What makes the proposal more interesting is this: it may be that the speed and the extent of the current changes in technology could break down the traditional distinctions between teaching and other social functions. It may be that, to discharge the teaching function adequately, the teaching profession as we now know it will have to interact in a new and more flexible manner with the human resources available in industry, commerce and elsewhere. We will develop this point later in the Irish context.

In his report Professor Simon puts forward twenty one proposals as a framework for further development in France. The main ones were (a) a training in informatics for Primary teachers be gradually instituted in the Ecoles Normales (i.e. primary training institutions): one compulsory unit, to be followed by one optional
unit (b) the creation of a CAPES and an agregation in informatics education to support the training proposed at upper-Secondary level, and creation of an additional qualification in informatics for lower-Secondary teachers (c) that certain ENI (institutions training Primary teachers) will use informatics based methods for some teaching, in a manner similar to that used at upper-Secondary level (d) that a qualification would be expected of teachers using certain informatics methodologies, and that this would be determined by the Inspection-General.

The Simon Report is important for the reasons that (1) it is of great significance that there should exist, in at least one country, a major official statement of the directions that education should take in respect of the new technologies (2) the report demonstrates that a new dimension, of a major kind, can in fact be incorporated into a de jure system such as exists in France (or Ireland). In this it presents a most interesting contrast with the infinitely more varied but less co-ordinated developments of a de facto system such as that of The United Kingdom (3) the Report lays down an important definition of the nature of development as it predicts that development. The critical element here is the insistence, through the Report, on the impact of informatics on the entire fabric of culture and society. Very significantly in the
French national context this definition includes both "informatics as a tool" and "informatics as a discipline". For France this was a very significant recommendation.

The question which has provoked the widest measure of disagreement amongst educational policy-makers in France has been that of the introduction of Informatics as a separate discipline. This step was proposed in the Simon Report and publicly endorsed by the then Minister for Education in November 1980. The decision reversed that taken at the beginning of the 58 Lycees experiment in 1970 to the effect that Informatics would be treated only as a dimension of other subjects. Since in other countries, especially the UK, both CAL and Computer Science tended to develop side by side during the 1970's, the strength of this particular debate in France may be rather surprising (72). Nevertheless, it raises real issues of principle and these may be examined in turn.

Like Ireland, there is the difficulty of inserting any new discipline into a centrally-controlled curriculum. If the new discipline comes in, especially on a compulsory basis, something else must go. Those who oppose the introduction of Informatics as a subject and argue that it should be a dimension of other subjects put forward a range of arguments (1) that for some teachers to
teach informatics as a discipline to some students does a disservice to the generality of pupils and teachers, all of whom need to know the implications of the new technologies (2) the argument that to create a discipline, complete with the necessary qualifications for teachers, is to institutionalise a syllabus for something which is not yet adequately known and which is likely to be in a highly dynamic state for the foreseeable future (3) the argument that there exists the risk of seeing a small number of experts and technicians take over control of information technology, that is to say take control.

The argument in favour of informatics as a discipline turns heavily on the need for specialised personnel and it is this argument, which has behind it the force of the strong nationalistic competitiveness so often encountered in informatics which has prevailed.

Fear that control would pass into the hands of a small group of experts also influenced attitudes about the production of teaching programmes. One question examined was that of whether the State should assume responsibility for the production of programmes or only for monitoring standards. (Contrast with the UK, for example, where a totally free market exists). In France, the debate on
this topic becomes even more difficult to resolve when the role of State-owned information networks is considered.

A fear rather closely related to the last is that of an undue 'uniformising' of education as a consequence of using information technology. This particular concern exists on various levels: for example, information technology could disseminate sameness throughout any given national system, but there is also the concern that sameness could also emerge on a larger plane through the importation, via information technology, of foreign cultural norms. While this is, of course, a possibility, it is highly unlikely that, under the auspices of a sound solid national plan that such would emerge. The potential of Information Technologies is such that, with imaginative planning, imaginative courseware and trained, competent teachers, it could lead to a more caring child centred system of education, where a teacher would have the ability to monitor each individual student and assign to him lessons suitable to his ability.

The French scheme builds on a decade of innovation initiated under the 58 lycées plan and continued with the 10,000 micros scheme. Its multiplier approach to the dissemination of teacher skills appears to work, and there is a fairly impressive national back-up of
The adoption of a standardised program language is an overwhelming advantage. Thus the scheme is likely to work and, the more it does, the less the temptation to raise questions of principle. Nonetheless the awkward questions will not go away, and they are of vital concern to teachers and to those who train them. [73]

IN 1970 a decision was made to make a first experiment with computers in secondary schools for students between 15 and 18. The idea was NOT TO TEACH PROGRAMMING AND/OR COMPUTER SCIENCE BUT TO INVESTIGATE THE USE OF COMPUTERS AS A PEDAGOGICAL TOOL WITH TWO MAIN AIMS (1) to use the computer as a tool to introduce new methods in the teaching of various disciplines and, (2) to emphasise a more systematic use of modelling and simulation in the teaching/learning process.

The aims were ambitious. While the instigators were able to define their aims in abstract terms, nobody knew, at that time, how to implement them concretely. Very few publications were then available internationally and little previous experience existed in France.

To try to solve the problem a number of decisions were made at Government level. [74] One hundred teachers from secondary
education were given training in computer science. These teachers were all VOLUNTEERS. For that purpose the group of 100 teachers was split into five small groups and each group was sent for a full academic year to a university. During this time each teacher being trained earned his/her normal salary. It was decided to rely on the trained teachers for discovering means and ends to implement concretely the above mentioned aims. For that purpose each teacher had to define and implement a project for a pedagogical use of computers in his/her discipline during the last three months of his/her training at the University.

A number of additional steps were taken:

* It was decided to set up a course, by correspondence, in computer science oriented towards teachers of secondary education and pedagogical applications. This course was distributed through an already existing institution of the Ministry of Education. From 1970 to 1976 about 5,000 teachers volunteered for the course by correspondence.

* A standard hardware configuration was defined based upon a time-shared minicomputer system able to accommodate 16 terminals.
In order to avoid spending a lot of time and money in rewriting programs from one language to another it was decided to have one single programming language for the whole secondary system. After lengthy discussions in the Computer Science Department of the Ecole Superieure d'Electricite won a contract by the Ministry of Education to develop a programming language based on its previous experience in that area and with the following specifications: (a) the language should use the French vocabulary; (b) it should be highly interactive; (c) it should be easy to learn for a beginner but still be sufficiently sophisticated to be effective for experienced programmers; (d) it should have an exhaustive and extensive set of functions on character strings (for literary disciplines); (e) it should have a sophisticated file-handling system; (f) it should have a very extensive set of error messages during compile and run-time.

After his one year training each teacher returned to class but while being paid normally, teaching duties were reduced by something between three and six hours a week during which he had to join the groups which were set up to write courseware packages.
The time-shared computers were installed progressively from 1971 to 1976 in the schools where there were at least two trained teachers. Fifty eight out of the estimated 1,200 schools for children between 15 and 18 received their equipment. About 600 teachers had been trained representing all disciplines ranging from mathematics to music through biology, history, geography, literature, physics, chemistry and foreign languages. The courseware packages amounted to more than 500 programs written in LSE. More than 7000 copies of these programs were distributed for use in schools. Over 7000 terminals were in use and each terminal was estimated to be in use for 20 hours a week. The accumulated total cost of the experiment between 1970 and 1976 was about $20 million which split up approximately as follows: $10 million for teacher training, $5 million for hardware, $5 million on getting available courseware packages.

In 1976, the imminent arrival of new types of hardware—the microcomputer (or personal computer)—as distinct from the minicomputer—led to a Ministerial decision not to continue with the original programme of installations, and, eventually, to the further Ministerial decision of 1978 to launch the new phase of informatisation of French secondary education, namely "the 10 000
micros programme.

The first phase of the French programme was characterised by the insistence that informatics should be introduced as a dimension of existing subject areas and not as a separate discipline.

In 1976 it was deemed necessary to wait for the new technology to emerge. The buying of equipment was stopped and so was the full year of training. The correspondence course continued and also the free time given to teachers for writing courseware packages.

Each year there had been an official "call for candidates" for the full year training and each year there were over 1000 candidates for the 100 places. Over two thirds were of the candidates were from Mathematics or Physics. Nevertheless it was decided to hold the total number of these candidates to between one third and one one half out of the 100. The reasons for this were to avoid giving the teaching population the feeling that computers can only be used in mathematics and physics and to attract teachers from those disciplines where the use of computers could have the greatest impact (biology, history, geography, language, art, etc...)

Since the very beginning there was a definite feeling that once the
teachers were trained in Computer Science, there would be an irresistible tendency for them to teach either about computers or to teach programming to their students on one hand, because that was what they had learned during almost a full year, and on the other hand, because both are well-established disciplines with a lot of manuals available. This, it was decided, had to be avoided at all costs, because the aim of the whole experience was not to have Computer Science taught in secondary schools but to have a teacher of any discipline use a computer for better teaching of his own disciplines. So teachers were strongly discouraged from teaching Computer Science as such.

By 1979 the first generation of microcomputers had arrived, mainly based on the use of 8 bit microprocessors, using floppy disks as auxiliary memory. Nevertheless it was realised that the "second generation" microcomputer was just around the corner. Therefore in 1979, a five-year plan was launched JOINTLY BY THE MINISTRY OF EDUCATION and THE MINISTRY OF INDUSTRY to install 10,000 microcomputers in secondary education for students from 15 to 18.

The decision was taken against a backdrop of:

- Experience gathered in the pedagogical use of time-shared systems.
* No experience existed in the pedagogical use of personal computers as opposed to time-shared systems.

* 600 teachers were fully trained to the level of being able to write courseware packages.

* About 5000 teachers had taken a course in correspondence on the basics of computer science and the use of computers in education.

* A bank of more than 500 courseware packages, fully portable because written in LSE, existed

* The first generation microcomputers were not the best possible choice for education.

* A national data transmission network including home terminals was under way.

Therefore the decisions were made (a) to install 400 microcomputers in 1980 and 800 in 1981, choosing each time the best machine available (2) having experienced the use of personal computers for two years to make a thorough comparison between personal computers and local time-shared systems from a pedagogical point of view and define then the proper kind of equipment to be installed (3) the language, Language Symbolique d'Enseignement (LSE), would be standard (4) for the academic year 1979/80, 40 teachers chosen from the most active of those having received in the past a full year
training, were given a full year free (while being normally paid). During that year they visited and gave short seminars to their colleagues in those schools which had just received equipment (8 computers per school). A three week seminar was held in October 1979 for those 40 teachers in order to give them the necessary training.

The '10 000 micros' project is described in a development plan published by the French Ministry of Education in 1981 [79]. It marked a new stage of development: for now informatics was introduced as an optional subject into the curriculum.

The plan identified four areas in which activity was to be concentrated. These were teacher training, installation of equipment, production of teaching/learning schemes, and interconnection with information systems exterior to the school. The plan also laid down guidelines for the introduction of Informatics into the initial training of teachers.

In January 1985, the French Government announced that it would provide schools and universities with 120 000 new computers for obligatory computer courses [80]. This is part of a £200M project
in which 11,000 teachers will also receive intensive training. School computing facilities would be made available to adults after school hours and the companies which would equip the schools would be French.

It is true to say that, in the 1980s, no other country in Europe could point to a national programme which in any way approached that of France. It is interesting to note that the French have developed their own programming language and their own microcomputers. In so doing, they are ensuring the dual benefits of modernising their educational system, while developing their own computer industry, which is an ideal combination of objectives. It is worth noting that this has been the case, perhaps to a lesser extent, in the UK and Ontario Province in Canada.

The main principles on which developments in France are based are adequate funding, provision of suitable hardware, a teacher training strategy at both inservice and pre-service levels. There is also the recognition that teacher training and school development are not separate, but inextricably linked. Recognition that the pace of informatics does not allow teacher training any space for leisurely catching-up. The needs are immediate, and the importance of a shared programming language (LSE) with no dialect idiosyncrasies.
cannot be over-emphasised.

The French also encountered another problem—that of teacher resistance. Recognising the resistance which the new technologies has met with in such areas as Banking and Printing, they try to ensure that it is not seen as something which is imposed from without, but rather something which was developed from within.

As a consequence of the experience gained in the field since 1970, the French now regard themselves as leaders in the field of Information Technology. Within the EEC, France has been to the forefront in an attempt to answer the 'high tech' challenge from the U.S.A and Japan. In July 1985 President Mitterrand pledged in excess of £105 million to the Eureka project, which is intended to help Western Europe keep pace with the technological advances of the U.S.A. and Japan. In his opinion only such a project will secure the technological independence of Europe.

On assuming office (1981) the new Government in France planned to double the finance for technology and research. The actual budget for this purpose increased dramatically in the 1981/82 year. The French Government also had plans to increase the percentage of the gross national product spent on research from 1.8% in 1980 to 2.5%
by the mid 80's. On the other hand, some delays have hit the French Videotext and Teletext projects. Originally, all telephone subscribers were to have received Teletel subscriber units by the 1990's. Now, however, these will become available on a voluntary basis and will only be capable of use as an electronic directory and not as a general teletext terminal as originally envisaged. While the British and the Japanese have their eyes set on the 1990's, the French set up a World Centre for Microcomputer Science and Human Resources which was to address the problems of the immediate future. This project was suggested in a report which Jean-Jacques Servan-Schreiber submitted to President Mitterrand in November 1981. The Centre is headed by Servan-Schreiber who is answerable to the Research and Technology Minister. Two Professors from MIT have to work at the Centre, one of them being the renowned Seymour Papert. French political ambitions in the field of Information Technology, caused these experts to leave shortly afterwards. Nevertheless, one must admire the French for their efforts.

The goals of the Centre were threefold: first, it would work on the development of a truly personal computer in co-operation with industrial firms. According to Servan-Schreiber, a few years should see the production of a book-sized machine incorporating a keyboard
and a flat display screen costing between $100 and $200. Secondly, it would search for ways of providing people displaced by robots with resources that would enable them to take over other jobs and thirdly, and perhaps, most interestingly, the Centre would help set up pilot projects in microcomputer uses in Third World Countries.

The French Government intend to give data processing training and computer education a higher priority with two initiatives. Under this scheme, more than 1000 unemployed people in France received high level specialist training for six months in 1983. The plan was to provide the high level technicians needed for France's rapidly growing data processing industry. In a second move, the Government has called for computer-aided learning to be given a boost through the development of a portable and adaptable standard CAI language for use in schools and universities throughout Europe. Computer-aided teaching has been designated as one of the most important growth areas in France [85].

3.4.1 LESSONS FROM THE FRENCH PLAN

The factual account, then, presents a model of development which may be of interest elsewhere. But there is more to be learnt from the example of France than a history of events and an illustration of
budgets.

The programme of development in France is either based upon, or has come to accept, each of the following principles, each of which has practical implications:

* any thorough-going national plan of development calls for a correspondingly thorough-going scale of investment. This investment must include provision of suitable hardware. In respect of this latter, the priority is for inservice training but preservice training is needed also. Equally, teacher trainers need training and their institutions need equipping.

* that teacher training and school development are not separate but inextricably linked. Training must follow identified needs but must itself be developmental, helping teachers to create new ways ahead.

* the pace of informatics development allows for no leisurely catching-up by teacher training. Needs are immediate. The school-based model of training adopted in France is then of considerable interest.

* centralised monitoring, and now centralised production of teaching materials is an important element in ensuring
control of quality.

* the existence of a shared program language with no dialect idiosyncracies (LSE) has been of equal importance.

However, behind these practical achievements in France there lie quite marked differences of opinion concerning aims.
3.5 LESSONS FOR IRELAND

Leaving aside the vast differences in educational systems that we have referenced, there is, nonetheless, a common thread running through the policies adopted towards the introduction of Information Technology into schools.

* The announcement of an official policy/plan regarding the introduction of information technology into schools is necessary to provide the stimulus to a co-ordinated effort. From such a policy grows debate, consultation and structures.

* Adequate investment is essential.

* In all cases, it was decided to introduce the topic at second level. It was only at a later stage that attempts were made at Primary level. The reasons for this were mainly financial. But there was also the fact that very little expertise existed as to how computing/information technology should be introduced to schools.

* In all cases, the introduction of Information Technology
was dual purpose (1) to enhance the educational system, and
(2) to provide the country with a microelectronics
base, which it was hoped would improve the country's economic
growth and competitiveness.

* Information Technology is here to stay. Its impact will be
widespread, affecting both the employment and social contexts
which will face pupils on leaving school.

* The introduction of Information Technology into the
educational system called for the provision of new
structures. These structures called for the pooling of the
resources of a number of Government Departments and
Agencies, notably, the Departments of Education and Industry
were primarily involved. The conclusion being that the whole
area of Information Technology is too vast and too diverse
to be tackled by Education Departments on their own.

* These new structures call for the establishment of a new
state sponsored structures as in France, or to a lesser
extent, Australia or a new state agency such as the MEP or
SMDP in Britain.
The structures that we have examined tend to suggest that the planning needs to be done at a National level. This is the case even in countries of vastly de-centralised educational systems such as the UK with the introduction of the MEP. This trend appears to be recognised even in the United States, where efforts are currently being made at a national or Federal level to co-ordinate and standardise.

Thus, the Irish centralised educational system should be of advantage to Ireland were we to introduce Information Technology into the curriculum in a meaningful way. Starting from very different perspectives, it appears that most countries now see the need for both information Technology as a tool for learning (Computer Assisted Learning) and as a subject. In respect of the new technologies, most countries see the need for education to meet the needs of all children. Consequently, most countries now realise that all teachers must be given training in the use of Information Technology. Teachers and teacher trainers need clear national guidelines within which to work. Most agree that teachers should retain control over the nature and quality of the learning experience undergone by their pupils. The standardisation of computer equipment can ease considerably the maintenance and software problems. The existence of a standard computer language as in France eased considerably problems of courseware transferability.
and development.

For the introduction of Information Technology into schools, the following areas at least must be tackled:

- teacher training
- curriculum development
- hardware
- provision of courseware materials
- evaluation of hardware/software/courseware
- provision of support services

While progress of varying degrees has been made in different countries in the other areas, progress in the sphere of teacher training, with the possible exception of France has been minimal.

Information Technology will be of major importance to education because it has immediate and far-reaching implications for the structures and methods of our education systems. It will, therefore, make heavy demands upon teachers, who will be called to adjust to quite new dimensions in their work. The training of teachers, at inservice and initial levels will occupy a vital part in any national strategy for responding to these challenges and
will call for a major investment of funding in hardware, research and development time, and retraining time if the strategy is to succeed. It is feared that these facts are not fully understood by many Governments. This is particularly so in the area of teacher training. The trend discerned is one where the problem is partly identified, its massive scale, when realised, causes Governments to shy away and seek piecemeal solutions, which, in effect, perpetuate the problem.

The major problems related to the training of teachers in most countries are:

* A lack of a real understanding of the scale of the problem on the part of national Governments

* The lack of political will to put funds aside for basic research/training/courseware and hardware evaluation

* The rapid rate of change of the technology causes its own problems. Australians estimate that teachers should undergo retraining every three to five years if they are to remain effective [86]. Fothergill [58] makes the point that teacher training is a never-ending task, for after you have
been around once. The technology has moved on and there is more to be learned. This situation makes it all the more difficult for a country to even begin the task.

* Information Technology is a new discipline without established traditions. Therefore, unlike other subjects, there is no established base of well-founded curricular theory or teaching techniques to draw on. It is therefore necessary for teachers to be trained to develop their own techniques. It is only through research and experimentation that this can be done.

* There is a lack of understanding at pre-service level of the effect that Information Technology can have on education in the future. Thus one of the priority areas is the provision of hardware and staff training in teacher training colleges so that, at least new teachers entering the profession will be trained to use Information Technology.
Computers are beginning to make a major impact on our everyday lives and will have an even more pronounced effect on the lives of our students who are currently in our schools. Radical changes in curriculum content may have to be made in order to bring schools into line with the modern world of technology. As Adams [87] points out:

"We are living through a real transformation similar to changes that occurred in during the Industrial Revolution: there were shifts in all areas; nothing could stop them; hardly anyone saw them coming; and it was all over before most people knew what was happening. True innovation occurs when you cannot go back to the way it was. Computers are a true innovation, unique among technologies. The permanent changes that computers bring confront educators with a new challenge, that of preparing ourselves and our students to participate in an ongoing series of technological changes."
We must now attempt to prepare the next generation for life in this information society, a life which will require them to interact with electronic information processes as part of their daily lives.

The main aim of this thesis is to deal with developments in Ireland in the area of Information Technology in education. We will look at developments since the early 1970's. It is important that we trace the history of Computing in Ireland for a number of reasons. It is important historically as it outlines the course followed by Computing in Irish schools, but the primary purpose for its inclusion is that it provides the background to our attempt to outline the best strategy to be adopted to bring Ireland into the age of Information Technology. In so doing, we will discuss the work done by the Computer Education Society of Ireland (CESI), a voluntary society of teachers, to get Computer Education into Irish schools, often despite the apathy of officialdom. The work and methods employed by CESI may serve as an inspiration and a model for teachers in other countries who may be experiencing against similar problems. In the age of Information Technology, no one country has a totality of knowledge - each has a little, and the rapid changes in the technology will ensure that this will always be the case.
Hardiman [88] draws particular attention to the French experience because it seems to have elicited a comprehensive response in policy which we can see reflected in French positions on a wide variety of questions whether in EEC policies or more directly in French industry and administration. He also points out that economic growth depends on new technological opportunities. The grasping of technological opportunities requires a comprehension of technological developments at all levels in society but particularly among decision takers in industry and in Government.

4.1 COMPUTER EDUCATION IN IRELAND: THE BEGINNING

The development of computer education in Ireland revolves mainly around the work and activities of the Computer Education Society of Ireland (CESI), a voluntary group of teachers interested in exploring and promoting the potential of the computer within the Irish educational framework. Were it not for the work of CESI, it is possible that the basic structures for the use of computers in Irish schools would not exist today.

We can trace the evolution of Computer Education in Ireland starting from 1971. Irish education had just undergone some curriculum changes in the late 1960’s and Department of Education
officials, fresh from their involvement in curriculum reform were willing to investigate the possibility of further changes. Educators were willing to investigate how new techniques and methods might influence education. The evolving area of computers in education was one of these. There was no expertise whatsoever in the area of schools computing. Computing expertise existed in the universities. Therefore, if progress was to be made in this field the expertise of the universities would have to be used and experts in the field of schools computing would have to come from abroad.

It was fortunate therefore, that Sean Ó Laoghaire, then Secretary of the Irish Department of Education met Professor A.C. Bajpai, who was heavily involved in Computer Education at Loughborough University of Technology at a Mathematics conference (Lyons, France 1971). Professor Bajpai was the visionary who foresaw the potential of Computer Education at a time when little was being done and experience and knowledge was in short supply. Professor Bajpai's offer to provide a teacher training course in Ireland was gratefully accepted by the Irish Department of Education and in the summer of 1971 Professor Bajpai organised and directed the first teacher training course in computers which was a one week course, hosted by the Department of Education at University College, Galway (U.C.G.). At its conclusion, participants were able to
write FORTRAN programs and process them on the IBM 1800 computer at the College.

It was recognised from the start by both the Department of Education, Bajpai and the teachers involved that teacher training was a fundamental part of the implementation of a programme of computer education on any reasonable scale (89). This may seem strange when one looks back from 1985 as no national policy with regard to the introduction of computer education into schools and the training of teachers in this area has yet been enunciated. Yet in 1971, Department of Education officials had the hope that some nucleus of 'trained' teachers might be established by Graduates with a Degree in Computer Science moving into teaching (this did not happen, due mainly to the more attractive salaries in Industry). Hence the first training course was initiated for teachers from a Mathematics or Science background who were interested in Computer Education, but who had no previous knowledge of computers.

The Galway course was repeated the following year (1972) under Professor Bajpai. 1972 was a significant year for computer education in Ireland. Teachers participating on the 1972 courses were mainly those whose interest had been maintained over the previous year, but there was also a significant number of newcomers. There was a
groundswell of support from course participants for the setting up of a Computer Society for teachers. This idea was triggered off by Professor Bajpai, who felt strongly that the time had come for a local input to the training of teachers of computing. It would be of little benefit to Ireland, he reasoned, if we continued to depend solely on the imported skills of himself and his team once a year for short week-long period. As well as that, Ireland now had teachers who had attended the previous year’s course, whose interest had been maintained since then and who could be used to train future teachers of computing. This is consistent with the policy that Professor Bajpai has adopted since then, particularly in India and the West Indies of identifying local needs and training key personnel, who would then take over the role of teacher training.

Due to the urging of Professor Bajpai and with the backing and encouragement of the Irish Department of Education, a steering committee was set up, and following some preparatory work, such as the drafting of a Constitution, the Computer Education Society of Ireland (CESI) was formally established in 1973.

Professor Bajpai and his colleagues became Honorary members of CESI and Sean O’Laoghaire, Secretary of the Department of Education became one of the Trustees of the society. In 1982, the work of
Professor Bajpal, who continued his summer courses at UCG until 1975 and who actively supported CESI throughout the years especially the early formative years, was finally recognised when he accepted the position of Honorary Founder President of Computer Education Society of Ireland. Since its inception, CESI has concerned itself with two principal aims: (1) the provision of training facilities for teachers (2) the introduction of Computer Studies into a Second level curriculum.

CESI first concerned itself with the search for suitable materials. The field was new and there was very little experience available. Members were attracted by the scheme laid out by International Computers Ltd-Computer Education in Schools (ICL-CES) in Britain. ICL-CES developed a set of materials, suitable for use with ICL computers. These materials were aimed at students under sixteen years of age (16-).

Two members of the society attended a an ICL-CES training course at Beaumont in England, with the aim of learning about the scheme and providing a teacher training course when they returned. This was to be the beginning of a long and fruitful association between CESI and ICL-CES. ICL, through their Dublin office have provided valuable processing facilities to Irish schools, especially in the period
before the arrival of the microcomputer in the late 1970's.

1974 began on a high note as far as computer education in Ireland was concerned. The first ever teacher training course based on CES materials (in the Republic of Ireland) was held in Dublin. This course was organised by CESI in co-operation with the Department of Education. Teachers from thirteen schools throughout the country were invited to send two teachers each to this course. At the completion of the course, participants were requested to take part in a pilot scheme set up jointly by the Department of Education and CESI to investigate the possibility of providing secondary level schools with a course in Computer Studies using ICL-CES materials. The main objective of the course was to give the participants a thorough familiarity with Part 1 of the ICL 16-scheme and to give them an opportunity of exploring CESIL, which was a Low Level language which would run on an ICL computer.

The course itself which was of five day duration was enjoyable, but the material covered proved rather difficult and confusing for those who were introduced to computers for the first time. Nevertheless, the course was successful in that it provided motivation and encouragement to the teachers involved to make the pilot scheme work. Active encouragement from the Department of
Education was a significant factor in its success.

The success of the course was also due in no small way to the generosity of the Irish Sugar Company who carried out all the card punching and processed all the programs on their ICL 1903 computers. For the first time in Irish Second Level Education, there was support from industry. Computing was a new area in Irish Education; there was industry support from the beginning.

It was unfortunate that the potential of this support to education was not recognised by the Department of Education.

4.2 TEACHER TRAINING

The society was, at this stage mainly Dublin based. There was now a concern about teacher training. Various courses for teachers, mainly in the Dublin area were organised in the early seventies under the auspices of the Irish Mathematics Teachers Association (IMTA). These courses catered only for IMTA members. It was generally felt at the time that Mathematics teachers would be the most enthusiastic in this field. There was also the fact that machinery existed whereby courses organised by the IMTA could get financial assistance from
the Department of Education to pay lecture fees. Thus use was made of existing structures in order to get a new topic started.

The enthusiasm was such that it quickly became evident that short courses were completely inadequate. Teachers were looking for more training, with greater access to the computer and some instruction in the use of a High Level programming language.

The computer language, BASIC, seemed to be the most suitable for educational use in Ireland. For example, BASIC was used on the CES course as a follow up to their Low level language, CESIL. Remember that CESI was at this stage using CES materials. DIGITAL EQUIPMENT CORPORATION (DEC) who were interested in becoming involved in the education sector, also used BASIC on their computers. DIGITAL had just installed their PDP8 minicomputers in the new Regional Technical Colleges (RTC).

Arising from the perceived need of teachers for more training, attempts were made by Fr. Cyril Byrne Cssp and others to involve a third level institution in the provision of teacher training. Trinity College was willing to provide the necessary batch compiler in BASIC. Therefore, plans were able to go ahead to develop a Computer Science course for teachers using BASIC as the second
language.

Fr. Cyril Byrne, CSSP, was the driving force behind the course and
the low level language, CSSP, developed by him has been used
extensively on the course.

In January 1973, Fr. Byrne, together with Professor John G.
Byrne, Head of the Computer Science Department of Trinity
College, Dublin began negotiations with the University to have a
Post-Graduate Diploma course inaugurated which would be open to
TEACHERS OF ALL DISCIPLINES to equip them to run computer
appreciation courses in their schools, if and when official
departmental approval for such courses was forthcoming [92]. The
Diploma course was approved by the University in May 1973. Lectures
commenced in October 1973. Twenty eight teachers attended. The
majority had mathematics degrees, but other disciplines were also
represented.

A tentative syllabus was drawn up for the course on the
understanding that a certain flexibility would be necessary for the
first year in order to allow more or less time for particular
topics as the need arose. The original Trinity Diploma Course
Syllabus is included in APPENDIX B.
The Trinity College Diploma in Computer Education is still going strong. It is one of the few courses that prepares teachers for the advent of computers in the classroom. The course is intensive in that it is held on two evenings each week during the academic year.

This course has proved to be an enormous asset to the advancement of Computer Education especially in the Dublin area; and it is largely due to the availability of this course that teachers with the most experience in this field are located in or around Dublin. In 1979, nine of those who had previously received their Diploma, qualified for their M.Sc. in Computer Practice from Trinity College, Dublin.

It is to be regretted that neither the Diploma Course nor the M.Sc has to date received official recognition from the Department of Education. Teachers who have attended the Diploma at their own expense find that neither their Diploma nor their M.Sc are recognised for incremental salary purposes, even though these courses enjoy a full academic status at the University.

While the issue of non-recognition by the Department of Education did not prove a disincentive for the organisers of the Trinity College Diploma Course for teachers, it did not encourage other
Third level colleges in other parts of the country to do the same. The majority, with the more recent exceptions of St. Patrick’s College, Maynooth, Thomond College, and some Regional Technical Colleges, have not even begun to organise any teacher training programme in computers. Even in those third level colleges where a teacher training programme exists, there is no standardisation of content nor do structures exist to ensure the standardisation of future teacher training programmes. Each College generally sets its own syllabus. The National Council for Educational Awards (N.C.E.A.) is now, however, attempting some standardisation.

The majority of those attending the Trinity courses were members of CESI and in this sense the obtaining of the Diploma and the M.Sc. demonstrated the maturing of CESI. CESI was now moving away from the enthusiast to a more sophisticated, more qualified membership (especially around Dublin), and this new awareness provided CESI with the enthusiasm to provide a forum for teachers through which views concerning the introduction of Computing into the curriculum could be aired through the CESI Newsletter. The evolution of the CESI Newsletter will be treated later in the thesis.

4.3 OFFICIAL DEPARTMENT OF EDUCATION PILOT SCHEME IN COMPUTER

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The first pilot scheme in Ireland on Computer Studies was initiated in January 1974 when teachers, having attended the ICL-CES training course returned to their schools. The ICL-CES computer language, CESIL, was taught to fifth year classes (This is the year before students leave school). The pilot scheme provided an unique co-operation between the Department of Education and the computer industry, and could have set a precedent for future development of schools computing, were it followed up ( 94 ). The Department of Education supported the scheme all through, while the computer industry provided the processing and back-up facilities at their own expense.

The main objectives of the pilot scheme were (1) to explore the feasibility and usefulness of providing some form of computer education in Second Level schools (2) to assess the suitability and possible need for adaptation of the CES materials for the Irish situation (3) to examine the availability of computer processing facilities for the use of schools (4) to study the possible integration of computer studies into the present curriculum or to investigate whether computer studies should be a subject in its own
right and (5) to awaken in educationalists an awareness of the implications for education of 'the Computer Revolution' and to encourage them to study this phenomenon.

The implementation of any pilot scheme within the Irish Educational system presents organisational difficulties, mainly due to the fact that the centralised Irish curriculum does not lend itself easily to change or innovation. This was particularly true with regard to Computer Studies which was essentially a new area in which there was little experience.

The main feature of the pilot scheme was its experimental nature. All the teachers involved adopted an open minded and flexible approach to the scheme and did their utmost to make it work, even when this meant that the course had to be taught outside normal school hours. Schools, particularly those outside Dublin, had some irritating problems. All programs had to be punched on cards. In the vast majority of cases, keypunch operators did not have any experience of the computer language, CESIL, and consequently, cards were frequently mispunched or not verified. Cards, punched locally, were then sent to the Irish Sugar Company in Dublin to be processed on their ICL computer. There was often a long delay between the time that cards were sent to Dublin and the time that
the processed programs would be returned. Once the errors in programs were corrected and the cards re-submitted a good deal of time had elapsed and it proved difficult to keep student interest alive. There was also the fact that ICL had relatively few installations in Ireland, compared to the rival company IBM.

The above is not to be taken as a criticism of the pilot scheme, because all the problems mentioned above could be rectified. It should also be remembered that cards were punched on a voluntary basis by firms who had ICL computers and the processing at the Sugar Company was done free of charge. This was the first pilot scheme of its type in a totally new area, in which there was very little experience especially at school level. There was a tremendous amount of interest and goodwill generated by the scheme, not only among the teachers and computer firms involved but also among parents and students. It was a shame that the Department of Education did not capitalise on this goodwill and form a closer liaison with the computer industry for the promotion of computer education in the schools. Never again was such an opportunity to present itself.

Despite the many difficulties and problems encountered, because of its experimental nature and the level of interest that it
aroused, CESI had hoped that the Department of Education would sanction another pilot scheme, learning from the mistakes of the previous one and that more schools would be invited to take part. On the other hand, if this were not feasible, then it was hoped that they would at least to continue the pilot scheme with those schools which were already involved. The Department of Education did not agree and thus a glorious opportunity to build up a core of teachers who could be used in a future National teacher training programme was lost as was the opportunity for the establishment of a National Policy with regard to computer education. We are still, in 1986, awaiting such a policy.

Having shown initial enthusiasm during the pilot scheme in 1974, the Department of Education did not take an active interest in the development of computer studies in Irish second level schools until 1981. This was left to CESI who, as a voluntary body, did not have the resources or the power to do the job adequately. CESI kept up the lines of communications with the Department of Education, but the replies from the Department of Education were few and negative. In spite of requests from CESI, the Department of Education declined to include Computer Studies as a subject on the curriculum or to include the time spent teaching Computer Studies as part of the teacher's hours for the payment of incremental
salary (in the centralised Irish educational system, if a subject is not on the curriculum, a teacher may not teach it within his minimum teaching hours, which at present is 18)

The Department also declined to issue a statement to the effect that Computer Studies are important for our students, or to set up a syllabus committee to investigate the feasibility of introducing Computer Studies into the syllabus. They also declined to consult with the Universities and other third level colleges on the question of teacher training.

In continuing to ignore the growing importance of Computer Studies, the Department of Education did a grave injustice to the youth of the nation. On the question of teacher training, the Universities and other third level colleges, such as the Regional Technical Colleges, would have been quite willing to help out. The Diploma course in Computer Practice which began at Trinity College, Dublin about can be cited as an example.

The Department of Education, in those pre-micro days, may have felt that the finance needed for such a scheme was too much. Indeed CESI presented them with some figures in 1974 and pointed out that the costs involved would be mainly processing costs, and on the basis
that forty schools would take part, the cost would be in the region of £40,000 (95).

As CESI pointed out various methods of processing could be employed (again we are talking of the pre-micro era) Central processing facilities could have been hired at some bureau, punch card machines could have been hired to schools and processing done at school, terminals could have been installed in some schools or CPU time could have been hired.

While it may be understandable that £40,000 in 1974 was a bit excessive, this should not have been a reason for the complete abandonment by the Department of Education of their apparent commitment to the introduction of Computer Studies into the curriculum. At the very least the thirteen schools from the original pilot scheme could have been used as a basis to monitor the suitability or otherwise of available material and provide a core of teachers knowledgeable enough to play a leading role in the teacher training effort.
4.4 CESI - THE FORMATIVE YEARS

Since its foundation in 1973, the Computer Education Society of Ireland (CESI) set as its main objectives to promote Computer Education in Ireland in a manner consistent with the best principles of education generally and the provision of facilities in computing for teachers, in order that they may acquire knowledge and experience in the operation of computers and impart this knowledge in an appropriate way to the students in their care. It also sought to advise and inform the public generally on the matter of computer education and extend the general awareness in this area and to provide a forum whereby the various aspects of computer education could be examined and discussed. CESI organised courses and seminars and also made recommendations to appropriate authorities. [96] A Constitution was drawn up and CESI applied for and was accepted as a Friendly Society under the appropriate Act.

The Executive of CESI decided that membership of the Society would be open to anyone who had a legitimate interest in computer education and its development. It was also decided to seek support from the Computer Industry with a view to obtaining processing facilities.
Many of the early ‘crusaders’ did quite well in this regard. It must be said that Industry, for its part was eager and willing to help, and in the majority of cases gave their services free of charge. It was only at a later stage, when the volume of work from schools became larger that some firms had second thoughts on the matter. This was quite understandable, but it is a pity that the Department of Education was not willing to arrange and co-ordinate the provision of computing facilities for schools at this time. Had they done so AT THE TIME a solid framework of co-operation between schools and industry could have been established.

Each year since 1971, the Irish Department of Education approved and financed a one week computer training course for teachers. In 1975, however, due to financial restrictions, the Department of Education was unable to finance such a course. (The Department of Education in Ireland is dependant on overall budgetary considerations within a financial year. Financial support meant that course participants would be entitled to travel and subsistence allowances.)

The young CESI expressed regret and, having failed to convince the Department of Education to reverse its decision, decided on a certain course of action, which, in retrospect, marked a significant
turning point in CESI policy. Up till then, CESI was in the background, and was content to work in co-operation with the Department of Education towards the implementation of a policy on computer education and from this point, however, support and leadership was not forthcoming from the Department of Education. Courses that had been organised up till now had, in effect been organised by the Department of Education who brought over experts such as Professor Bajpai, the Founder President of CESI.

CESI, now faced with the prospect of no courses being organised by the Department of Education, feared that Computer Education might be put back indefinitely were no course to be offered. It was feared that to halt the momentum and good will that had been created would be detrimental to the progress of Computer Education.

Since the main costs involved in attending such a course were travel and accommodation, the Society decided to hold a course at Colaiste Choilm (C.B.S), Swords, Co. Dublin. This school was the only one in the country to have, at the time, both a minicomputer and a time-sharing terminal installed (donated by DIGITAL EQUIPMENT CORPORATION). The course catered for both beginners and those who had some knowledge of computers. Included in the course were a
series of lectures concerning Computer Education in schools, an ab initio course in BASIC programming running concurrently with a course for the already initiated. Demonstrations of computer equipment and the opportunity to use these facilities. The A.G.M. of the Society at which Mr. Dennis O'Sullivan from Queen's University was the guest lecturer was also held.

Twenty five teachers attended the course and up till 1981 at least. CESI has played a major role, being the only organisation, outside of Trinity College (and more recently Maynooth and Thomond Colleges), which has been involved in the provision of teacher training facilities. The Department of Education, for its part, was not willing to provide the necessary financial support nor were they willing to grant recognition, for incremental purposes, of the hours a teacher would spend in the teaching of computing.

CESI, however continued to grow and had 96 MEMBERS, MAY 1975). A new Executive committee was elected at the 1975 A.G.M. and work began on a number of projects. A paper was submitted to the Department of Education containing new proposals for the implementation of Computer Education in Schools and giving estimated costs. A communications and publicity committee was set up.
and began work on a number of ideas to make the existence and work of the Society more widely known. A syllabus committee was formed to draw up a syllabus for Computer Studies, suitable for implementation in schools.

Discussions with the Executive Committee of the Irish Computer Society (ICS) took place over a period of time with a view to forming a liaison between the two societies. While contact was maintained, no possibility of a merger between the two organisations was ever really on, as both represented different interests. CESI were practicing teachers in second-level schools, while ICS represented the computer industry and personnel from third-level institutions. There has been, however, a great deal of contact between both organisations.

An intensive experimental scheme involving eight Dublin Schools was set up with the help of the ICL-CES team from Britain. This scheme was sponsored by ICL and preparations were made to get the scheme off the ground by January 1976.

From the start CESI was aware of the need to give accurate and up-to-date information to their members, and decided that this could best be accomplished by the publication of a Newsletter. The
Newsletter provided a forum for members to express their views and kept them in touch with their colleagues, the Executive and the progress of Computer Education in general. The Newsletter was also distributed to those who had an interest in the promotion of Computer Education, such as the Department of Education, third level colleges and the computer industry. Members, through the Newsletter, were urged to lobby their Public Representatives (T.D.'s, Senators etc.) in order to acquaint them with the importance of Computer Education in the modern world, to write to the newspapers and to both the Department of Education and the Minister for Education, and, of course to spread the word among teachers in their own local area.

Since nothing was being done at official level, CESI decided to take the initiative and see what facilities could be made available to teachers and, possibly students at third level institutions around the country. CESI was fortunate in the sense that many third level colleges were being established around the country at this time. Therefore, the Regional Technical Colleges in Letterkenny, Sligo, Galway, Athlone, Dundalk, Carlow and Waterford and the National Institute for Higher Education (N.I.H.E), Limerick were contacted and the replies received were most encouraging. In the Dublin area ICL/CES offered their assistance in the mounting
of a project in Dublin schools using ICL-CES materials, thus maintaining the ICL-CES link with the promotion of Computer Studies in Ireland.

Most CESI activities had up till 1975 been largely concentrated in the Dublin area. There was, for example, the Trinity Diploma Course in Computer Practice and the ICL-CES project which was held in Dublin schools early in 1976, which has been discussed earlier. Consequently, the Executive Committee of CESI decided that the time was right to attempt to set up a core of expertise in areas outside Dublin. They were also influenced by the fact that, in 1975, the Department of Education was unable to fund a computer course, which led to CESI organising a course of its own at Colaiste Cholm, Swords, Co Dublin. The success of this course gave CESI the necessary confidence in themselves to mount further courses. CESI now had the confidence and expertise to provide at least some of the lecturers for any future course.

Summer courses had, since its inception, been the high-light of the CESI calendar, and, in 1976, the financial situation allowed the Department of Education to offer some support, such as the payment of travel and subsistence allowances to course participants. CESI availed of this opportunity to break new ground and spread the word.
about Computer Education to areas outside Dublin. The venue chosen was the National Institute for Higher Education (N.I.H.E.), Limerick (101).

CESI was attracted to the N.I.H.E., because the facilities there provided the best opportunities for teachers to gain 'hands-on' experience. For the week of the course, participants had almost the exclusive use of eight on-line terminals attached to a DIGITAL PDP8 minicomputer. A BURROUGHS computer was also available. Photocopying facilities were readily available as were excellent catering facilities nearby. All these combined to enable CESI to break new ground and also to avail of more sophisticated computing facilities.

Forty teachers attended and following the successful pattern established at Swords in 1975, a two-tier course was offered: an elementary course in BASIC for beginners and a more advanced course, ranging over a variety of topics, such as Numerical Analysis, FORTRAN, COBOL and File Handling. Staff of the N.I.H.E. gave the advanced course and CESI members provided the BASIC course and also some of the general lectures on Logic Gates and Computer Assisted Learning, which were attended by all participants. Tutorials were plentiful, which ensured that
participants had the opportunity to gain programming and 'hands-on' experience during the week. [102]

Feedback from participants singled out the availability of hardware as the strongest point of the courses. The BASIC course was judged to have covered the right amount of ground, but it was felt that the advanced course was too ambitious because it was felt that two new languages to be covered in such a short period of time was one too many and that participants felt that the pace of the lectures from third level personnel was inappropriate for second level teachers who were just past the elementary stage and, who, with the exceptional few, had little access to a computer on their return to school.

At the conclusion of the course attempts were made to find all participants computing facilities at least for themselves, but ideally for their students also. Some teachers had already found facilities for themselves either through ICL in Dublin or through a third level institution. For those who had not managed to obtain facilities, CESI endeavoured to obtain such facilities by putting them in touch with either ICL or a third level institution or, in some cases with a private computer firm. CESI, in this way forged a vital link between schools and industry and thus provided
a valuable service to schools. As there was nothing being done at official level CESI attempted to provide continuity needed to develop and organise Computer Studies within Second Level schools.

4.5 DRAFTING A SYLLABUS FOR COMPUTER STUDIES (1977)

Due to the fact that nothing was being done officially towards the introduction of Computer Studies into Second level schools, CESI decided in 1977 to draft a syllabus for Computer Studies in Second Level schools. This syllabus was the fruit of the efforts of Fr Cyril Byrne, Cssp, and Elizabeth Oldham, who, aided by suggestions, comments and criticisms from other members of the Executive Committee, designed and structured the draft syllabus. [103] The full outline of this draft syllabus is contained in APPENDIX A. The proposed syllabus represented a working document which was then submitted to the Department of Education with the aim of stimulating discussion on the implementation of a solid and attractive course in Computer Studies in schools.

Looking back, it is easy to conclude that the syllabus was all embracing and, therefore, somewhat impractical. It was deliberately so in order to stimulate interest and discussion. It was also
intended that it would be of some help to those teachers, who were at that time, experimenting in their schools. It was also the intention of the Executive committee to formulate a scheme, which, as well as offering sound and workable substance, was flexible enough to accommodate desirable changes and yield to solid criticism.

The syllabus content reflected the trends in computing at the time. It did stimulate interest among teachers and did provide practical guidelines to schools wishing to include Computer Studies on their curriculum. It DID NOT, however, spur the Department of Education to set up a working committee to prepare the ground for the introduction of Computer Studies into schools. No formal acknowledgement of this CESI submission was ever received, nor were CESI ever invited to meet the Department of Education to discuss the syllabus content.

4.6 THE ADVENT OF THE MICROCOMPUTER

By 1977, there were rumours that the microcomputer was really on its way. CESI, at this stage, the only organisation actively engaged in the promotion of Computer Education in Ireland, now hoped that the advent of the microcomputer would provide the imminent breakthrough.
of computer studies into the curriculum. Alas, this was not to be. There was no official recognition of Computer Studies as a subject on the curriculum and the time spent teaching Computer Studies within normal school hours could not be included for the payment of incremental salary. Indeed, apart from the payment of travel and subsistence allowances to teachers who attended five day summer courses for teachers, organised by CESI, the Irish Department of Education had little or no involvement in the development of Computer Studies in Irish schools at this time.

CESI members, and the Executive Committee, in particular, from the outset set out a policy to make the relevant educational authorities aware of the importance of computers in education. This policy was implemented through contacts with bodies involved in educational computing in other countries, particularly the United Kingdom, and through the publication of an information sheet and booklist.

In its concern to bring the work of the society to a wider audience, CESI undertook several activities in the field of publicity and computer firms were contacted with a view to providing a prize for a competition for schools. The response, however, was negative. CESI also sent letters were sent to
the newspapers, to teacher unions, and Managerial bodies. The Department of Education were contacted at several levels (Ministerial Secretary and Inspector) with a view to making them aware of the impact of Computing and the urgent need for the introduction of Computer Studies into schools. The publicity campaign began to bear fruit to a small degree: there was an increase in membership; also, members of the Executive were asked to give talks and lectures to various interested bodies.

In the centralised education system which Ireland has, schools look to the central authority, which is the Department of Education, for guidance, initiative, support, and leadership. This is particularly true in relation to the introduction of new topics into the curriculum. The Department of Education has never given CESI adequate support in its endeavours. **It is to their eternal shame that the Department of Education, in their indecision and inactivity over a number of years, have slowed down the growth of Computer Studies in Irish schools, and while a certain amount of growth has occurred, it has been of a haphazard and un-coordinated nature. Simply because, unlike other countries even the semblance of a national policy does not exist. CESI, as a voluntary organisation, has done a tremendous job in keeping Computer Studies alive in Irish schools at a time when there was very little action.**
4.7 FORMATION OF CESI BRANCHES

At the Annual General Meeting of CESI in 1974, a motion was passed permitting the Branches of the Society to be set up. Each Branch would be affiliated to National CESI. It was the strong feeling of the A.G.M. that in so doing, the aims of the society could be best furthered by spreading computer education and awareness to as wide an audience as possible. By forming branches, members could be kept in constant touch with the work of the National Executive and at branch level, members would have the opportunity to meet more regularly and discuss common problems [104]. As no branch structures existed, guidelines were drawn up.

The Dublin Branch of CESI, formed in 1974, is almost as old as the society itself. As a result of the Diploma course for teachers at Trinity College, in particular, there was a continuous flow of expertise into the Dublin Branch and, through Branch activities, many schools in the Dublin area were in a position to do some pioneering work in the field of computer education and many worthwhile
projects were initiated in Dublin schools. The Dublin Branch was involved in the ICL-CES sponsored pilot scheme in the 1975/76 school year [105] and conscious of the need for teacher training the Dublin Branch embarked on a policy of providing two day courses for teachers during the Easter recess. It was hoped that the Department of Education would finance the course. This was not possible, and participants paid a fee of £5 [106]. The Dublin Branch, over the years, provided many interesting lectures and activities. For example, in 1977 one of the lectures was on 'Structured Programming', a topic that is very much in vogue at the present time. There was also a lecture entitled 'Computers at Primary Level' during the 1977/78 school year. In 1977 there was only one school based computer in the Dublin area. The following year, 1978, there were six, and many more were in the process of being installed. [107]

There was, at this time, no third level institution outside the Dublin area which was willing to provide a Diploma course for teachers of computing. Consequently, the formation of a group interested in the topic was much more difficult. In most areas outside Dublin, where a Branch of CESI has been formed, its formation was due to the hard work and enthusiasm of one or two individuals. In this category are Sr Lourda Keane in Limerick. Hugh
Dobbs in Waterford and Mary Delaney in Kilkenny. The author suffered similar frustrations in getting a Branch of CESI off the ground in Cork.

The Branch structure did help the introduction of Computer Studies especially into areas outside Dublin. Courses were organised and, in a voluntary capacity, enthusiastic members tried to promote CESI by disseminating information and providing elementary courses in the BASIC computer language in the local area.

While Branches were formed it was (and still is) rather difficult to maintain interest despite the fact that many excellent lectures have been provided by well qualified personnel from third level institutions and industry. This was due, perhaps, to the fact that Computer Studies was not officially recognised by the Department of Education. Centralised education systems do not encourage schools to develop their own syllabuses. Instead all syllabi are centrally controlled by the Department of Education, as is the case of Ireland. Only subjects officially recognised by the Department of Education may be taught in the schools. At this time, Computing was not recognised, which principally explains the reluctance of schools to take up the subject.
It is also probable that Branches outside of Dublin depended too much on too few people. Outside Dublin there was not the opportunity to obtain a Diploma in Computer Studies. This often meant that leaders in such areas felt that they did not have the confidence or expertise to do the job adequately. This attitude is slowly changing, however, as members of CESI, through contact with each other, gain in expertise and confidence and if the establishment of branches of CESI did little else, it did establish a network of key personnel throughout the country.

Having attended CESI courses at Colaiste Choilm, Swords and the N.I.H.E., Limerick, the author felt that the time was right to try to get some movement in Computer Education going in the Cork area. [108] An introductory six week course was held at Colaiste an Spioraid Naoimh, Bishopstown in February 1977. Thirty eight teachers, the majority of them beginners, enrolled for the course and learned the rudiments of INPUT/OUTPUT statements, rogue values, counts, lists and string variables. Once more, computer education in Ireland was indebted to ICL-CES for their excellent service in running the course. While the punch card processing facility rendered by ICL-CES in Dublin during the course was excellent, nevertheless, teachers felt it better if processing facilities could be made available locally. Negotiations were
entered into with Cork Regional Technical College who kindly granted facilities when terminals were not in use at evening time.

A further introductory course was held at Coláiste an Spioraid Naoimh early in 1978. Twenty teachers attended, the majority, having no previous knowledge of computers. Learning from the previous course, it was decided to start at the most elementary level by showing slides of essential computer hardware. On the last night of the course, Mr Fred Damodaran, Head of the Computer Bureau at University College, Cork (UCC) gave a lecture on how he would see computer education developing. Mr Damodaran was to prove of tremendous assistance in getting Computer Education off the ground in Cork. On May 11th 1978, the Cork Branch of CESI was formed at a meeting, chaired by Michael Moynihan, of forty-one teachers.

Early in 1978, at the instigation of Damodaran, CESI began negotiations with the authorities of U.C.C. in order to explore the possibility of obtaining processing facilities from U.C.C. The outcome was that in June 1978, the Governing Body of U.C.C. sanctioned the donation of an IBM 026 card punch for the use of schools. The punch was sited at Coláiste an Spioraid Naoimh and the Cork Branch formed a SCHOOLS' COMPUTING CENTRE, which was probably the first in Ireland, situated at Coláiste an Spioraid Naoimh.
CESI had negotiated with Cork Regional Technical College and had obtained processing facilities on their PDP8 computer. The times at which the computer could be made available did not always suit and it was now felt that schools should try to obtain processing facilities for themselves.

There was, at that time, no school in the Cork area which had its own processing facilities. The opportunity offered by U.C.C. was the most welcome development in Computer Education in that it provided schools with a unique chance to share their experiences. Cards were punched at the Centre and brought to U.C.C. to be processed on their IBM 370/318 computer.

The main aim of the Schools Computing Centre was to share scarce resources for the benefit of all. Any teacher and his/her pupils could use the Centre on a rota basis. In this way, the Centre was unique in that it provided a valuable link between second level schools and a third level institution. Even with the advent of the microcomputer, the Centre provided facilities for schools in the area. Teacher training courses are held at the Centre. Indeed it can be said that the majority of teachers involved with computers in the Cork area have attended at least one course at the
Outside the Centre there no other means existed whereby teachers interested in computing could learn the rudiments, although negotiations are in progress with the Computer Science Department of U.C.C. since 1978 to examine the feasibility of providing a Post-Graduate Diploma Course for teachers on the lines of the Trinity College course. To date, there have been no developments in this regard. A more detailed analysis of the Schools' Computing Centre will be given later on in the thesis.

The Limerick Branch ran many successful courses for teachers in conjunction with the National Institute for Higher Education (N.I.H.E.); for example, during the 1977/78 school year, an appreciation course was held as was a beginners course in BASIC and an advanced FORTRAN course. There were, of course, no computers in schools at this time but some schools in the Limerick area, however, arranged for their students to visit the Computer Centre at the N.I.H.E.

Nevertheless, despite the valiant efforts of individuals outside Dublin, computing in schools was largely un-co-ordinated and depended too much on such individuals.
4.8  ACTION AT OFFICIAL LEVEL

Before the Minister for Education announced his intention to introduce Computer Studies into Second Level schools as an optional extra on the Mathematics course at senior level (ages 15+- 18+), it is estimated, from contact with dealers, that there were 80-100 microcomputers in Irish Second level schools. The Ministerial announcement, early in 1980, spurred various bodies, in particular the Vocational Education Authorities (V.E.Cs), to purchase microcomputers for schools within their jurisdiction. City of Dublin V.E.C. had in fact begun to purchase microcomputers in 1978, but they, along with Cork County V.E.C. and Dublin County V.E.C, installed APPLE II systems in nearly all their schools.

Courses in Computing sprung up, especially in the Dublin area and by March 1980, we are aware that courses were held in the following institutions, at least The Teachers’ Centre, Drumcondra, Dundrum College of Commerce, Crumlin College of Business and Technical Studies, The Institute of Education, Leeson Street, Elron Computers, Dun Laoghaire, and Dundalk Regional Technical College [109]

Even though grants for the purchase of computing equipment were not
yet available, more and more schools purchased microcomputers and it is reckoned, again from distributors figures, that there were at least 300-400 microcomputers in Irish schools by the time the Department first provided microcomputers to schools in November 1981.

From 1975 to 1980, CESI organised and conducted one week training courses for teachers. Up to 1980, CESI was the only organisation which provided such courses exclusively for teachers.

Now, with the advent of the new computer option [110], there was an explosion of interest among teachers and this manifested itself primarily in the number who sought places on the CESI summer course. As the Department of Education would not, itself, provide extra courses, CESI felt that it had a duty to cater for as many teachers as possible. So in 1980, instead of having one course, CESI catered for over 300 teachers at seven venues around the country. In so doing, CESI stretched its personnel to the limit as it felt obliged, being the only body experienced in the training of teachers of Computing at Second level, to cater for as many teachers as possible.

The most significant features of these CESI courses was the
increased prevalence of microcomputers. Courses in Dublin and Cork were run entirely on microcomputers. Participants brought twenty microcomputers to the Limerick course, where they also had access to the VAX PDP11/70 computer.

Despite the fact that the Computer Studies option was coming into being, CESI accepted, with reservations, the fact that no computer equipment would be provided to schools until the Resources/Advisory Committee, set up within the Department of Education, delivered report. The organisation was, however, deeply distressed and disappointed that no extra financial support was available to cater for the extra teachers who now wished to attend the summer courses in computers and that the Department itself was not willing to shoulder some of the responsibility of organising and/or providing computer courses for teachers.

As we have seen besides providing travel and subsistence allowances to teachers who attended the CESI organised summer courses, the Department of Education played a minor role in the evolution of Computer Education in schools. Letters from CESI and others to the Department were left generally unanswered and it became next to impossible to find out what progress, if any, was being made towards the provision of courses in Computer Studies at
Second Level. CESI had done all the groundwork. It produced a syllabus, disseminated information, conducted seminars, and was the only national organisation at that time active in the provision of teacher training courses. The Department of Education, which should have led the way did little.

It was a pleasant surprise then when the Department of Education invited CESI to meet them in October 1979. From the meeting, it emerged that the question of Computer Studies at Second Level was being considered on two levels (1) from a long-term viewpoint and (2) from a short-term (or interim) viewpoint.

A Resources/Advisory Committee was formed within the Department under the Chairmanship of Mr. Bill Hyland and was then examining the feasibility of introducing Computer Studies into the Second Level curriculum as a subject in its own right from a long-term viewpoint. This Committee, the Department claimed, was at that time, examining costings, level (junior/senior cycle), syllabus content, equipment (type), student/machine ratio, etc., teacher qualifications/training, etc and would make a final report and interim reports as was deemed necessary.

As a SHORT-TERM measure the Department decided to place Computer
Studies as an OPTIONAL EXTRA on the Leaving Certificate Mathematics syllabus. Schools would be invited to take part in this computer course, but only those schools which had a teacher with some "qualification" to teach the subject would be allowed to take part. This "qualification" was never defined, however. Schools participating in the scheme had to have their own or access to computing facilities.

No special grants were being made available at that time for the purchase of computers, but it was suggested that special funds might become available when the resources committee submitted its report. Schools, in the meantime, would have to obtain finance or facilities by other means. There would be no examination at Leaving Certificate level in Computer Studies, but the course would be monitored by Department of Education Inspectors. The Department of Education would issue a certificate to each student who successfully completed the course.

The syllabus would be broadly based on the CESI syllabus of 1977. A working party within CESI was established to modify this syllabus to take in, at maximum, fifty hours, to be taken mainly by fifth year students (that is, the year before students leave school). Although Computer Studies was attached to the Mathematics syllabus.

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interested and "qualified" non-mathematics teachers would not be excluded from participating in this interim scheme. Even still, the vast majority of teachers came from a mathematics background.

In February 1980, the Department of Education officially informed the authorities of Second Level schools of the proposed scheme in Computer Studies. The contents of this circular are contained APPENDIX D. This Leaving Certificate option scheme began in September 1980 and sixty schools took part. This type of course was considered far from ideal by the then Executive Committee of CESI.

It was felt that attaching a Computer Studies option to the Mathematics course at Senior Level helped to reinforce the impression that computing would or should remain the preserve of the Mathematics Department in a school whereas computers could be introduced in almost any subject area. There was a growing feeling within CESI that computing should be introduced across all subject areas. Within the present Mathematics syllabus, it is very difficult to devote a period a week to Computer Studies, especially when the topic cannot be taken as part of the certificate examination. This is especially true of teachers who have an Honours Mathematics class to teach. As it is virtually impossible to obtain a period
from other subject areas, much had to be done outside normal school hours. The monitoring of the scheme has always been a cause of concern to CESI. From the beginning CESI realised that, with no Inspector of Computer Studies appointed, that the burden of this work would fall upon an already overburdened and understaffed Mathematics inspectorate. CESI did offer to help out in the monitoring of the scheme. CESI, being a National body in the field of Computer Studies had acquired some knowledge and expertise and would, therefore, be in a position to offer guidance and advice to schools involved in the scheme. This offer of assistance was, however, refused by the Department of Education. The Department of Education also refused to consider the feasibility of employing personnel from Third Level institutions to assist them in the monitoring of the scheme.

In its first year of the operation (1980/81), because of the relatively small number of schools taking part, the Department's inspectors managed relatively well. But by the next year (1981/82) when the number of schools taking part had more than doubled, many schools did not have their students monitored at all. Teachers in these schools were, nevertheless, asked to supply to the Department a list of students who, in the teacher's opinion had reached a 'satisfactory' standard. These students were then presented with a
certificate to state that they had 'successfully completed a Computer Studies course'. This was far from ideal mainly because it put the onus on the teacher to decide who merited a certificate when no standard was set by the Department of Education. This is there is now at least one microcomputer in every second level school in Ireland. With an increasing number of schools wishing to take part, it cannot be overemphasised that the monitoring problem cannot be adequately tackled and consequently the course is devalued.

The scheme did, however, have some not insignificant advantages. It showed a small step on the part of the Department of Education towards an official recognition of Computer Education. From CESI's point of view, it was hoped that the establishment of the scheme would provide a stepping stone to the establishment of Computer Studies as a subject in its own right. At least the subject was now listed in the Rules and Regulations for Schools [111], which outlines the syllabi to be pursued in all subject areas, and schools were notified to this effect. Consequently, more schools became aware of the growing importance of computing. It was now permissible to teach Computer Studies within normal school hours, if only at Senior level only. This was a major breakthrough as, up till now, many teachers had had to teach computing either outside normal
school hours or under the guise of another subject. Indeed, there were teachers who had some difficulty in obtaining their incremental salaries by honestly stating that they had taught computing within normal school hours. At least now, schools had the option to teach Computer Studies within normal school time, should the constraints of the timetable permit.

In many cases, this did not happen and teachers taught, as before, outside normal school hours. Also, the fact that Computer Studies was attached to the Mathematics syllabus had the effect of discouraging all, but a small minority, of non-Mathematics teachers to become involved in computing in any way.

4.8.1 THE RESOURCES/ADVISORY COMMITTEE OF THE DEPARTMENT OF EDUCATION

As previously mentioned, CESI was informed at their meeting with Department of Education officials in October 1979 that it was proposed to set up a Resources/Advisory committee, under the Chairmanship of Mr. Bill Hyland, to examine the feasibility and implications of introducing Computer Studies into the Second level (Post-Primary) curriculum.
The committee was an INTERNAL Departmental one with the following terms of reference:-

"to consider the possible function of computer studies and computing in second level education in Ireland in the next decade in the context of the increasing and changing role of computers in society and to make recommendations to the Department. These recommendations should take account of:-

i) Existing institutional structures and conventions at this level

and

ii) The resources implications of any recommendations.

The committee would be free to review applications from schools in this area of activity and to make interim recommendations should such be deemed desirable.( 110 )

In reply a question in the DAIL from Mr John Horgan, T.D. the then Minister for Education, Mr John Wilson, T.D. issued the following statement:-

"the Advisory Committee on the role of computers and computing in second level schools has decided to proceed with its work in two phases; the committee will deliver its
report on the first phase of its work before the end of the 1980/81 school year and it is anticipated that the second phase of its work will be completed by the autumn of 1982.

In the interim, I have arranged for the introduction of an optional section on Computer Studies in the Leaving Certificate syllabuses in Mathematics in respect of the school year 1980/81\([112]\)

According to the circular [110] sent to CESI by the Department of Education, the first phase of the report was expected to cover, inter alia, recommendations concerning appropriate target groups and the aims and objectives, structures and major components of syllabi relevant to these groups. It was also expected to make recommendations concerning qualifications of teachers, the training implications these might have, and supportive arrangements that might be desirable in a new situation. No official recommendations were ever made, however.

CESI duly made recommendations, but little or no heed was taken of them. It appears that the committee had minimum contact with the computer industry or with teachers who would ultimately have to implement whatever recommendations they would make.
At the time of writing, the Report of the Advisory Committee has been with various Ministers for Education for over four years. Yet its findings have never been made public. It is likely that the rapid progress of technology has made the findings of the report obsolete. A more serious and fundamental problem is the failure and inability of the Department of Education to recognise that the implementation of Information Technology into schools, in however diluted a form, cannot be done within the present structures of the Department of Education alone.

While the report has not been made public, some of its apparent recommendations have, however, been divulged by the actions of the Department of Education since the end of 1981.

The Department of Education tendered for the purchase of microcomputers in the autumn of 1981. APPLE COMPUTER COMPANY won this contract. For the summer courses of 1982 (and subsequent years, up till 1985), the structured language, COMAL was used. A group was set up under Fr Cyril Byrne, CSSP to develop a suitable set of Structured Diagrams for use in Irish schools. Copies of this Report [113] were distributed to schools in the autumn of 1984. A group from the Computer Science Department of Trinity College
Dublin (TCD) have undertaken two projects on behalf of the Department of Education. The first concerned the development of a "kernal" COMAL on the VAX computer. It is hoped that this version will be the standard for the future, and, secondly TCD was approached to develop a 'chip' to replace the expensive 2-80 card which has currently to be installed in machines, such as the APPLE to enable them to run COMAL.

The Department of Education also appears to be interested in the use of computers in monitoring and process control, that is, the use of computers in controlling the environment. A seminar on this topic was held at Thomond College, Limerick in October 1982 and, ten schools were selected and given equipment to pilot in their schools in November 1983. A further and extended pilot project in microelectronics was in progress for the 1984/85 school year.

The absence of a policy and a lack of manpower on the part of the Department of Education, together with a conservative nature which inhibits their ability to deal openly with bodies or individuals outside that Department has caused a certain nervousness on the part of officials when dealing with the overall situation of computers in schools. Here, they were faced with a new situation. The knowledge, for the most part lay outside the Department and CESI had
attained some knowledge in this area. Therefore, for the first time, a body of mainly second level teachers had, perhaps, more knowledge in this area than Department personnel. Therefore, it appears that the unwritten policy of the Department of Education, to this day, is to provide CESI personnel with as little information as possible with regard to their plans for the introduction of computers into education. Yet, for example, use is often made of CESI to conduct courses on behalf of the Department at very short notice.

While it may have been prudent for the Department of Education to set up an internal Advisory Committee initially to determine policy and a strategy for the proposed introduction of Computer Studies into second-level schools, the fact that their report was not made available outside the Department underlines the folly of not then setting up the structures which would favour the introduction of the Information Technologies, including computer studies into schools.

In the absence of a policy, it is likely that we will see a piece-meal introduction of Computer Studies into schools. The wider implications being ignored. We have seen the provision of hardware to every second level school in Ireland in the last few years, but no moves have been made towards the provision of a comprehensive teacher training programme. Nothing has been done at a national
level towards providing basic minimum qualifications for teachers of computing. To date only Trinity College, (Dublin), Thomond College (Limerick), St. Patrick's College, Maynooth and relatively few RTCs provide Diploma courses for teachers of computing.

There are no structures whereby a quantity of high quality courseware can be developed for use in the classroom, yet Department officials wonder why a body such as CESI can not produce a range of materials, both software and courseware, which could be used in schools. Such an attitude is unfair, for while CESI has been involved in the distribution of software to its members, it must be realised that CESI is a voluntary organisation. Its members, like all teachers, must, in the absence of a policy for the secondment of teachers, put in a full day at school. The only way that an adequate supply of courseware materials can be produced is to develop the structures under a National policy for the secondment of teachers and the establishment of a network of resource or support centres around the country. This matter will be dealt with later in the thesis.

4.8.2 MINISTERIAL ANNOUNCEMENTS (1981.)

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In December 1980, a government White Paper on Education contained the announcement that courses in Computer Studies were to be formally introduced into the curriculum. Further details emerged when the Minister, Mr. John Wilson, T.D. made the announcement that

"it is my firm intention that Computer Studies will be formally introduced into the second-level curriculum as a separate subject by the 1983/84 school year at the latest. To enable this to be done, a number of activities must be undertaken, such as the establishment of research and curriculum developmental projects in selected schools, the development of appropriate syllabi, the provision of teacher training courses and the provision of hardware and software in schools."

The Minister went on to say that he had undertaken many steps in these matters. Substantial funds were to be made available in 1981 for in-service courses in computers. Funds had been made available, the Minister declared, for a number of projects to ensure that appropriate software will be available by 1982, and that essential curricular materials can be developed so that the syllabi may be introduced on a sound basis. The Minister announced
that with effect from September 1981, a scheme under which microcomputers will be made available to ALL Second level schools. The Minister did not indicate the level and scope of the proposed courses. These were, apparently, to be determined by the Resources/Advisory Committee referred to earlier.

The provision of training courses for teachers has always been a bone of contention between the Department of Education and CESI. Since 1975 when CESI first decided to organise in-service summer courses for teachers, the Department of Education have been unable to fund these courses adequately. CESI, as the body representing teachers of computing, kept pressing the Department of Education to fund adequately the inservice courses which they organised. One should remember that from 1975 to 1980, the Department of Education did not have any direct involvement in the organisation and running of such courses. They confined their role to financing and this they did badly. Due to the peculiar system which is used to finance courses, there is, generally, a lump sum put aside for a certain course. From this sum, participants are paid travel and subsistence allowances, the remainder going towards lecturers' fees. This meant that lecturers on CESI courses often received less than a participant's travel and subsistence allowances. [116]
In 1980, because of the fact that the Interim course was on the way, CESI had more than three hundred applications for courses, which was six times the number that attended the one course in Limerick in 1979. Despite this, however, the Department had no plans to organise extra courses, and as well as that, the amount of finance available was reduced to £1000, which was about half the allocation for 1979. CESI protested about this, to no apparent avail.

In 1980, CESI stretched its personnel to the limit and organised a total of 11 courses at seven venues around the country. A total of 300 teachers attended.

By November 1980 the total fund for the computer courses had risen to almost £6 000. [117] CESI received no indication from the Department that there had been a re-consideration of the fund allocation, until the Chairman wrote to enquire about the break down of finances for the 1980 summer courses.

In 1981, the provision of microcomputers to schools had been announced. Thus there was a further interest in computer courses. For the first time since 1974, the Department of Education became actively involved in the organisation of in-service courses. They
organised courses for beginners at six venues around the country, mostly in the Regional Technical Colleges. CESI were never officially informed of this development, despite the fact that they had done the majority of the work in the area of teacher training for many years.

CESI, nevertheless, got Departmental approval to run 14 courses at eight venues around the country (7 beginners, 5 intermediate, 1 advanced and one special course for Career Guidance Counsellors). Approval meant that participants would qualify for travel and subsistence allowances.

The Department of Education did not, however, publish details of these CESI courses in their circular to schools, thus giving their own courses an unfair advantage, as most teachers would feel that the courses listed on the circular were the only officially sanctioned ones. The reason for this decision is difficult to fathom, but could have something to do with the pressure exerted by CESI to increase the financial allocation for the 1980 summer courses.

With reference to the Ministerial announcements [115] no
Immediate moves were made with regard to the establishment of research and developmental projects, other than the setting up of the twin projects at Trinity College, as outlined previously. The development of the 'chip' to replace the costly Z-80 card has been, to date, unforthcoming. The 'Microprocessors in Monitoring and Control' project at Thomond College, under the direction of Dr. John O'Brien, seems to be the most successful. Its Report is due to be published shortly.

In the autumn of 1981, the Department of Education sought tenders for the supply of microcomputers to Second Level schools. APPLE COMPUTER LTD., Hollyhill Industrial Estate, Cork won the contract and initially 105 systems were installed in November 1981.

At a Press conference on November 26, 1981, the then Minister for Education, Mr. John Boland, T.D. (there was a change of Government) stated that in excess of $200,000 would be spent by the Department of Education in providing the APPLE II to Second Level schools by the end of the 1981 financial year. The Department met the full cost of the equipment in the case of Community, Comprehensive and Vocational schools and 80% of the cost in the case of those provided to Secondary schools. This was the first time that a grant scheme had been provided for the acquisition of microcomputers. See
APPENDIX H for hardware details.

Schools which received microcomputer systems from the Department of Education had no system of their own at that time, but had a teacher 'qualified' to teach Computer Studies. This teacher qualification was never defined, however. Schools which, over the years, had purchased computer equipment out of their own funds and who had pioneered Computer Studies courses received no extra computer from the Department, while a number of the schools which received computer systems could not use them to their full advantage. Thus schools were penalised for their initiative and this caused much bitterness and resentment among teachers.

In the Ireland of the early 1980's there was a lot of political instability, for the reason that no faction was able to obtain an overall majority. There were three General Elections in a space of eighteen months and there were five different Ministers for Education.

The provision of microcomputers to schools was ill-planned and appeared to be a political gimmick for the 1981 General Election. Certainly there was no guidance provided to schools as to what they were expected to do with this equipment, no policy on
Computer Education in schools was formulated, nor were adequate funds put aside for training of teachers, as the then Minister, Mr Wilson, or his successors, to date, have promised.

4.9 CESI SUBCOMMITTEE ON COMPUTERS IN EDUCATION

Until 1980 members of the Executive Committee of CESI had been solely concerned with the introduction of Computer Studies as a SUBJECT IN ITS OWN RIGHT. This, they saw, was the only way of getting the topic onto the curriculum. There was always the hope that somehow, once established on the curriculum, the subject would spill over into other areas of the curriculum. Until then, the members of the Executive Committee of CESI had been almost exclusively from a Mathematics and Science background. In 1980, some members of the Committee felt that undue importance was being given to the establishment of a Computer Studies subject at Second Level, in particular, the more global view of the use and application of computers in education was being neglected.

Therefore in order to achieve a sort of balance, the Executive agreed to set up a special sub-committee to investigate the implications of "computers-in-education". In February 1981 the sub-committee issued a draft report [118] and made several recommendations.

The committee recognised that the new information technologies will
have a great impact on the youth of our country during the coming decade. In particular, it is expected that computer networks and telecommunications will play a very large part in forming the course that "computers-in-education" will take. This fact is acknowledged in the Government White Paper of 1980. [119]. The Committee felt that CESI ought to look at the broader aspects of "computers-in-education" in our society. In particular, the educational concepts of "Distance Learning" and "on-going education" will take on a new meaning as the century draws to a close. While it is to be expected and welcomed that students will have a greater choice in what they wish to study due consideration must be paid to "structured learning" so that the process of certification may be safeguarded. The committee considered it as a matter of urgency that CESI reach out to the "layman" who has been and who will be put off by programming. This includes teachers or students in Second Level education.

The committee investigated the kind of "hardware" that would be needed by a school of the 1990's. The committee was divided on this issue. A school could have its own large computer or it could be connected to a computer network via Data Terminal Equipment (DTE's). The subcommittee on "computers-in-education" acknowledged that CESI
ought to be involved in developing Computer Studies subjects for second level schools, but should not neglect the wider field of "computers-in-education".

For the first time there was, within CESI a new breed of teacher who saw the computer only as a part of the wider aspect of Information Technology and who spoke for those teachers outside the Mathematics and Science disciplines. They were interested in the computer as a tool in their own subject areas and were more interested in the use of applications packages than programming. These teachers had, heretofore been neglected or passed over within the CESI organisation, which consisted mainly of Mathematics and Science people, and thus catered for these to the exclusion of others, by reason of the fact that, as was the trend at the time, Computer Education was strongly linked to mathematics.

For this group of teachers especially, the development of good courseware materials is vitally important. Mackey [120] called for the introduction of a National Plan for the introduction of Information Technology into schools. He makes the point that any National Plan must concentrate on the development of courseware. In too many countries, an emphasis on hardware has resulted in underused equipment and the alienation of many teachers from
computing. A good variety of relevant courseware must be produced, now that the computer equipment is installed in our schools. No plans have yet emerged at official level towards the wider implementation of computers across the curriculum.

4.10 PROPOSALS FOR THE SETTING UP OF COMPUTER RESOURCE CENTRES

As a result of the setting up of the its subcommittee on Computers in Education. CESI decided that the provision of adequate Resource Centres to service the needs of teachers was essential. Therefore in November 1981, Brendan Mackey, Chairman of CESI, called a meeting of interested parties to discuss ideas and proposals for the setting up of Resource Centres for teachers of computing. [121]

At the meeting it was felt that accommodation did not present a big problem, as all those proposing centres were in a position to provide a resource room of reasonable size, with an adjacent lecture room.

There was broad agreement on what the Centres should have. These fell under the heading of hardware, software, technical knowledge, library facilities, ability to deal with telephone...
enquiries and the provision of workshops and seminars. It was felt that centres should have as wide a range as possible of all computer equipment likely to be used in schools, with a constant inflow of latest developments. It was suggested that each Regional Centre should have a networking system available and that each Centre also have the capability to link with other Centres to create a national network to facilitate the flow of materials between Centres. Each centre should have a comprehensive software library. The question of evaluation of software arose and two possible answers were put forward: firstly, that one Centre be designated to evaluate; secondly, that evaluation of software be a specific funded project. It would be important to avoid duplication i.e. each centre evaluating the same programs. Also, members should be encouraged to develop their own software and make it available, thus using the Centres as "clearing houses".

It was stressed that Centres should be able to offer independent advice on equipment. The Director could become experienced in this area or an expert could be seconded from Industry. Alternatively, comparisons and assessments could be part of a project. Each Centre should have a complete set of relevant books, periodicals, magazines, etc in stock. A software library could also be included. It was felt also that a telephone advisory service
would be of great benefit and this service could, in time, be linked to a National Information Network. Workshops and seminars could be organised at the Centres according to local demand. A majority stressed the need for the Director to visit the schools in the area to provide back-up and general guidance service.

Many were in favour of each Centre picking its own area of specialisation in addition to its general functions, such as Evaluation, Information, Development, etc. It was stressed, in the interests of uniformity, that a free and easy exchange of materials between Centres would be essential.

Staffing would be the greatest cost and the greatest problem. It was clear, however, that centres would succeed or fail depending on the quality of the staff.

All mentioned the need for a full-time Director and most were of the opinion that the success of the Centre would depend on the Director. As to qualifications, most seemed to prefer a person with a background in Education and Computing (or the best combination of the two). Some suggested that a full-time Secretary be appointed, while others favoured part-time Secretarial assistance. With regard to technical back-up the suggestions ranged
from the employment of a full-time technician to back up services provided by CESI members or even students on a rota basis.

The main requirements were identified under five main headings:

1. Resources
2. Information
3. Technical support
4. Seminars/Workshops
5. Projects

In order to provide these requirements on a co-ordinated basis the following approach was suggested. With regard to Resource Centres a two-tier approach was needed (1) that five Regional Centres be set up - two in Dublin (attached to the Teacher Training Colleges at Drumcondra and Blackrock), and one each in Cork, Limerick and possibly Galway and (2) that provision be made for the setting up of local centres in this case, the initiative to be taken by the local branch of CESI by proving that it has sufficient active members to warrant a centre. These centres would be smaller than the Regional Centres, but could be linked to the Information Network already outlined and also be able to claim the Seminar/Workshop services. Placing the onus on the local branch would serve two purposes. It would avoid the problem, expressed by some members, of
the Executive being seen to create Centres which would later prove to be under-utilised. Secondly, it would help to strengthen CESI at grass-roots level by making the local branch the centre of activity. The location of these centres would be a matter for the local branch to decide. They could, for example, be based in the local Teachers' Centre or in a local school. They could be operated on a rota basis by local members. Finance should be made available from a central fund.

With regard to information a central DATA-BASE would need to be established to disseminate information to the Regional Resource Centres, local branch centres, and, perhaps, individual schools. The Information Centre could also carry out the function of a clearing house for books, magazines, and, perhaps, software to the Centres in order to centralise this function and avoid duplication. While the Information Centre could be placed in one of the Regional Centres, it would be preferable for CESI to have a Head Office for this purpose.

CESI should attempt to reach agreement with firms in the Electronic/Computing industries with a view to the provision of expertise who would be willing to provide technical support and assist CESI in an advisory capacity. It was proposed that a panel be set up consisting of experts from the Electronics/Computing
Industries, third level institutions, etc who would be willing to give seminars, lectures or workshops on specific topics to members at local branch level. A list of desired topics could be prepared at branch level, and such seminars, etc would be provided at the request of branches.

In order to provide the information essential to the future use of Computer Technology within our Education System, it was suggested that a number of projects relevant to this area be initiated as soon as possible. The possible areas for project are too numerous to outline here, but, as well as the obvious one of the computer as an Educational aid in helping to solve some of the problems areas of education, the development of Educational Software should be included.

The CESI decided to approach a National, prestigious sponsor with a copy of the Outline Plan [122] and ask them to set the plan in motion by sponsoring part of it. If this were acceptable, the formation of the Regional Resource Centres would be the priority of CESI. Such a sponsor would be asked for a commitment of £50,000 - £60,000 per annum for a period of, say, five years to finance these centres.
In the event of this approach being successful the manufacturers/suppliers of all equipment likely to be of interest to schools would be approached with a view to making such equipment available at these centres and the Department of Education would be approached at Assistant Secretary level, and asked to release six teachers on present salary scale. The cost to the Department would be approximately £24,000 to £30,000 per annum to pay replacement teachers.

In the event of the Department being unwilling, CESI would look at other possibilities of staffing the Centres within the financial limits available, possibly by employing part-time staff or CESI members on a rota basis.

The CESI decided to approach a national body representing the Electronic/Computing Industries at senior level with a view to their members sponsoring stages 3 and 4 (technical support and seminars/workshops) of the Outline Plan [122]. CESI proposed that the Computer Industry co-operate in setting up the panel of expertise required and the funding necessary. With regard to projects, it was proposed that either a fund be set up to finance a certain number (5 to 10) or that individual firms be invited to finance individual projects. Should this be successful, it would be
up to individual institutions, schools or Centres to put forward possible projects for funding.

With regard to the provision of information CESI would approach one computer manufacturer and propose that it set up and fund a National Information Network, based in CESI Head Office with Secretarial assistance. Such a system should be capable of disseminating information to Regional Centres, local Branch Centres, and eventually, to schools.

In presenting the Outline Plan, the Chairman of CESI, Brendan Mackey pointed out clearly that it was not intended as a solution to our problems, but rather as an outline of a structure which would help us arrive at a solution.

The document was submitted to the Department of Education and to bodies involved in the Computer/Electronics field. The plan suggested a co-operative venture between the Industrial and Educational sector. So far, no reaction has been received from the Department of Education. On the Industrial side, it was submitted to the Federation of Electronic and Information Industries of the Confederation of Irish Industries. They set up a working party to study the document, but nothing has yet been decided. The document
was also submitted to the Irish Business Trade Association (I.B.E.T.A.). Mackey was invited to address their Computer Committee, which then reported back to the General Council of I.B.E.T.A. Once again the reaction was positive and favourable, but again there have been no developments to date.

In his address to the CESI A.G.M in September 1982, Mackey stated:

"It is encouraging to see the positive response of Irish Industry, because, I firmly believe that if we are to overcome the "computers in the cupboard" syndrome in Irish schools, or if the initiative of the last few years is not to be totally lost, we must now create the appropriate structures ....." [123]

Over four years have elapsed since the idea of resource/Information Centres was first mooted. At this stage, we cannot be over optimistic that either the Department of Education and/or the Computer/Electronics Industries will help CESI to implement the proposed outline plan.

Ireland is currently in a deep recession, and cut backs have to be made all round. Industry appears reluctant to become involved in
educational schemes while there is little or no input from the Department of Education. The Department of Education, from past experience tends to react to situations rather than play the role of innovators. It is extremely difficult to get an official response from the Department of Education at the best of times. In the field of Computer Education, there is very little expertise within the Department and this fact may underline the reluctance of the Department of Education to make any worthwhile official move towards the introduction of information technologies into schools.
In this section the author discusses an unique project in the Cork area, under the CESI umbrella, whereby schools share resources, expertise and provide a forum for the development of computer education. The project illustrates the author's ideas on the development and co-operative nature of computer education and focuses also on the unique co-operation between a third level institution and second level schools, many of which were incorporated into the CESI outline plan for the setting up of Resource Centres outlined in the previous section.

The Cork Branch of the Computer Education Society of Ireland was formed in May 1978. Prior to its formation introductory courses for teachers had been organised at Colaiste an Spioraid Naoimh, Bishopstown by the author, who was then on the National Executive of CESI. The author had taken part in the original pilot scheme, organised by the Department of Education during the 1973/74 school year. At the completion of this pilot scheme, he felt computers had an important role to play in the school and society of the future. This role was not, as yet, clearly identified, but the feeling was that the momentum created should now be.
maintained, even though no official support or recognition was forthcoming from the Department of Education.

The provision of 'hands-on' experience was critical at that time. Computer equipment was scarce and purchase of computer time was too costly. The priority was to obtain processing facilities for the teachers who had attended the courses at Colaiste an Spioraid Naoimh. ICL had very kindly provided batch processing facilities for the duration of the course, but it was imperative that processing facilities be found locally. Some computer firms were contacted with a view to providing processing facilities for schools, but the response, if one was received, was negative.

Contact was then made with Cork Regional Technical College (RTC) with a view to providing processing facilities for schools in the Cork region. Their initial response was favourable and time was provided on their DIGITAL PDP 8 computer at times when RTC students would not be using the computers. These times were, however, at very unsociable hours for teachers, (between 5.30 and 6.30 p.m.). There was, nevertheless, a constant flow of teachers and pupils in and out of the RTC computer room. The fear of a large increase in teachers and/or second level students using the RTC facilities probably prompted the Board of Management to levy a fee on the teachers.
who were then using the facilities. Despite pleas from the then Chairman of CESI, the college authorities refused to waive the levy, even though the computing facilities were not being fully used at that time and spare capacity existed. The teachers involved then decided not to use the RTC facilities any further, the feeling being that they had made enough sacrifices with respect to their time without having to pay for the privilege as well.

The author had the feeling that the only way forward was for schools to have their own facilities. At that time, there were few schools in Ireland which had their own processing facilities. Coláiste Chóilme, Swords, Co. Dublin had obtained a PDP 8 computer from Digital and the author had discussions with the teacher involved (Pat O’Leary) and then decided to approach Digital and seek similar facilities for Coláiste an Spioraid Naoimh. The response was negative, however.

The author had had discussions with the Head of the Computer Science Department at University College Cork (UCC) with a view to obtaining facilities for interested teachers in the Cork region at the University. At that time the Professor of Computer Science had also responsibility for the running of the College computers and, while sympathetic, was not in a position to offer much assistance.
at that time.

The breakthrough came when the University decided to appoint a Director of the Computer Bureau who took over responsibility for the computer equipment areas from the Computer Science Department. We were lucky in that Mr Fred Damodaran was appointed to this new position. Mr Damodaran was very interested in getting schools computing off the ground having been involved in similar schemes in Cardiff and Aberdeen. He approached the author with a proposal to set up a Computer Centre for schools and undertook to draw up proposals and discuss them with the University authorities. Damodaran drew up proposals for the provision of computer facilities to schools in the Cork area and placed these proposals before the Computer Committee of University College, Cork. The Committee were in principle supportive of the idea of providing computing facilities to schools.

4.11.1 EXERCISE IN SELF HELP

The Computer Education Society of Ireland had been actively involved in the promotion of computer education in schools both on
a national basis and in the Cork area. The society had, at a National level, done a great deal of very important work, including the drafting of a syllabus and the production of regular newsletters. A few schools in Cork had been giving their pupils some introductory courses, but these had been limited by lack of computing resources. Since computing was not a recognised subject on the schools' curriculum, the courses had had to be classed as extra-curricular activities, but attracted a considerable amount of support from the pupils concerned. The main constraint on further developments was the lack of appropriate computing facilities.

Outline proposals for computing facilities for the schools were described in a brief note to the Computer Committee at its meeting on January 27, 1978. The outline proposals were for batch computing facilities to be given to schools with FORTRAN, ALGOL and BASIC languages being supported. No charge was to be made for the computer time used but it was deemed appropriate for schools to pay for the cards and line printer paper that they used.

It was envisaged that data preparation would be done by the teachers and pupils themselves. For this purpose the University was prepared to make available an IBM 026 card punch on indefinite loan.
Colaiste an Spioraid Naoimh, Bishopstown undertook to provide accommodation for the card punch and office space for both data preparation and off-line activities. The school undertook to administer the data preparation and off-line areas on behalf of other interested schools and share access to equipment and facilities. Details of the facilities available were brought to the attention of other schools in the area via the Association of Headmasters. Additionally, the CESI newsletter was used to publish details to those who are interested. It was envisaged that the schools would acquire computing resources for their own "hands on" use in time and that the computing facilities based on the University's IBM 370/318 configuration would complement any such computing capacity acquired by the schools.

It was agreed that the data preparation area would be set up in Colaiste an Spioraid Naoimh and would be equipped with desks, chairs, pigeon holes, etc. A supply of cards, purchased under bulk purchasing agreements by U.C.C. but charged to the school, were to be held in this area. The Headmaster of Colaiste an Spioraid Naoimh, Brother Ephrem, kindly provided the facilities. Programs were punched on cards either by the pupils themselves or selected 'volunteers', who would punch their own and other people's programs...
and data. When card decks of completed programs and data were ready either a teacher or a pupil would bring the job into the Computer Bureau at UCC to be run off and collect the processed jobs.

Small groups of pupils were brought into Colaiste an Spioraid Naoimh from time to time for debugging sessions where they would correct errors in their programs and re-submit the jobs. When used in this form the data preparation area took on the characteristics of a computer laboratory lacking only a local computing facility.

It was also envisaged that costs be shared between participating schools, that commercial organisations in the Cork area would support the cost of such a venture in the event that these costs would prevent the exercise from getting under way and that administrative costs of heating, lighting, cleaning and portering services for the data preparation and off-line area would be met by Colaiste an Spioraid Naoimh.

In order to get the project off the ground, it was necessary to canvass support among schools and commercial firms and institutions. Many schools expressed their interest and willingness to take part in the project, but it was felt that in order to make the project viable and to leave room for expansion, it was
necessary to gain a continuous financial support from the industrial and commercial sector. We felt that the Centre was a positive step towards the provision of a co-operative spirit among schools and industry in the new emerging area of Information Technology. In the long term, it would be to the benefit of local industry to support the Centre, in that they would be obtaining young people with a knowledge of computers and how they work.

The author undertook to circularise local industry outlining the aims and objectives of the Computing Centre and outlining the benefits both to industry and to education. It was a unique opportunity for closer co-operation between a third level institution, second level schools and industry to work together for the benefit of all. It was clearly pointed out from the outset that the proposed centre, although based in one school, was intended to be used by all interested schools on a rota basis. In this manner, it was a commitment to share what were then scarce resources for the benefit of all and to encourage and further interschool contacts under the auspices of CESI.

It was hoped that the project would receive wide support from the commercial and industrial sector, but the reality was that, although the author sent out over a hundred circulars, only one reply was
received and this was negative. We can only speculate as why financial support was not forthcoming from the industrial and commercial sector. It is possible that such institutions saw no immediate benefit to themselves in this undertaking and, not understanding its implications for the future, did not wish to get involved. If this is so, it is rather surprising, as many of the firms contacted were involved in the computer/electronics field. Another possibility is that the scheme, being the first of its kind in Ireland certainly, was treated with caution by the industrial sector, who did not want to infringe in any way on what was regarded as the traditional role of the Department of Education. There may also have been some who foresaw the possibility that this could be the thin edge of the wedge which would involve industry in carrying some of the financial burden for the Department of Education, while that Department stood idly by. Now, if it were to be a joint effort between Education and Industry, initiating from the Department of Education, under the terms of a National Plan, things may have been different.

In the meantime, Damodaran, undertook to seek financial support from the Banks and succeeded in obtaining a nominal commitment from them. The Bank of Ireland were willing to provide a once-off grant of £400 towards the setting up of the Centre and sponsored an essay
competition for schools in the Munster area on the theme of computing. The Allied Irish Bank, on the other hand were willing to provide the Centre with £100 per year for the first two years. [125]

With financial assistance forthcoming, the officers of the newly formed Cork Branch of CESI and the Director of the Computer Bureau at UCC decided to go ahead with the setting up of the SCHOOLS COMPUTING CENTRE. Taking into account its Irish environment, it was decided to call the centre Ionad Ríomhaireachta na Scol. The author became the Director of the Centre and we set out to have it in operation by the beginning of the 1978/79 school year.

There was much work to be done both at Coláiste an Spioraid Naoimh and at University College, Cork. At UCC, the proposals went before the computer committee which approved it. Prior to getting the proposals before the Academic Council, a delegation consisting of Brother Ephrem, Headmaster of Coláiste an Spioraid Naoimh, Mr. Damodaran, Director of the Computer Bureau at UCC, Professor Patrick O'Regan, Head of the Computer Science Department, the Chairman of CESI Cork Branch, Michael Moynihan and Ms. Mary Anne Sheehan, Secretary of the Cork Branch of CESI were invited to meet with the then President of UCC, Dr. McCarthy. At this meeting the
President expressed his interest in the project and gave his approval. This was a most important step forward as it paved the way for an unique co-operation between a third level college and second level schools. The project got the go ahead from the Academic Council of UCC shortly afterwards.

Coláiste an Spioraid Naoimh undertook to provide a room to accommodate the Centre. This involved the converting of a large cloakroom into a room suitable for use as a centre. Desks, chairs and carpeting were laid down and a suitable number of power points were installed. A room was now ready.

University College Cork provided an IBM 026 card punch and the cards. We now had a Centre. Local schools were contacted and the response was encouraging. Many teachers expressed an interest in attending an introductory programming course and from then on courses were run under the auspices of Ionad Ríomhaireachta na Scol. Cards were punched at the Centre and then brought for processing on the IBM 370/318 computer at the college.

The 026 card punch was rather obsolete and was also inclined to breakdown quite a lot. Therefore, Damodaran petitioned IBM to donate an 029 card punch, which was a later model, to the Centre. Thus at the
Beginning of 1979 IBM agreed to donate an 029 card punch to the Centre. While the punch card machine itself was to be given on a permanent loan, IBM insisted that a maintenance contract be signed between IBM and the Centre. This contract stipulated that the Centre pay a monthly sum of money to IBM for maintenance of the card punch. As time went by, the punch became more and more obsolete and parts became harder to obtain and was, in general, being superseded by the microcomputer. The maintenance cost of the punch (per month) consequently spiralled from £30 in 1979 to almost £70 per in 1983. As this proved an enormous burden on the meagre resources of the Centre the card punch was abandoned at the start of the 1983/84 school year.

The author saw the need to maintain the link which had been established with the Computer Bureau of UCC. He therefore, in 1982, entered into discussions with the new Director of the Computer Bureau at UCC, Mr. Trevor Linger with a view to establishing a computer link from the Centre to a UCC computer over the telephone lines via a modem. The Director undertook to provide a Digital terminal at an educational discount as soon as one became available. The Headmaster, as agreed when the Centre was established, contacted the Department of Post and Telegraphs with a view to the provision of a modem and a computer link to UCC. In
March 1983, a computer link was established between the VAX computer at UCC and Ionad Riomhaireachta na Scol. Colaiste an Spioraid Naoimh paid the cost of the terminal and the rental for the modem.

The link-up gives students access to a powerful main frame computer and a variety of computer languages and packages, which are not readily available on the microcomputers. The VAX system supports FORTRAN, PASCAL and BASIC and VAX COMAL developed at Trinity College.

The advent of the microcomputer in or around 1978 brought the cost of computing down and schools began to purchase microcomputers for themselves. The microcomputer in Cork schools did not, however, take off until near the time of the Department grants in 1981/82. Nevertheless, its advent did cause the Centre to reassess its role. The Centre continued to play the major role in the provision of courses for teachers in the Cork region. It is true to say that the vast majority of teachers currently involved in computing in the Cork area attended at least one course at the Centre. The Centre has also acted as a clearing house for computer information to interested schools. As the Centre has no permanent staff and has been denied official recognition, so far, from the
Department of Education all this work is being done on a voluntary basis by the Director and other volunteer members of CESI Cork Branch who also deal with an ever-increasing volume of correspondence and telephone queries.

Not being officially recognised, means that funding for the Centre has got to be found. Since schools do not, in general, have the financial resources to provide computer equipment, the author decided to attempt the dual target of providing computers for his own school and to then utilise the school's resources as a Resource centre for outside schools.

To accomplish this, the author gave whatever monies came from teacher training courses towards the provision of computers to the school/centre. In this manner, it has been possible to purchase five APPLE II microcomputers, six APPLE disk drives, one printer and one Commodore PET. The author was fortunate in that he works in a school where the Headmaster gave full backing to the project and waived charges for the hire of rooms etc. The Headmaster has more recently purchased an eight system COMMODORE 64 network, for use in the Centre, and a further eight COMMODORE 64s have been purchased by the Parents Committee, thus giving the Centre much needed extra computing power.
The Centre has been to the fore in the training of teachers of computing in the Cork area. The more recent projects have been the organising and running of courses for Primary teachers and courses in COMAL for second level teachers. In the summers of 1984 and 1985, a two-tier course for Primary was held and second level teachers under the auspices of the Department of Education. During the 1984/85 school year, courses and workshops were held for Primary teachers and trainee teachers from the Higher Diploma in Education class at University College, Cork.

The Centre was officially opened in February 1980 by Mr. Gene Fitzgerald, T.D., then Minister for Labour who in the course of his address congratulated the CESI and UCC for their foresight in opening the Centre and wished them every success on their venture. The opening ceremony was also attended by the then Lord Mayor of Cork, Mr. James Corr and a large and representative audience drawn from the industrial, commercial, educational and academic fields.

In the course of his address, Mr. Damodaran, Head of the Computer
Bureau at UCC stated that the future development of the Centre can be done in one of a number of ways, either the Department can provide a number of microcomputers or, alternatively they could consider buying terminals for both the Centre or other schools and linking these to the UCC computer systems. Either of these approaches was technically sound and could have been used. A combination of both microcomputers and terminals would be ideal. Damodaran also suggested that extensive use be made of software packages for teaching computing and other subjects, as this could save a great deal of time and effort. (126)

Damodaran also guaranteed that, in the event of plans being formulated that involve the use of computers at UCC, the College would continue to provide support for schools. He also recommended that a full-time post should be funded centrally and should go to a person who is first and foremost a teacher, but who has computing skills. This person would form a liaison and teaching function specially related to computing. He was emphatic that NOTHING LESS THAN A FULL-TIME APPOINTMENT WOULD BE SUFFICIENT.

Education, Damodaran went on to say, is a 'pipeline' process. If a school leaver in 1980 were to be properly equipped for the life they face, they should have received a broad-based computer

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education starting at least in their second year in secondary school. That would have required qualified teachers and computing facilities available in the secondary schools in 1976. That, in its turn, would have meant computer trained teachers coming out of the training colleges in 1975. On this basis there should have been computing expertise and computer facilities in the teacher training colleges by 1968 AT THE LATEST. Therefore, in 1980, we were at least twelve years too late and the only way we can make up lost ground is by recognition at Government level of both the urgency and scale of the problem. While something can be done on a voluntary basis, it is essential that a fully researched programme be put into operation as soon as possible. Damodaran stated that such a programme need not ignore the goodwill, technical competence and energy that is available through CESI, but what is now needed is for the Department of Education and the CESI to combine their resources to resolve the current problems.

In Damodaran's opinion, there are those in industry who say that the educational organisations have failed them. To them he pointed out that they have also failed the education bodies at both second and third level. There has been absolutely no feedback of information from the Data Processing (D.P.) industry on its projected growth rate, market sizes, trends, skills requirements and
new applications areas. Information of this sort is an essential component in the planning of education at all levels. It is essential that those in the computer industry and the computer users must recognise the 'pipeline' nature of the educational system and must co-operate NOW with others to ensure that by 1990 there are no similar problems to be sorted out.

What is needed is joint planning under a Department of Education initiative, involving all concerned with both the broad-based educational requirements and specialised training of people for the D.P. industry. This joint planning activity will have to embrace second and third level educational institutions, the Department of Education, the Department of Labour and the Computers Users Associations, the computer manufacturers, software houses, service bureaus, and vitally, the Irish Computer Society (ICS).

Damodaran's comments are worth noting and CESI in Cork are indebted to him for his work and energy in setting up the Centre. The Centre gave the co-operative nature of computer education as espoused by CESI since its foundation a new meaning and certainly gave the author a new dimension to his teaching. He was now a co-ordinator albeit in an unpaid capacity, of computer activities in the Cork region, with all the extra work that involved.
We, at the Centre have outlined in some detail the aims and objectives involved to successive Ministers for Education and their officials and requested them to grant us support and recognition as a Computer Resource Centre for schools in the Cork area. So far our requests have gone unheeded, but we had hoped that since her Four Year Plan for Education outlines the need for such centres, that the present Minister, Mrs. Gemma Hussey, T.D., would recognise the value of our work and grant us the back-up facilities to proceed in a more efficient manner. Having written to the Minister outlining our work, we were informed by telephone by a Departmental official that our request for official recognition had been turned down, and this was confirmed in writing by the Minister in May 1984.

As it is we have achieved much on a shoe-string budget. Were the financial assistance forthcoming for the development of courseware, software and hardware evaluation and teacher training, how much more could we achieve? Yet, it is ironic that the Department appear to be about to set up computer resource centres 'in the principal Teachers' Centres', where little or no expertise exists. (128)
Courseware is a relatively new word in Irish Education, but its development is one which must be a growth area in the future. By courseware, in the area of computing, is meant the whole area of the production, evaluation and the testing of materials that will be of use in the Information Society of the future, for teacher, student and society as a whole. Courseware development should not be regarded merely as the production of software in its narrowest sense. Users have become more sophisticated and have long ceased to accept anything just because it happens to come from a computer.

CESI had always expressed the wish that software be developed for use in Irish schools. Items on User Packages appeared in the early Newsletters of CESI. As early as 1975, the CESI Executive had designated Pat O'Leary as its Program Librarian. In the intervening years members of the CESI Executive, notably Elizabeth Oldham and James Walsh,[129], attempted to set up a software library exchange, without too much success. Remember that this was the pre-micro era, when the majority of schools certainly did not have a computer and, probably did not have access to one. CESI did also publish and update a resource list, for which there was unprecedented demand.
One of the first references to courseware in Ireland occurred at the 1981 A.G.M, where the then Chairman, Michael Moynihan called for teachers of all disciplines to be freed from school work for one year on full pay in order to pursue a computing course full time at some educational institution and develop courseware which would be used in their teaching. [130]

CAMET(Ireland), directed by Dr John O’Donoghue, which is based in Thomond College of Education, Limerick and CESI co-operated in the organisation of a seminar on Courseware Development at Thomond College in April 1983. This was the first ever seminar of its type in Ireland. As there was insufficient expertise available in Ireland, speakers were invited from outside. These included John McDonald HM Inspector attached to the SMDP(Scottish Microelectronics Development Programme), Professor Steven Kamm of South Oklahoma City Junior College, and Mr Harry Mac Mahon, Senior Lecturer, New University of Ulster, Coleraine, and Director of MEP Northern Ireland [131].

McDonald outlined the progress of SMDP in spending £1M to promote computer awareness and applications in Scottish schools. At first, about 70 schools had been ‘seeded’ with equipment. The Programme
then set about the tasks of co-ordination and communication. Software was collected, assessed and distributed through a library system. The library consisted of two tiers. Software was either supported or unsupported. Distribution was operated on a regional basis, with publishers acting as agents for abroad. At that time (1983) there was an average of four computers per secondary school in Scotland, due largely to the work of the SMDP and the grant scheme from the Department of Industry. In Scotland each Local Education Authority (LEA) had its own arrangement, with some releasing teachers to develop courseware. In general, however, teachers wrote the scripts, which were then encoded by the programmers. The latter were either teachers or employees of the SMDP. At all stages there was close liaison between teachers and programmers. Copyright was jointly owned by the LEA and the SMDP.

In Scotland supported courseware had to pass a rigorous assessment and testing. The supporting documentation had to be of a high standard, and had to be in three sections: pupil notes, teacher notes, and technical notes. Each set of notes had to conform to guidelines laid down by the SMDP. Courseware meeting these requirements was supported, which meant that it would be maintained and, if necessary, modified by the SMDP.
McDonald indicated some of the areas where the computer could be used in education. These included electronic blackboard, simulation, calculation, information storage and retrieval, control, drill and practice, teacher's aid and teaching with the computer.

Kamm spoke of his experience in writing Physics courseware for his college students. The need arose because some students needed individual attention in order to master specific topics. These tutorials imposed enormous demands on his time, so he sought the aid of the computer.

With the help of a grant from the U.S. National Science Foundation, Professor Kamm secured leave of absence from his employment and the resources necessary to design a physics tutorial package for the APPLE II microcomputer. The important feature of the package was that students using it were able to make decisions. They could proceed through the exercises at their own pace and could repeat sections if desired. Professor Kamm demonstrated these programs to the seminar and suggested that the animated colour graphics, clear text and general user friendliness made the programs very popular with the students. Their success could be gauged by the increased pass rates among his students.
During the seminar, two workshop sessions were held. One involved the assessment of courseware on the APPLE.PET and BBC Computers, while the second allowed courseware development by the participants. Professor Kamm outlined the stages which he felt should be involved in software design. He suggested that packages should operate through the following steps: (1) Title, (2) User name, (3) Program purpose, (4) Pre-requisites/testing, (5) Instructions/help, (6) Learning sequence and (7) Evaluation.

From the open forum, it was clear that participants felt that a start should be made to courseware development in Ireland and that CESI, as the teacher organisation, should play a leading role. Initially, it was felt that programs might be mainly of the demonstration kind, using the computer as a teacher's aide, but could develop into other areas.

As part of CESI's ongoing commitment to the creation of a policy on Courseware Development and as a follow up to the Thomond seminar, a meeting was held in October 1983. The aims of the meeting, firstly to outline a Plan of Action on the production of guidelines for Courseware Development, and, secondly to meet some commercial concerns who were actively involved or intended to become so, in the
production of Educational Courseware for Irish schools. The meeting with the commercial concerns was held so that Education and Industry could hold exploratory talks on common aims and objectives, and to see what roles could be played by CESI on one hand and Industry on the other, in this development. From a CESI point of view, the development and distribution of Courseware mainly by commercial concerns was considered to be inevitable. CESI felt that it had a duty to ensure that educational standards are adhered to, and, in order to do this, the goodwill of Industry was necessary. [132] As well as CESI representatives, there were also representatives from AnCO, the Training Authority, who are themselves involved in Courseware Development for the training sector.

After much discussion, CESI decided to draft a set of interim guidelines on courseware standards [133]. In drafting the guidelines, CESI acknowledged the use of the excellent guidelines set out by the SMDP [134]. These guidelines were never published in Rionhiris na Scol, but were available to CESI members on request. These guidelines are contained in APPENDIX M.

From a commercial point of view, various attempts have been made to gate by firms to enter the schools' software market. Their success has been minimal for two main reasons. Firstly, the quality of the
software produced is very low, has not generally been produced by teachers, and is of doubtful educational value. Indeed some firms have attempted to recruit teachers to develop software through competitions for software development for schools, but these also have been relatively unsuccessful. Secondly, it is doubtful if the market exists at present for expensive commercially produced software. Although high standard courseware/software is needed urgently throughout the whole curriculum, schools can ill afford to purchase high priced software of dubious educational value, having spent a sizable part of their budget on the purchase of computer hardware. The absence of a policy on the whole area of the Information Technology in Education inhibits the growth and co-ordination of all aspects of this important area in schools, and is especially felt in the area of software/courseware development. An abundant supply of quality courseware is needed.

CESI has for some time advocated the setting up of Resource Centres around the country. In this way, it was felt that information could be distributed evenly around the country. The Department of Education has, to date, shown little enthusiasm for the concept, which means that many of the projects, that are needed to stimulate educational computing are difficult to accomplish.
In the meantime CESI decided to go into software distribution in a modest way. Mike Norris, Chairman (1984/85) undertook the task of circulating copies of several packages to CESI members. Two MEP products from the U.K. - a database known as QUEST for £32 and a turtle graphics package, DART for £25 - were made available to CESI members. These packages ran on the BBC microcomputer.

On the home front the CESI software library grew and grew and by April 1986 there were twenty six disks available. Of these the majority were for the APPLE.

Topics available include COMAL tutorials, Leaving Certificate Physics, Trigonometric graphs, Irish spelling, Word power, Symmetry, Radioactivity, Parabola/Differentiation, Primary, Hooke's, Boyle's and Charles' laws. All these for the APPLE. Available for the BBC were PhCurve and a utilities disk. The full list of items in the CESI software library is available in APPENDIX V. Many of these efforts are a direct result of the Coursware Conference at Thomond College.

By October 1985, Norris distributed over 500 disks to CESI members (135). It is quite probable that these disks spawned countless others as well. In providing these disks CESI is providing a
valuable service to its members for it gives them the opportunity to use high quality software across a wide spectrum of subject areas. It is by no means adequate, but it is a start. It is significant that the Department of Education agreed to include three disks from the CESI library with their 1984/85 APPLE package to second level schools.

Early in 1985, a special committee to investigate the prospects for applications in both education and training was set up under the auspices of the Department of Industry, Trade, Commerce and Tourism. Among the participants on this committee were representatives of other government departments, the Industrial Development Authority (IDA), Telecom Éireann, Radio Telefís Éireann (RTE), the National Board for Science and Technology (NBST) and the National Software Centre [136].

Influenced, perhaps, by these developments, the Department of Education made money available (March 1985) from their Research Grant to fund four or five courseware projects selected from the areas of Business Studies, Geography, Physics, Mathematics, Chemistry and Geography. A Steering Committee was set up to oversee and direct the Projects. Six courseware projects were eventually supported. These projects are presently being vetted by the Steering
Committee with a view to distributing them to schools. A further courseware projects has been indicated for 1986. (130)

The methods employed by the Department of Education in recruiting courseware developers in 1985 left a lot to be desired: the Department wrote to the Secretaries of some CESI Branches (137), inviting them to send two teachers to a meeting with the Steering Committee on March 28, 1985. Invitations were not exclusive to CESI, as other interested non-CESI personnel, such as RTC lecturers, were invited as well. It was unusual for the Department to contact CESI Branch secretaries. In the past invitations such as this would have been channelled through the Chairman of CESI. This time, however, the Chairman of CESI was not contacted or consulted. The reason for this policy shift on the part of the Department of Education is unknown.

According to the invitational circular sent project teams would be formed to cover the selected areas of study and each team would prepare an outline of what it proposed to do. Each team would have to research the present availability of software in its study area and choose an aspect of the Syllabus at Intermediate Certificate or Leaving Certificate level which would best lend itself to courseware development. Each proposed project had to be costed and
then forwarded to the Steering Committee before April 19, 1985 and
the Steering Committee would then decide on the selection of the
four or five projects and on the funding to be made available to
each.

While one must welcome the involvement of the Department of
Education in the area of courseware development, one must query the
methods and approach adopted. First of all, if the Department of
Education wanted full CESI involvement, then they would have
contacted the Chairman, who would then identify key personnel in
different areas of study, who would be willing to participate in
courseware development. As Branches of CESI are rather weak on the
ground, contact with them did not ensure that the information was
passed on to all interested personnel. The lack of communication on
the part of the Department of Education surfaced once more. Although
welcome, the £20,000 allocated was by far too little to make a
significant impact. A large supply of quality courseware is needed.

As well as that, courseware development takes time, and with an
Educational system that does not easily allow for the release or
secondment of teachers, it is hoped that this obstacle will not
impede the production of much needed courseware. It is to be hoped
that the teachers chosen to work on future courseware projects will
be released from their normal school work on full pay. This, at present, appears unlikely as does the establishment of meaningful Resource/Information Centres.

4.13 THE CESI NEWSLETTER/JOURNAL

From its inception, CESI considered that it was most important to create a forum not only for members of the society, but also to bring an awareness of the potential and role of computers in education to a wider audience. Thus the idea of a newsletter was conceived, whereby news, notices and items of interest could be published. The first newsletters were published in the 1973/74 school year and were single page efforts to report on specific events such as meetings with the Department of Education. This gradually gave way to the idea that the newsletter could do more than that. Therefore, some members of the society were prevailed upon to contribute articles on topics related to computers in education.

From the start CESI regarded its newsletter as its organ of publicity and it was distributed to various bodies and organisations where publicity and awareness might help its
cause. Copies of each edition of the newsletter were, therefore, distributed to Teachers Centres, the National newspapers, the Minister and Department of Education officials, members of the Dail and Seanad, and the various Managerial Bodies.

The first 'editor' of the CESI newsletter was Sr. Lourda Keane, Laurel Hill Convent, F.C.J. Limerick, who set the tone for the newsletter. Due to pressure of work, Sr. Lourda retired from the post of Secretary and editor at the 1975 A.G.M. [139]

It seemed traditional that the Secretary of CESI was the one to edit the newsletter. CESI was lucky that their next Secretary was Diarmuid McCarthy, who was a man of great dedication and enthusiasm, who for the next four years, until he retired in 1979 (once again due to pressure of work) was the one who set the tone and standard for the newsletter. Three to four newsletters were issued in each school year. The content of each issue depended on who could be coaxed to write an article at a given time; yet in each issue McCarthy faithfully wrote a column called 'BITS AND PIECES', which was a miscellany of news and exhortations to others to do their bit for the promotion of computers in Irish Education. McCarthy also compiled a 'SOURCES OF REFERENCE/USEFUL INFORMATION' list (and kept updating it) which proved invaluable.
to members and educators who were interested in the area of computers in education. At this time also the newsletter was the main item which kept an increasing membership in touch with developments in computer education, the Executive and each other. This was important in the early days when there were not that many branches as it helped to keep up the individual morale when there was very little happening at official level.

For example, Mc Carthy has this to say:

"We in CESI are trying to make the public aware of the need for computer education (especially in second level schools) and to let them know what is happening in that field. We are asking various organisations who are in a position to help us to do so. (Please disseminate at least within your own organisation)." [140]

It should be remembered that CESI is a voluntary organisation. There is no remuneration of any kind for the work done by the members of the Executive Committee. All the work done, over the years, has been done on a voluntary basis. By far the greatest amount of this work
fell on the shoulders of the Secretary who saw the membership of CESI increase from fifty in 1973 to over seven hundred by the time he retired in 1979. As well as responsibility for the newsletter, the Secretary had to cope with an increasing volume of enquiries and correspondence. But, still, it was the newsletter that took up most of his time. It can be argued that the issuing of a newsletter, however valuable, is not worth the sacrifice, but there were within CESI people of such tremendous drive and dedication that the promotion of computer education, which they recognised as being of fundamental importance for the future of our students in our schools, came before any personal considerations.

Michael Moynihan, who took over from Diarmuid McCarthy, gave a detailed account of the time taken to produce the newsletters for the 1980/81 school year. This account is contained in Appendix N.

Once again, during this period, all the work was done on a voluntary basis and photocopying was available from Colaiste an Spioraid Naoimh. Yet by 1981, the costs were spiralling and were now in the region of £500 per issue, but the human input in terms of man-hours was prohibitive. In terms of articles and presentation the newsletter had improved with the maturing of the society, but there was always the continuous problem of acquiring adequate funding for
the journal. CESI lived from issue to issue not knowing whether or not sufficient funding would be available for the next, as there were no adequate grants available from the Department of Education or otherwise. There were the occasional grants from the National Board for Science and Technology, for which CESI were grateful, but the main portion of the cost involved in the publication of the newsletter had to be borne out of the membership fees, which meant that much needed finance could not be made available for other projects such as courseware development.

The Department of Education did provide a minimal grant towards the publication of the newsletter from 1978 onwards. In 1978, this grant stood at £133 for the year and has been increased gradually over the years to around £500 in 1985.

This grant was available on condition that the cost of producing the newsletter in question justifies in the estimation of the Department the payment of the grant and that the Department Inspectors are satisfied with the content of the publications. [141]

The newsletter had by 1981 become rather large (38 A-4 pages in May 1981) and was also time-consuming for the Editor who was
responsible for all aspects of its production. It would be impossible for the Editor or anyone else to produce newsletters in this manner. There was also the fact the newsletter was growing in stature and sophistication. CESI was now able to readily obtain permission from teacher organisations abroad to reproduce articles from their magazines, which would complement the articles from the home front. There was also an increased demand for copies from many sources, especially industry and education.

Therefore, the Executive of CESI decided to investigate the possibility of getting the newsletter professionally printed. This was done and, as it had by now become more than a newsletter, Moynihan, as Editor, proposed that the new updated publication be called Ríomhiris na Scol (which means Schools' Computing Magazine) and this was accepted by the Executive Committee. The first edition of Ríomhiris na Scol was published in November 1981. In general three to four editions are issued in each school year.

If the finance were available from elsewhere, it would considerably ease the burden on the society. For example, in the U.K., a commercial publisher has taken over the production and distribution of "Computers in Schools", which is the Journal of MUSE (Microcomputers Users in Secondary Education), which is, in many ways, an equivalent
organisation to CESI in the U.K. MUSE retains editorial control over the contents. The commercial publisher does the rest. If such a possibility could arise in Ireland, it could give rise to more frequent and more informative Journals. As it is there is no publisher willing, at present, to undertake the task. Should finance become available, and, even if no publisher were to come forward, CESI could itself publish more frequent editions of Riomhiris na Scoil and do many other things, for instance in the area of courseware development and the development of Resource Centres.

It appears unlikely, however, that finance will become available in the immediate future. This means that CESI will continue to produce editions of Riomhiris na Scoil, not knowing whether or not the finance will be available for the next. At this stage, it is no longer a problem to find articles for the Journal. If it has done nothing else, Riomhiris na Scoil has, against the odds, become a worthy publication and is much sought after. It continues to bring new topics to the fore and keep members informed of what is happening in the field of computer education. In the 1984/85 school year, there was a large influx of Primary teachers into CESI and a section of Riomhiris na Scoil was specifically devoted to the needs of Primary teachers.
Riomhíris na Scol is now considered to be a valuable resource in Ireland and is also sent abroad to many sister organisations in several other countries such as the U.S.A., Canada, Australia, New Zealand, the U.K. and the European Community.

As long as funds are available to produce it, Riomhíris na Scol will strive to provide articles and cover issues which are of concern to Irish educators in the Information Age.
4.14 THE COMPUTER SYLLABUS AT JUNIOR CYCLE

As has already been outlined, Computer Studies has been introduced as an optional extra on the Mathematics syllabus at Senior Level since 1980. Under the Irish centralised system, second level schools were only permitted to teach Computing at this level officially.

In December 1983, the Department of Education circularised interested groups with a list of possible options for Computer Studies in Post-Primary schools. This list is contained in APPENDIX K. As can be seen six of these options contain proposals for Computer Studies at Senior level, and envisage the linking of Computer Studies apparently exclusively to the Mathematics/Science areas. This line of thinking was confirmed by C.C. O Caoimh, Chief Mathematics Inspector, who proposed yet another option, which he termed the 'half-subject' option. In this he would combine Statistics and Computer Studies, the student opting for one or the other.

Option 1 of the Department Circular proposes a familiarisation course in Junior Cycle, which would be non-examinable and of about 50 hours duration. With the increasing number of microcomputers, however, schools were, of their own accord
experimenting with the use of computers at Junior level. This occurred, as previously happened at Senior level, by the teaching of computing under the guise of another subject or as an extra-curricular activity.

As well as that, the Minister for Education, Mrs Gemma Hussey, T.D., set up a Curriculum and Examinations Board (CEB) to examine present syllabuses and to suggest how best these changes could be implemented in the curriculum at both Primary and Post-Primary levels. This Board was set up on an interim basis in January 1984 and is expected to become a Statutory body in 1986. The CEB will, no doubt take over some of the functions of the Department of Education, but as of now, it is unclear as to what precisely their relationship will be with that Department in the future. We do know that as and from February 1986, the CEB has taken over the responsibility for syllabus content from the Department of Education.

The CEB, in their consultative document (September 1984), outline the need for change. Concentrating on the Junior cycle, second level, it points out that an examination of the existing situation leads to an identification of the need for a broader and more balanced core curriculum, with an increased emphasis on
skills and processes, a curricular structure that is sufficiently flexible to recognise and accommodate curriculum initiatives at school and regional level and assessment procedures that are determined by the aims and objectives of the curriculum.

A curricular framework is proposed in response to these needs, and takes account of the existing situation. The framework consists of a CORE, which would be obligatory for pupils, and a series of options described as Additional Contributions.

The proposed CORE categories are:

- COMMUNICATION, LANGUAGE AND LITERATURE
- CREATIVE AND AESTHETIC STUDIES
- GUIDANCE AND COUNSELLING
- MATHEMATICAL STUDIES
- PHYSICAL EDUCATION
- RELIGIOUS EDUCATION
- SCIENCE AND THE NEW TECHNOLOGIES
- SOCIAL AND POLITICAL STUDIES

The Science and New Technologies appear to give some indication as to their ultimate intentions. Under this heading are included
understanding of basic scientific concepts, development of the scientific method, the application of science to technological developments, understanding and application of technology, ecology and use of natural resources, basic knowledge and skills needed for home management (including design and use of materials) and health education (including sex education). Computer Literacy is defined as part of the Communication, Language, Literature section, while problem solving and computer studies are part of the Mathematical Studies section.

Although the document deals only with the Junior cycle of second level schools in some depth, it emphasises the need for the inclusion of the new information technologies at many points throughout the curriculum. The inclusion of 'modules' on computing goes some way towards the inclusion of Information Technology in its broader sense. It remains to be seen, whether or not, or in what form, these proposals are implemented.

The consultative document of the Curriculum and Examinations Board offers hope for the future. However, the Statutory Board is not scheduled by the Minister until 1986. The precise relationship between the Curriculum and Examinations Board and the Department of Education after 1986 remains uncertain.
Spurred on, perhaps, by the publication of the Curriculum and Examinations Board’s Consultative document, the impending role of this Board in the drafting of syllabi for Second Level courses, and the inclination to legitimise a de facto situation, the Department of Education issued a Circular [148] to all Second Level schools, informing them that it was permissible to take a suitable module on Computer Studies at Junior Cycle from the beginning of the 1984/85 school year. Schools were also informed that a Syllabus Committee was to be set up. As is the case with the Computer module at Senior Level, the subject was non-examinable, but, unlike the option at senior level, certificates would not be issued.

As is the case in all syllabus committees, the members are drawn from a wide spectrum of educational interests. These include representatives of the Department of Education, School Management, Teacher unions and the subject association. On this Syllabus Committee, CESI were ably represented by Art Anglin. This Syllabus Committee first met in December 1984 and produced a syllabus in May 1985. Anglin, through his articles in Riomhíris na Scol, kept CESI members informed of the progress and thinking of the Committee.
In the early stages of their deliberations, the views and recommendations of Syllabus Committee members were, of necessity, drawn from their own personal experience because some of the bodies represented had not yet begun to formulate a policy on Computer Studies for second level students.

The one group that had addressed itself to this topic was CESI. This had been done long before the Junior Cycle Syllabus was mooted. Many of these ideas have been put forward at various times in Ríomhiris na Scol and elsewhere and, the presence of CESI members representing some of the bodies on the Syllabus Committee and well-thought out submissions from other CESI members ensured that, at this level, at least, the views of CESI prevailed.

Anglin submitted a draft document to the Committee [149] outlining a possible syllabus. This document was published in Ríomhiris na Scol, and formed the basis for the final draft. He had two reasons for undertaking this task. Firstly, he felt that it was important to introduce a Draft Syllabus that was firmly based on the principles that were implicit, if not explicit, in the expressed views of CESI. This meant that Computer Education should be directed at all students and, thus reflected current CESI thinking on the use of computers across the curriculum and secondly
he wished to concentrate on the job in hand, and did not want the Committee to get bogged down in a debate on educational philosophy.

Anglin's submission to the Syllabus Committee contained not only a Draft Syllabus, with its Aims and Objectives, but also the rationale behind the Syllabus. This submission formed the basis for the syllabus which was ultimately issued to schools.

Unlike other Syllabus Committees, there was no previous syllabus to work from. Flavin [150] makes the point that the openness of members to views, ideas and suggestions of other members and outside submissions was a tremendous factor in ensuring that the syllabus was completed for the 1985/86 academic year.

The Computer Studies module at Junior Cycle is non-examinable. According to the Department circular outlining the syllabus [151], it is envisaged that about pupils would spend 70 hours on this module in the course of the Junior Cycle. The course document issued by the Department, while comprehensive, does not include notes on all aspects of the syllabus. The module may be taken as part of an approved syllabus in MATHEMATICS at Junior level from the beginning of the 1985/86 school year. The [contradicts C.C O'Caoinm, Chief Mathematics Inspector, who stated]
that the module would be independent of Mathematics [152].

Anglin summarises the approach to syllabus design as one that would consist of a set of signposts for Junior Cycle students on the road to Computer Literacy. [153] In so doing a number of constraints had to be taken into account:

* It is not an examination subject.
* There was wide spectrum of student ability at Junior Level and a wide divergence of computer experience among the teacher population.
* There were marked difference in the amount of hardware and software available to schools.
* Restrictions existed due to timetabling and teacher availability.
* The facilities and ability to program in more than one language may not exist in every school.
* It was important that students be exposed to a wide range of computer uses.
* The historical development of computers was an important aspect to be considered as was the place and use of computers in society.
As Computer Studies at this level is not an examinable subject, the syllabus allows freedom of choice to teachers to do all or some of it. It is not envisaged that each pupil studies all aspects and it is left to the teacher to choose according to ability and available resources. As Anglin points out [154], some students may complete the whole course; some will pass many signposts. Some will traverse a little of the road and that with difficulty. The main concern was that ALL would at least be tempted to start the journey.

The syllabus is wide enough to cater for all student ability levels. The syllabus will have to be monitored very closely by the Department of Education in a large number of schools to ensure that teachers could be assisted with the various problems and difficulties which may arise, so that students attain a certain level of competence.

A knowledge of the various computer systems would be acquired by the Department Inspectorate which would be beneficial if and when it is decided to assess and certify the subject.

One of the greatest problems facing schools at present is the lack
of a pool of well trained teachers who are competent to teach Computer Studies. As Flavin [155] acknowledges some schools do have a number of competent and qualified teachers and there is great support in having others present with whom to discuss, plan and decide what to teach to different pupils.

The Department of Education has not adequately addressed itself to the task of teacher training. This has been previously illustrated. Nor have they the will or ability to realise that the task cannot be tackled adequately under present day Departmental structures. By a continuous refusal to recognise the existence of microcomputers, other than the APPLE, in second level schools, they are hindering the introduction of computing into schools. For example, the 1985 Department courseware project only provides courseware for the APPLE; inservice courses in the summer of 1985, by concentrating on micro-PROLOG and APPLEWORKS, catered solely for APPLE users. There is an insensitivity on the part of the Department towards the expense and effort the schools put in to buying systems. In many schools, the APPLE is a minority machine and systems such as the Commodore 64 and the BBC do not support software such as APPLEWORKS, but do support their own DATABASE programs. It is a pity that the Department does not see its way to support courseware for these systems. Computer languages such as COMAL and micro-PROLOG
are also an added expense.

The Smith-Winning survey of late 1984 [156] points to the fact second level schools with more than four microcomputers installed at least 91% of these systems are not APPLE. The results of this survey are confirmed by a later survey conducted by the Association of Secondary Teachers, Ireland (ASTI) which was completed in the middle of 1985.[157] While the issue of new APPLE IIE computer systems to schools and the reduced offer by APPLE which considerably reduced the cost of APPLE systems to schools, will reduce this percentage somewhat, it will not make an appreciable difference.

Connolly [158] makes the point that Computer Studies curricula in the past have tended to over-emphasise programming and points out that the majority of computer users will not have to write their own programs. If they do, the coding in a computer language is only one phase in the process. Other phases such as design and testing are equally, if not more important. The underlying concepts are more important than the language used. Since 1980, especially, courses run under the auspices of the Department of Education have placed the emphasis on programming. This means that, in Ireland, Computer Studies has become identified with program learning. The Department view, as
espoused by O Caoimh [159] emphasises this fact.

While programming must form an essential part of any syllabus, there is a lot more to a syllabus besides programming. The Junior Cycle syllabus with its sections on DATA, Generic Software, History and Monitoring and Control acknowledges this fact.

The Junior Cycle Computer syllabus represents a unique breakthrough in computing in Irish schools. It is highly likely that any future computer syllabus will be modelled on this one. When one considers the rapidly changing world of technology, flexibility is the key word.

On the negative side, one must have reservations about inadequate teacher training schemes and the absence of an overall policy concerning the introduction of the wider concept of Information Technology into schools. Information Technology will not compartmentalise itself into a given subject area. The author is unsure if this fact has been fully grasped even by the Curriculum and Examinations Board. The role of the Department of Education in relation to a statutory Curriculum and Examinations Board also needs clarification as this will affect computer education.
The pioneering spirit of CESI pervaded the efforts of the Syllabus Committee from the beginning. As Anglin puts it:

"The founding fathers could have said
'we will not dabble in computers until the Department of Education issues schools with them or we will not bother until schools are presented with computer systems and all the requisite software'

They did not. CESI was founded in 1973 and not 1980 or later.

" [ 160 ]

The society started small and did wonders while working within a very confined budget. Little by little, it expanded and the expertise gained became invaluable when movement began in the world of computers in Irish education.

4.15 CESI INVOLVEMENT IN PRIMARY EDUCATION

Like most other countries computer education in Ireland began at second level. The idea of using a computer in Primary education is of much more recent vintage.
Since the Department of Education issued microcomputers to second level schools in the 1981/82 school year the Colleges of Education which provide pre-service training for Primary teachers began to include computing as part of their Mathematics course and to explore the potential uses of microcomputers in the Primary school setting. Today there is a wide range of computer hardware in the Colleges of Education and lectures are generally provided by personnel from the Mathematics Department. The Colleges of Education are in a position to provide their students with a better grounding on the educational uses of microcomputers than are many University Education Departments which provide pre-service training for second level teachers.

The main microcomputers in use in the Colleges of Education are the BBC micro, the Commodore 64 and the APPLE II. Some of the Colleges of Education also have links to mainframe computers. The content of the computing module usually consists of lectures and practicals on the BASIC and LOGO computer languages and examination and evaluation of courseware materials for use in Primary schools.

Consequently at least some students from the Colleges of Education enter the Primary education system with a knowledge of computing and its application in Primary education. However, there is a
shortage of job opportunities in teaching at present, which means that there must also be a concerted effort to provide adequate in-service training in computer education to Primary teachers.

The Colleges of Education have, especially over the last few years provided in-service education for Primary teachers, both in the form of in-term courses and Department of Education recognised summer courses. Some Colleges of Education, such as Mary Immaculate, Limerick and St. Patrick's, Drumcondra, are engaged in projects/experiments with local schools. [162]

Klotz (1983) [163] maintains that the computer should not be added to the Primary curriculum as a separate subject, but that work with the computer should be integrated with the standard subjects of the traditional curriculum. If we accept this, then there is an urgent need for the Colleges of Education to provide all their students with a module in computing in their general degree course. This would mean, of course, that extra staff would have to be trained or provided.

In Scotland, for example, since 1984, the new four year B.Ed degree course for trainee Primary teachers includes significant computing elements to ensure that all students are aware of the
theoretical and practical aspects of of microcomputing and information technology.[ 164 ]

Primary education, as distinct from second level, is based on Curraclam na Bunscoile (1971) (165). This document acknowledges the basic principle of child-centredness and admits the central role of pupils as active agents in their own education. Strategies and methods of learning are recognised as being more beneficial educationally than the attainment of knowledge per se.

As a direct result of the change in CESI policy with the adoption of the modular approach under the Chairmanship of Brendan Mackey (1981-84), an approach was made to CESI by a group of Primary teachers, mainly in the Dublin area, to affiliate to CESI. As a result, part of the 1984 AGM was devoted to the issue of the computer in Primary education, and a Primary Education Group was formed under the CESI umbrella. A steering committee, consisting of Primary teachers, representatives of the Colleges of Education and members of the CESI Executive was formed in May 1984.

Primary teachers interested in promoting Computer Education in their schools felt that CESI could provide them with a forum to
service their needs. CESI was, after all, a national organisation with the structures necessary to promote their interests. From the standpoint of CESI, the influx of Primary teachers meant that its members were now drawn from the three levels of education and it could now rightly speak on behalf of all teachers, especially at first and second level. In the long term, it was felt that CESI now provide the framework whereby teachers from all three levels could meet together.

The Steering Committee began to compile reports and to commission articles which were published in Ríomhiris na Scol. All editions of Ríomhiris na Scol which were published in the 1984/85 school year had a special section devoted to computers in Primary Education. Topics included Computers in Primary Education (166), Preparing for the computer in a Primary classroom (167), The computer as an aid to (Primary) classroom management (168), Which computer should we buy? (169), The microcomputer and Primary school mathematics (170), Computer Resources in the Teachers' Centres (171), Book and software reviews, Computers in Colleges of Education (172), A computer experiment with Primary school children (173), and Reports on summer courses involving CESI personnel (174).
CESI was invited to make a submission to the Curriculum and Examinations Board (Primary Review Committee). This Report was compiled by Dr. Gerard Enright, Chairman, Primary Education Group, in consultation with other members of the Steering Committee in January 1985. A full text of this submission is contained in APPENDIX P.

As well as that CESI devoted its annual seminar (November 1984) to the theme 'PRIMARY AND BEYOND'. This seminar proved very successful. Over two hundred teachers in attendance, the majority of them from the Primary sector.

From 1983, there was CESI involvement in inservice course for Primary teachers. In 1984 CESI co-ordinated the content of and materials used in many of the inservice courses that summer. In 1985 CESI was involved in one way or another in the organisation and running of nineteen inservice computer courses for Primary teachers. As Enright points out, the interest and application of the hundreds of participants and the commitment and dedication of organisers and lecturers is a source of encouragement for the future.

In her Programme for Action, the Minister for Education
announced that she proposed 'to establish pilot projects on the teaching of Science and on the use of computers in a selected number of National (Primary) Schools.' As a consequence of this, the Department of Education (Primary Branch) announced the setting up of a Pilot scheme during the 1984/85 school year. Thirty schools were selected to take part in the scheme. The selection of schools was based on the following criteria: location (urban/rural), the size of the school, single sex and mixed schools, the social spectrum, the experience and qualifications of participating teachers and the availability of hardware. The selected schools were chosen on a regional basis, but were, for the purpose of this initial pilot scheme confined to Cork, the Midlands, Dundalk and Dublin. The full list of the schools involved in the pilot project is contained in APPENDIX O.

The selected schools had to have their own computer systems. No recommendations were made regarding the type of system to be used and the Department agreed to provide a grant of about £200 for the purchase of software.

The Department of Education's Curriculum Unit (Primary) is monitoring the scheme and convenes meetings of the schools involved in the project. But the real onus is on the schools themselves to
prove that the computer has a role in the Primary curriculum.

This pilot scheme is due to end in 1986, its progress evaluated, and hopefully, a report published. In the meantime, finances permitting, the Department hopes to initiate a further pilot scheme in other areas of the country, such as Limerick, Galway and the North West.

In the pioneering years of educational innovation to meet the challenge of new technology, to harness its power and to exploit its capabilities, one's greatest support is in one's colleagues. CESI exists to foster teacher-teacher support. Having done so at second level since 1973, it is in a unique position to cater for the primary sector. The success of the Primary Education Group, depended, in its first year of existence, on the work of the Steering Committee. To be successful, in the future, it will have to depend more on the assistance of all CESI members.
An EEC Conference held in Luxembourg (1974) examined the effects of computerisation in general [179]. Delegates realised that people would need preparation for living in a computerised society, and recognised that economic development could be seriously hindered unless prejudice against the computer was countered. Therefore their final recommendation was that money from the EEC Social Fund should be utilised for TEACHER TRAINING, to ensure computer literacy at all levels. This recommendation highlighted the importance of computer education for teachers, but was never implemented in Ireland.

In Ireland, it was teachers' courses that led to the foundation of CESI and to this day the society has continued to work in this field. It is evident that CESI was influenced by the latest thinking from Europe, which emphasised the de-mathematising of computer education is necessary, especially at Junior cycle and that teachers of non-science subjects should be involved. Nobody was certain, however, as to how this might be achieved, and in reality CESI, dominated as it was by Mathematics and Science teachers could do little, other than pay lip-service to this ideal until the
period 1981-84 during the Chairmanship of Brendan Mackey and, perhaps, for this same reason, CESI as an organisation did not become involved in the promotion of computing at Primary level until 1984.

There have been five Chairmen of CESI up to 1986 and each has left his mark in one way or another on the society. They were:

- JAMES P. ROCHE, CRAWFORD MUNICIPAL INSTITUTE, CORK (1973-75)
- JOHN KELLY, VOCATIONAL SCHOOL, WICKLOW (1975-78)
- MICHAEL MOYNIHAN, COLAISTE AN SPIORAID
- NAOIMH, BISHOPSTOWN, CORK (1978-81)
- BRENDAN MACKEY, VOCATIONAL SCHOOL, WEXFORD (1981-84)

Moynihan was re-elected Chairman in September 1985.

James P. Roche did tremendous work in the establishment of CESI and played a major part in the drawing up of the Constitution of the society. He was also one of those who organised the pilot scheme for the thirteen selected second level schools during the 1973-74 school year. This pilot scheme was organised jointly by CESI and the Irish Department of Education. Prior to the introduction of this
pilot scheme. Both he and the Vice-Chairman, John Kelly attended an ICL training course at Beaumont in England at the expense of the Department of Education. Roche also delivered a paper on 'Computer training for teachers in Ireland' at the Second IFIP World Conference on Computers in Education (Marseilles 1975).

While Roche and the then Executive Committee played a major part in the establishment of the society, his successor, John Kelly was able to take the Society a stage further. Kelly initiated a campaign to bring the aims of the society and computer education in general to a wider audience.

During this period, there was a real hope that the Department of Education would set up the structures for the implementation of Computer studies into Irish schools. Many new third level colleges were being opened. These included the Regional Technical Colleges and the National Institute for Higher Education (N.I.H.E.) in Limerick. CESI contacted these colleges with a view to obtaining computer facilities for teachers and the responses received were most encouraging.

In his editorial comments in various CESI newsletters, Kelly kept up the morale of the membership, encouraging them to keep the
computing flag flying despite the apathy at official level.

At the CESI A.G.M. (July 1976), Kelly put forward the CESI policy with regard to Computer Education in schools at that time. These were recognition of the time spent in teaching Computer Studies, the adoption of a suitable syllabus, the expansion and extended use of third level facilities, the appointment of an Inspector of Computer Studies, the establishment of a Committee to map a plan for future development and, the installation of at least one moderate sized computer in an easily accessed school. (these were the pre-micro days). [181]

In his final report before leaving the office of Chairman (in 1978), Kelly stated

"Three years later, the Department shows no recognition of the urgency of the problems of educating for a computerized society. Worse still, teachers in general, teachers' unions, education correspondents all seem to think little about and care little for one of the prime moving forces of the modern industrial society. If the people responsible for identifying educational and social needs are indifferent, is it any wonder that the general public is ignorant of a development which is considered by some observers to be of
greater significance than the industrial revolution."

Yet CESI survived and grew in numbers, skill and confidence. During this time the society also assumed responsibility for in-service courses in computer studies for second level teachers. Members took advantage of the microcomputer revolution and suddenly the equipment scene was transformed. It was hoped that the advent of the microcomputer would force the hand of the Department of Education. Computers were now cheap enough to fall within most school budgets and some schools were actually equipping themselves without waiting for the Department. For instance, at the CESI summer course at the N.I.H.E., Limerick in 1978, for the first time microcomputers were available (five—mainly on loan from computer firms). In the following year there were ten and the number of microcomputers at CESI courses continued to increase in subsequent years. Also through his numerous articles in the newspapers and his correspondence, Kelly kept CESI in the limelight in difficult times.

Michael Moynihan was elected Chairman of CESI in July 1978. He was reluctant to go forward as he felt that he did not have sufficient experience to carry out the onerous task of Chairman, but finally
agreed because the most experienced people in CESI were studying for their M.Sc in Computer Practice at Trinity College. He continued in the same vein as his predecessor, John Kelly, by lobbying the Department of Education and spreading the word about CESI nationally and internationally.

As CESI had from the beginning a close liaison with the computer industry (ICL, DIGITAL etc), Moynihan called for:

"...... a four way partnership between industry, the Department of Labour, the Department of Education and CESI. This would provide an ideal opportunity for the Government and industry to combine in an unique schools' project which could only benefit the country as a whole. The Government Departments by providing the necessary finance and the computer industry by providing the necessary equipment, could help CESI to set up schools computing centres at various points around the country, possibly in Teachers' Centres. These facilities could initially be used to train teachers, and, perhaps, could be given out to schools on a rota basis." [183]
This theme was to come up again, and be taken a stage further, during Mackey's Chairmanship (1981-84). There was still the problem of non-recognition by the Department of Education who refused to accede to any of the CESI requests such as the enunciation of a policy on computer education or the recognition of the time spent in teaching Computer Studies as part of the teaching hours.

We have discussed the Department of Education Resources/Advisory Committee previously, but it might be worth noting that while CESI was busy trying to get the Department of Education to promote Computer Education in our schools and were continually lobbying Departmental officials as to its benefits (and getting few replies), those same officials were themselves planning moves towards the introduction of Computer Studies into schools. What is more, they were planning its introduction without consulting CESI who had been doing all the groundwork up till then. CESI, for its part, always expressed a desire to work in close co-operation with the Department of Education, but this has proved rather difficult over the years, as it appears to be impossible to obtain any commitment from them with regard to policy or intent. It has proved impossible for CESI to enter into any serious discussions with the Department of Education. The strategy seems to be to keep CESI at arms length, but use them to the last. The Irish Department of
Education does not want a partnership with CESI or any outside body, even though they do not have the means or capacity to bring in meaningful computing courses on their own.

The 'interim' course on Computer Studies was decided on before CESI met the Department in October 1979. The reality was that Departmental officials merely wanted to inform CESI of their plans. CESI, having campaigned for the introduction of Computer Studies, could only express its reservations about the course and its method of implementation. But the Department needed CESI to draw up a syllabus for this interim course. The fact that many schools around the country have not been monitored by the Department for up to four years speaks for itself.

CESI were informed of the existence of the INTERNAL RESOURCE/ADVISORY COMMITTEE the Department of Education had set up to examine the implications of computers in Irish Second level Education, but no attempt was made by the Committee to liaise with CESI or any other group who were working for the implementation of Computer Studies in schools. The fact that the Report of this Committee was never been released outside the Department of Education, even though it was presented to the Minister for Education over four years ago, probably means that the report was
out of date by the time it was published.

CESI was not consulted prior to the issuing of microcomputers to schools, although CESI were invited to evaluate the APPLE system but only AFTER THE DECISION WAS MADE.

The Department of Education introduced the 'interim' Computer Studies option for the 1980/81 school year. Yet they made no plans for the provision of extra courses to cater for the increased number of teachers who wished to attend. The only course that had hitherto been available was the one organised by CESI at the N.I.H.E., Limerick and financed by the Department of Education. Normally, this course catered for about 50 teachers.

In 1980, however, anticipating an increase in numbers, CESI petitioned the Department to provide extra courses and finance to cater for the increased number. The Department refused, and also informed CESI that the amount of funding available was being reduced from £1500 to £1000. Nevertheless, CESI provided courses for over 300 teachers at seven venues around the country. In November 1980, however, the Chairman of CESI wrote to the Department and was informed that £5815.98 (117) had been spent on CESI summer courses in July 1980. CESI were never informed as to how and why the decision to
increase the allocation had been made.

When the Department of Education finally became involved in teacher training courses (1981), there was no consultation with CESI, who had been organising courses since 1975, as to dates and venues. In fact CESI, unaware of the Department’s intentions, submitted a list of fourteen courses at eight venues around the country, but for some reason, the Department did not include details of these courses in their official summer course circular to schools. This meant that CESI courses did not appear to have the same status as the Department courses and this tended to give the impression that a dispute existed between the Department of Education and CESI.

Mackey, in his statement of policy (184) called for a clearer definition of the role of CESI. The Department had just introduced the interim course and were about to tender for equipment and, he felt that it was time that the role of CESI in relation to future Department policy was clarified and sought meetings with the Department. During the 1981/82 school year at meetings with the Department, CESI suggested that a liaison between the Department and CESI be formalised. This was not acceptable to the Department, but they did appoint Mr. Con O’Keeffe to act as spokesman on Computing
and they expressed a willingness to meet with CESI on matters of mutual interest. As we have seen even this proved unsatisfactory and, certainly the Department of Education has not sought meetings with CESI to explore policy.

When the Department introduced their 'interim' course on Computer Studies, implicit in their attitude was that CESI should have little or no input into the planning process. There seemed to be a concerted effort on the part of the Department to keep CESI in the dark with regard to their plans for Computer Education.

At this time also, CESI, as an organisation was in a dilemma. When there was nothing happening at official level, there was in a sense a greater unity of purpose among the Executive as all were striving towards the same end, that is, the introduction of Computer Studies into the curriculum. Now that the 'interim' scheme, with all its faults had been introduced, there was a difference of opinion within CESI as to which way computing in the future should go. There were the traditionalists, who still sought the introduction of Computer Studies AS A SUBJECT IN ITS OWN RIGHT and a group who wanted to achieve a general literacy and an interdisciplinary approach, but who saw the the exclusive provision of an independent subject, even on a short term basis, as counter-productive because they feared
that such a short-term provision might become permanent, and may
pre-empt other developments.

During his term of office, Moynihan was one of the advocates of
the idea that education for the future should not be confined
within the present educational structures. The Industrial
Development Authority (IDA) had assisted in the setting up of many
electronics, computer and high technology companies around the
country and it was felt that these companies could co-operate with
the education sector in order to provide a base for the Information
society. Mackey, spent much of his Chairmanship trying to develop
support from and contacts with industry for the betterment of
education. In Britain at this time the M.E.P. programme was about to
commence. The British Government had backed two education projects
on computing: a £9M programme from the Education Department to
provide software and teacher training, to cover the years
1980/84. France had introduced 10,000 micros into Secondary
schools. Britain had even appointed an Industry Minister with
responsibility for Information Technology.

During the 1978-81 period, especially, CESI developed contacts with
similar teacher organisations abroad. Many countries were, at this
time, developing strategies for the introduction of computer
education into schools. Contacts always existed between CESI and organisations in the U.K., such as MUSE and the Computer Education Group (C.E.G.), but now contacts were established with organisations in countries such as the U.S.A., Canada, Australia and New Zealand and was in a position to exchange journals with them. CESI also became an institutional member of the International Council for Computers in Education (I.C.C.E.), which meant that CESI was now plugged into an organisation which had worldwide membership. Indicative also of the growing stature of CESI was the fact that it was invited to send a delegate to meetings organised by the Association of Teacher Education in Europe (A.T.E.E.), which was under contract to the Commission of the European Communities to write reports on current responses in the field of teacher education, to the development of microprocessors and Information Technology in schools. As a result a Report on Computer Education in Ireland has been prepared and has been distributed through ATEE. [185]

4.16.1 CESI - A CHANGE IN DIRECTION (1981-84)

Brendan Mackey, elected Chairman of CESI in 1981 came from a non-mathematics background and saw the role of the computer in a
different light. He believed that CESI should be working towards the 
widest possible application of the computer and Allied Technology 
within our education system in such a way as to reap maximum 
benefit from it. This would involve not only teaching computing as a 
subject, but also the use of the Computer as an Educational aid, and 
as an educational resource. He strongly supported the inter-disciplinary approach to achieving computer literacy and 
believed that the Computer could be of great benefit in some of the 
problem areas of the present education system. Its effectiveness in 
such areas can only be gauged by proper research, and called for the 
establishment of pilot schemes to be carried out, in the CLASSROOMS 
by the teaching Professionals, that is, the teachers [186]. The 
Resources for such work would have to be provided for the 
teachers. The establishment of Educational Resource Centres is, he 
claimed, fundamental to such a system. In his statement of policy [187] Mackey insisted that it is only by the widest possible 
integration of the technology in our educational system that we can 
both gain the maximum benefit from it, and also economically 
justify the provision of more advanced and more expensive equipment 
which our education system, and through it, our youth, both need and 
deserve.

In other counties, notably in Ontario Province in Canada, a special
Educational Microcomputer, with many modern powerful features included, has been developed. More recently, the Queensland State Government has ordered more than 1400 IBM-compatible PCs for schools, which will give them access to, among other things, more sophisticated commercial packages [188]. An advanced 16-bit computer, designed especially for schools and capable of supporting up to 32 workstations is now available to Swedish schools at a bargain price. [189] Mackey [190] makes the point that all our attempts to integrate Computer technology into the Education system are less effective by virtue of the fact that equipment that is available to us was never designed for educational use. Large Computer Systems were designed for specifically for Commercial and Industrial use, and the microcomputer was developed as a 'personal' computer. Therefore, he concludes that Educational Computing will never be fully successful until we see a system designed specifically to provide all the functions required in a school environment, from Computer Assisted Instruction (CAI) to administration, backed up by Software developed by and for professional educators. [191]

CESI had, since its foundation, been a society for a small group of dedicated enthusiasts, who devoted time, energy and money to introducing the computer to Irish Education. Now with the interim...
course and the provision of hardware, their dreams were being realised somewhat. Consequently, Mackey pointed out the CESI would have to change to adopt a more professional approach, to be able to voice the views of, and service the needs of, a growing number of members on a national basis. [192]

The major problem, as Mackey saw it, was information. The average teacher starting to use the Computer in the education process is starved of relevant information and claimed that the immediate aim of CESI must be to ensure that this information is readily available to its members. In order to fulfil this, it was essential to establish an Information Network. CESI needed a national office to service Regional Resource Centres so that the latest information and resources can be effectively disseminated throughout the country, as any course in computing would have to be supported by a constant flow of updated information. To this end, CESI published its Outline Plan [122] for the establishment of a network of Resource Centres around the country, supported and financed by industry. The Resource Centres issues have been dealt with elsewhere in this thesis.

Mackey put much time and effort into his attempt to set up resource centres and to elicit a policy or National Plan for Information
Technology from Government Departments such as the Departments of Education, Labour and Industry. The response from industry was at first encouraging, but not enough money was pledged to open even one centre as yet. With support from industry and the secondment of teachers by the Department of Education to run the centres, Mackey reasoned that the available expertise could be spread evenly around more schools. Staff from the Resource Centres could offer technical advice to teachers so that the microcomputers in the schools would not remain 'in the cupboard'.

The lack of response from industry could be put down to a number of factors. Among them would be the fact that Ireland, like most of Western Europe was, at that time, in a deep recession and industry did not have the resources to support such a scheme. But there is also the underlying fact that industry saw a lack of interest on the part of the Government and did not see why they alone should become involved in the setting up of an alternative educational system; while they may, perhaps, have been willing to co-operate in the setting up of the system with Government Departments, they certainly had no intention of doing so on their own.

Mackey also advocated close ties with industry, reasoning that the expertise and the information comes, not from the education sector
but from the Computer Industry.

4.16.2 REFORMING CESI STRUCTURES

After the introduction of the 'interim' course in Computer Studies, there was a flood of new members into CESI. This put considerable strain on the existing structures of the society, as it put an extra load on the Executive in general, who operated in a voluntary capacity. It seemed clear that the teachers now joining CESI were not the enthusiast type, but teachers who had been appointed by their schools to teach Computer Studies. These were teachers rightly identified by Mackey as those who wished to use computers in Education, and, if CESI were to provide them with a national voice, and a sense of co-ordination in their work, and a source of information and support, then it must strengthen CESI at grass-roots level and ensure that it does, indeed speak on their behalf. Thus Mackey and the Executive set out to strengthen CESI at Branch level. This proved to be an onerous task, since, as has been pointed out already, the Branch structures, with the possible exception of Dublin, were never strong and depended too much on one or two people. Indeed there were plenty of teachers who wanted strong Branch structures, with courses and seminars laid on, but too
few who were willing to work towards that end. So, at Branch level, in general, CESI did not function too well.

At National level CESI called for the production of a policy with regard to the whole area of Information Technology and urged the Minister for Education to set up a Syllabus Committee for Computer Studies immediately so that the subject could be introduced into the curriculum at the earliest possible date. Mackey produced a document (1981) in which he stressed the need for such a policy in view of the relevance of Information Technology to future educational development. It outlined the need for the development of an Educational Computing system and Educational Courseware. It also lists developments which are at present taking place in Ireland which will have direct impact on Educational Development, such as developments in the Training sector, a National telecommunications network, and a Distance Learning Unit and argued that Ireland is in a unique position to benefit from such developments, with its centralised education system, and its Computer and Electronics industries.

At the CESI A.G.M. (1982) a motion proposed by the Chairman to allow institutional as well as individual membership was passed. In this way, schools who affiliated to CESI were allowed to name up to
four staff members as full members of National CESI (Branch affiliation was extra) for £20. The normal individual fee was £6 per person. In this way CESI attempted to encourage an increased involvement by schools in the affairs of CESI. During the 1985/86 school year, nearly 150 schools had affiliated.

CESI also co-operated with many other bodies. For example at Christmas 1981, CESI co-operated with the Royal Dublin Society (R.D.S) in running two courses in computing for younger children [194]. In November 1983, CESI co-operated with the Irish Association for Curriculum Development (IACD) in the organisation of a joint seminar for members of both societies. Such activities demonstrate a sense of maturity on the part of CESI.

In 1984, CESI attracted Primary teachers into the Society and formed a Primary Education Group to promote Computer Education in Primary schools. The annual CESI seminar of 1984 was devoted to the theme 'Computing in Primary and Beyond'. Since then there has been a large inflow of Primary members into CESI. Whether CESI, which in the past catered mainly for second level interests can, in the long run, provide the backup required by the child-centered education at Primary level remains to be seen. In the meantime, it is fulfilling a vital need for the relatively few Primary schools involved in
The computer equipment in Primary schools is spread rather thinly at present. Outside College of Education areas of Dublin and Limerick there is an inadequate degree of inservice teacher training. The fact that the Teacher Training Colleges for Primary teachers can produce Graduates with a knowledge of educational computing is good, but the scarcity of job opportunities dictates that a massive inservice programme on teacher training must also be set in motion without delay.

The Department of Education has set up a pilot project in the use of computers in thirty Primary schools around the country. The schools, selected on Regional basis, had to have their own computer system. The Department agreed to give a grant of about £200 for the purchase of software. Besides this, there is very little guidance provided to the schools as to how best they can incorporate the computer into the Curriculum. Hence the efforts of the CESI Primary group were very important. Members put themselves at the disposal of their fellow teachers to offer help and advice. Through its Journal, Riomharris na Scol, numerous articles related to Primary Computing were published.
In the long term, it is hoped that CESI, with members drawn from all three levels of education can provide the framework whereby teachers at all three levels can work together towards the elimination of the current problem areas of education.
CESI was founded in 1973 and is a voluntary organisation set up to promote computer education in Irish schools. It is the national body representing those interested in Educational computing in Ireland. The society at the beginning, concerned itself mainly with the introduction of computer education into Irish second-level schools. The society, like the technology, has undergone many changes in its history. It began by representing Mathematics and Science teachers, but has spread its influence to nearly all educational groups and disciplines. From the 1984/85 school year there has been a strong move towards Primary education, which resulted in the formation of the CESI Primary Education Group. Despite its voluntary nature and the fact that it receives little by way of outside funding, CESI is regarded as the voice of Educational Computing in Ireland. It has been extremely active and influential in promoting Computer Education. It publishes a journal, liaises with the Department of Education, the Curriculum and Examinations Board and other State Agencies. It organises courses for teachers, seminars and workshops on specific topics relating to Educational computing. There is no other body, official or otherwise, which provides such a forum for the promotion of Computer Education in
Ireland. It has strongly advocated the need for a National Policy and the creation of a network of Resource Centres for the introduction of Information Technology into Irish education.

If the contribution of CESI to Computer Education in Ireland must be assessed, it must be done with reference to the following:

1. Its contributed the framework and expertise to teacher training.
2. It created an awareness of the the computer in education and made available a pool of expertise. CESI personnel, ideas and expertise are behind most innovations that have occurred with regard to Computer Education in Ireland.
3. It provided support for interested teachers (such as advice, technical support, training, and information).
4. It attempted to break the mould of traditional Education in Ireland, by seeking support and liaison with Industry.
5. Through its journal it provided a forum whereby matters relating to Computer Education could be developed, debated and discussed.
6. Special submissions (e.g. to the Department of Education, Industry and the Curriculum and Examinations
Board) made a valuable resource of expertise available. In most cases CESI was the one organisation which had fully thought out the implications of Information Technology for Education.

As we have seen, the efforts of CESI to obtain the recognition of Computer Education on the Irish second level curriculum brought it into conflict with the Irish Department of Education. It is difficult to get a new subject onto a centralised educational system. But CESI kept trying. Despite its voluntary nature, CESI kept lobbying for its inclusion. CESI made numerous contacts with the Department of Education, lobbied TDs and Senators, especially the Minister for Education. The 'interim' course in Computer Studies at senior level and the new Computer Studies module at Junior Cycle can be attributed mainly to consistent lobbying of CESI.

From the start, CESI saw the need to involve industry, especially the computer industry, with education if computer education was to be successful. In the pre-micro days, for example, CESI attempted to obtain processing facilities for its (then small) membership. It later put forward its Outline Plan for the development of support structures, which depended ultimately on industry support.
In the early seventies CESI had active encouragement from the Department. There was an air of optimism that the Department might consider change in the curriculum and include computer studies. This optimism was fuelled by the 1973/1974 pilot scheme. Any such hopes were dashed when the Department was unwilling to expand or renew the pilot scheme the following year. From that point on there was a gradual withdrawal of the Department from involvement with computer education and from an active participation in training teachers in computing. The Department of Education did not again become involved in the organisation and running of courses until 1981. In the intervening period (1975-1980), the Department either provided no funds (as in 1975) or inadequate funds for computer courses.

With the withdrawal of the Department from the organisation of computer courses CESI filled the void. There was no question of CESI usurping the role of the Department whose function it is to provide teacher training courses, but as no courses were being provided, CESI felt that students in schools needed computer education. The world outside was gradually becoming computerised and students would live and work in a world dominated by the computer. Therefore teachers needed training.
CESI gradually gained expertise and confidence. This manifested itself in the provision of the first CESI course (Swords 1975) and subsequent courses at the N.I.H.E, Limerick. CESI was founded as a direct result of the courses given by Professor A.C. Bajpai at University College, Galway and as we have seen, members of CESI had also attended ICL-CES training courses in England. Therefore, the trend was set for the importation of necessary skills to complement CESI course activity. At CESI courses, CESI was able to call on the assistance of the ICL-CES team from England and C.C.H. Dawkins (a former Vice-Chairman of CESI) who was by then based in England.

Innovation was the keyword in the CESI courses and this was coupled with a willingness to try out new ideas. As there was, at that time, little experience in the area of computer education, the courses had, of necessity, to be of an experimental nature. The fact that there were no computer facilities in schools had also to be taken into account certainly up to 1979 (when the micro began to arrive in significant numbers). The courses evolved over a period of time and CESI learned from the experience. The main lesson learned was that courses, where possible, should be given by practicing teachers. Each subsequent course consisted of programming in BASIC together with lectures on topics such as Computer Assisted Learning and LOGIC.
The introduction of the 'interim' Computer Studies option at senior level illustrated a lack of policy on the part of the Department. One would expect that, if such an option was being introduced, that the implications would be clearly understood. They were not. Not only did the Department not organise courses themselves, but their initial reaction was to reduce the financial allocation to CESI to organise courses, despite the fact that CESI was due to demand, now had Departmental approval to run courses at seven venues, instead of one. Certainly, up till 1981, the Department did not fulfil its obligation to provide Computer Courses for teachers.

While one must acknowledge the right of the Department to organise courses, and must sympathise with it on its dependence on the financial constraints of a given year, not all their actions can be attributed to financial considerations. Pettiness played its part as well. For example, the re-emergence of the Department as an organiser of Computer Studies courses in 1981, was done without informing CESI and CESI courses, despite obtaining approval, were not published in the Department's summer course circular to schools. The consistent failure of the Department of Education (at second level) to communicate with or to deal fairly with CESI, on matters relating
to Computer Eduaction, but especially concerning inservice courses, has been a constant source of disappointment to the society. In 1982, CESI opted out of the organisation of courses, which in the author’s opinion, was a mistake. CESI themselves provided better courses, had a total commitment from course tutors, who were not hindered by particular Departmental policy for a given year.

For the 1982 courses the Department made use of some CESI personnel and some of the CESI venues, but CESI itself was not acknowledged. In 1983, there were no courses and CESI were not informed. The list of dates and venues for the 1985 courses were published in late May (before lecturers were consulted). Anyone who, for whatever reason, was unavailable on the given dates was not re-appointed the following year. One must agree that this is a rather petty attitude to adopt. It would be expected that, as a matter of courtesy, lecturers would have been consulted well in advance and that course content would have been discussed and clarified. It is difficult to understand the Department’s strategy in this matter or what purpose it was meant to serve. The result is that it has only served to confuse and alienate teachers further.

It was unfortunate that the then Executive Committee of CESI handed over completely the handling of courses to the Department in
1982. It was done in good faith because CESI had some difficulty in catering for the growing needs of teacher training. But it should have retained control over at least one course and seek Departmental approval. As it is, CESI personnel are being used to conduct such courses for the Department, but CESI as an organisation is not acknowledged as having a role. As it is, the Department simply considers these lecturers as employees and can hire and fire such personnel as it sees fit. In 1986, CESI attempted again to organise its own courses, but was refused sanction.

These points illustrate clearly that the Department of Education, certainly at the second level, has the intention of undermining CESI as an organisation, while doing little itself to promote Computer Education in Irish schools. Because of this, there has been a mood of tension within the Executive for some time. If CESI were to stand firm and evolve a policy in relation to co-operation with the Department, then some progress could be made towards a solution to this matter once and for all. As it is, the Department has no other option but to use mainly CESI personnel as tutors on their courses and on various steering committees as there is very little expertise outside CESI. But, there are those within CESI, who have done well personally out of their association with CESI, see advantage in working with the Department of Education and do not
realise that a framework for the proper introduction of Information Technology cannot be built on existing structures.

The Department of Education, instead of leading, tends to react to events. Over the years, CESI has provided the ideas, but does not have the personnel or the financial resources to implement them. For example, courseware development in Ireland was unheard of before the C.A.M.E.T/CESI seminar in 1983. In order to create a semblance of official action the Department initiated a minor courseware development project in 1985.

The CESI proposal for the establishment of a network of Resource Centres (1981) was never implemented. Ionad Riomhaireactha na Scol, which has been acting as a Resource Centre for teachers in Cork since 1978 was refused recognition as such by the Department of Education, even though no costs would have been incurred by the Department. If such is the case now, there is little chance that the Department will recognise the need for, not to mind implement the proper support structures needed for teachers involved with computers.

In the area of teacher support, CESI has done its best to provide a service, although hampered by a lack of local structures. Despite
its best efforts, CESI has failed to establish strong Branch structures. Where Branches exist, they depend too much on the abilities of too few people. There is a marked unwillingness on the part of teachers to come forward to take positions within the CESI Branch structures (needless to mention, other teacher associations experience the same problem). Nevertheless, a service is provided. At the National level, as can be seen in Appendix T, the Executive Committee has remained virtually unchanged over the years. While providing continuity, this cannot bode good for the future well-being of the society. It leaves the society open to the criticism of being seen as an exclusive club, which is not catering for the needs of its members. This may be so, but there has been a dearth of candidates coming forward to take positions on the Executive Committee. Membership currently stands at about 800, but while CESI has gained some members at Primary level, it has undoubtedly lost members at Second level. While there are those who used CESI for their own advancement, the vast majority of the CESI Executive only wish to serve. Hindered as it is by its voluntary nature, inadequate funding, personnel and resources, it tries, and has succeeded to a certain extent.

CESI does provide a forum whereby teachers of computing can come together, air their views and exchange ideas. It has done so since
1973. In line with the rapid advances in technology, CESI evolved. It moved from programming, exclusively to the wider implications of Information Technology in education. Over the years CESI has provided resources and booklists for teachers, has consistently provided a high quality journal and conducted seminars and workshops, often in association with other interests. CESI has also co-operated with other organisations such as the I.A.C.D and C.A.M.E.T. in the provision of seminars and workshops of mutual interest and has extensive contacts with sister organisations abroad. There are few organisations which have done as much for their members. CESI has provided support when no there was no action at official level. It is only now that the teacher unions are beginning to formulate policy on computer education. Also the success of the Primary Group in its first year brought fresh ideas and a new life into CESI. There is a certain pride at the outcome of the Junior Cycle syllabus committee.

CESI attempts to fill the void left by official inaction. The Department provided the computer language, COMAL, and recommended it for use in second level schools. But schools were left to their own devices as to how best to use it and needed help. CESI set up a COMAL Special Interest Group to provide the environment within which COMAL could be fostered. This is especially true in relation
to microcomputers such as the COMMODORE 64 and the BBC, which are not officially recognised. This was done mainly through the provision of articles in the CESI Journal, Riomhiris na Scol. CESI is doing the same for Micro-PROLOG, which schools received with the APPLE IIe in 1984/85.

CESI also faces the problem that members with the greatest expertise and qualifications have, in the past few years, been lost to second-level education. This is, by no means, unique to Ireland, but in the absence of a national plan, does cause some concern. Those who leave the teaching profession at one level cannot maintain the same interest in or concern about the educational requirements and needs of teachers at the level that they have left. The needs of practicing teachers can only be articulated by those teachers themselves. This is particularly true in the rapidly evolving area of Information Technology.

Professor A.C. Bajpai, Founder President of CESI (1961), spoke at the 1984 CESI A.G.M. He was encouraging. CESI, did not have only two options, to go down the road which leads to 'Computer Studies' or to campaign for the introduction of technology right across the existing syllabus. Instead, he said that the society was on a roundabout with many exits. One path could involve a closer
relationship with the Irish Computer Society. In this way a strong united front could be created to put pressure on the Minister and other TDs to recognise the importance of computer education. The Plan outlined in this thesis leans heavily on the involvement of outside agencies in the educational sector. Another exit might concern the introduction of professional status membership for teachers with computer expertise. Such a route would further the status of educational computing. But, the most attractive exit, he points out, is the one in which teachers band together to carry out mini-research projects, setting up networks to exchange ideas and experiences. In this way software development could be accelerated.

The fact that CESI was invited to have a member on the Junior Cycle Syllabus Committee and has been acknowledged as one of the bodies that the Curriculum and Examinations Board will consult illustrate the stature of the society. But it must be recognised that at official level, CESI is regarded as just one more SUBJECT ASSOCIATION. The fact is that CESI, because Information Technology covers such a wide area, transcending nearly all traditional subject barriers has the potential to be more than a mere subject association is of concern to those in authority, who see it as a threat. Never before, has there been an organisation in Ireland which transgresses traditional subject boundaries and has members drawn
from all three levels of education. In this sense, CESI is an organisation which can have an input into almost every other subject area.

It is hoped that CESI will become involved in courseware development projects during the 1985/86 school year. Consistent efforts are being made to extend the software library. It is also hoped to draw more on the experiences of outside people like Professor Bajpai, in order to learn how to apply this expertise to Ireland.

There is an urgent need for a mass-scale teacher training programme. There is a need on the part of schools to come to grips with the Information Age and realise that they have an active role to play. Too many schools are just sitting back waiting for an instant computing syllabus to teach in their schools. In the new Information Technologies, there can be no such thing. In the past efforts on the part of CESI to co-ordinate computer activities in schools has been not as successful as it may have wished. This has been due to three major factors. Firstly, centralised educational systems look for support and guidance from the central authority, which, in Ireland's case was not forthcoming. Secondly, the voluntary nature of CESI meant that it did not have the personnel
or resources to do a proper Public Relations job and, thirdly, CESI was ahead of its time, and many teachers and schools did not quite understand what it was about. Consequently, while CESI did have an influence, it did not get the support it deserved from the schools it tried to serve. CESI members are expected to provide a service to schools (answering queries, giving advice, etc.), but the schools, in turn, did not, in many cases, provide membership support.

In the future, there will, hopefully, be an increased role for CESI in computer-related educational areas. But it must be seen to be serving the teachers, more than it is at present. CESI, by virtue of the fact that it has, within its membership, teachers at all three levels, is the only body that can offer INDEPENDENT advice and guidance to teachers involved in the area of Information Technology.

The schools can provide us with the resources needed to make the country economically sound. The Japanese, who have really embraced technology, realised long that revolutions are not made by the elderly, but by the 'young and excellent' [197]. Where better to start them than in the schools?
The Intergovernmental Bureau for Informatics (IBI) [198] in a policy guidelines document (1976) states clearly that it is most important for each country to establish a national policy on Informatics (or Information Technology). Informatics, because it reaches far ahead into the future for all its potentialities for society SHOULDN'T BE CONSIDERED AN INVESTMENT RATHER THAN AN EXPENSE. Therefore the actions to be taken in the field of Education in informatics should be based upon a national policy that realises this impact. Since Information Technology WILL INVOLVE EVERYBODY IN SOCIETY, a national policy should be broad and oriented towards all categories of society. Governments have the responsibility of setting the standards required and providing the means for education in order to prepare society for the appropriate application of Information Technology.
It is vital then that Information Technology be introduced into our schools in a meaningful way for all students. It must be structured in such a way that all students on leaving school would be able to take their place in an Information society. This does not mean that each student will have to attain the same level of competence. But there should be a basic minimum knowledge in the uses of Information Technology required of each school leaver. For some students, this basic minimum will be the only thing that they will learn about Information Technology, while other students will use what they have learned as a basis for further studies. The minimum learning content must, therefore, be reasonably self-contained, but must also provide a basis for further courses. Information Technology continues to change at a rapid pace. It is therefore desirable to present invariant knowledge to the students—that is, knowledge not dependent on existing machines or software.

Any plan to introduce Information Technology into schools should begin at the earliest stage in Primary schools and should include a co-ordinating link between Primary schools and the junior cycle in Second level schools and at the other end, a co-ordination between the senior cycle at Second level schools and the world of work (or the point of entry for third level institutions). If we are serious about introducing Information Technology ACROSS THE
CURRICULUM and with it new and vibrant methods of teaching and learning, it is vital that we give consideration to the problem areas that exist in our present day educational set-up, that is at the entry from Primary to Second Level and from Second to third level. We have here an opportunity to get in at the ground level and develop new educational structures, which will enhance education (and provide a population capable of coping in the Information Age). Therefore, it would be opportune to provide our students with an easy transition through the three stages of our educational system.

Computer and communications technologies have become very powerful and comparatively cheap. Progress in these areas in recent years has been surprising. The tools that justify the need for strategic plans for educational and social development are already here. It is now necessary to evaluate what happens when the applications they can support start to be disseminated.

In telecommunications applications, for example, a fibre optics cable can handle about 80 000 telephone calls per second. Many postal administrations today are aware that electronics can now move messages faster, more cheaply and more reliably than conventional mail. New 'voice mail' systems are being tested that essentially
store telephoned voice messages in a computer and deliver them to recipients by telephone, according to pre-programmed sequence. [199]

An IBI document on Policies for Informatics [200] suggests that Education is largely responsible for the gap between the levels of development that exists in various countries. The dilemma is that one needs the resources to promote education and generally without education one often misuses the available resources. It seems clear that in the not too distant future the way education will impact society will be markedly influenced by developments in the area of Information Technology.

The area of Information Technology witnessed some important developments which point to some new tools that might play an important role in the establishment of a new socio-economic order. There is a widespread feeling that Information Technology is already changing society and that it should be channelled to change it in a positive way. The Japanese, for example, practically invest all their hopes in the future of high technology, and, in particular in Information Technology. We are now faced with the problem of developing a new model of society, the Information Society, if we want to play a significant part in today's or tomorrow's world.
It is true to say that the educational systems of developed countries have not coped with the very fast developments that have taken place in industry. Even the most technologically developed countries have had this difficulty. But if a country such as Ireland does not make a conscious effort to put forward a policy with regard to Information Technology and a plan for its implementation in education, then we stand little chance of making our mark in the technological age. If Ireland, as a nation, is satisfied to just provide assembly-type employment for our people in multinational firms, it does not say much for our pride. There are many opportunities to be grasped in the field of Information Technology, which would be of immense benefit to our country. These opportunities could occur in areas such as software development, hardware and software engineering. The key to all this development is computer education in the schools. Thus for me as an educator, the first priority is the setting forth of a national policy on Informatics/Information Technology in the whole area of our Educational system.

Present day education should prepare pupils for life in the Information Society. In this society the daily functioning of citizens is highly dependent on the use of data and information, and
therefore on Data Processing and communication equipment. The automation of routine actions and processes will influence daily life and work, and will affect the existing distribution of power in society. Consequently, human beings will have to adapt themselves time and again to far-reaching processes of change and this will require great flexibility in mankind's reasoning capacity and power to act.

Students will need to be able to function in such a society, to assess a multitude of incoming information, and to understand applications of Information Technology in work and in society. This assessment requires not only basic knowledge and skills, but also a critical attitude to both the new Information Technologies and their uses. Education may cease to be a process for the transfer of knowledge, but may well gain importance for the development of student's thinking capacities and their insight into structures of, and relations between, data. This is what O'Brien refers to as Relational Knowledge. [201]

If we are to develop technologically as a nation (and we must to survive), then we must embrace Information Technology in our education system, at all three levels, but particularly at Primary and second level. The long-term strategy should be to put forward a
plan to introduce Information Technology into schools, beginning at the Primary school and Junior Second Level. Cameron [202] suggests that the introduction of computers is most creatively effected when children are just starting to become literate and numerate, that is, in the Primary classroom.

5.1 EDUCATION FOR LIFE

The main concern of schools and of parents at present is that children will be able to take up employment when they leave school. In Ireland, with nearly 240,000 people unemployed, the situation is critical. Therefore it is imperative that some solution be found that will provide employment for our youth and at the same time provide them with a life-long education, or alternatively, if the idea of full employment is no longer an attainable goal, to provide them with the ability to use their leisure time profitably. The next ten years or so promise to be a real challenge both in education and in industry. Rapid technological change and the increasing intensity of foreign competition will test our businesses. If we react boldly, we can provide the type of training and re-training environments that will keep our industries competitive. The key to a solution is the provision of a technologically based curricula in ALL our schools, both Primary
Mackey (203) makes the point that we have at present the Department of Education, starved of funds, while AnCO, the Training Authority, which is under the Department of Labour, has more funds than it can dispose of. As the demarcation line between Education and Training is becoming rather thin, and even our traditional academic type secondary schools realise this, is it not time that the structures that divided these areas were dismantled. Their resources could then be combined under the auspices of a new broadly based authority which would be set up, under the terms of a National Plan. The purpose of such an Authority would be to oversee the introduction of Information Technology into the Education system. Only in this way can students be provided with the tools to live and work in the Information Age and the economic well-being of the country be preserved.

The tendency in most countries is to adopt Information Technology in a piecemeal manner into the curriculum as the need arose. There has not as yet been a conscious effort on the part of any country to examine fully the total implications of Information Technology into society and to reflect this in their education system. France has come nearest.

Ireland has a POTENTIAL microelectronics base, thanks, mainly, to the
efforts of the Industrial Development Authority (IDA) in attracting many foreign computer/electronics companies to our country. It also has one of the largest unemployment rates among EEC and one of the largest proportions of young people per population. Consequently it must adopt a bold, imaginative policy towards job creation. We urgently need new methods to provide employment for our people and to replace the old out-dated employment bases that, in recent years, are closing down. Old long-established industries, particularly in the manufacturing sector, are closing down: in Cork, for example, we have witnessed, in recent years, the closure of Duniops, which manufactured tyres and Fords, which assembled cars. These were two of the biggest employers in the city.

For long it has been the aim of society to have full employment as the norm. As Gwyn [204] points out it has been a norm of expectation that men and women somehow fitted into a societal scheme of things based on some form of work/employment contract. The work ethic predominated. Future predictions for Information Technology suggest that this may not be the case much longer. This point of view is much disputed, and it is politically very desirable that we all believe that Information Technology will generate more employment than it suppresses. Whatever the next century may bring, we must consider that the work ethic may not be
as permanent a belief as we had thought.

The area of Information Technology offers the best available means of economic growth and indications are that the major job opportunities will occur in this sphere in the future. Hardiman (205) states emphatically that Science and Technology are the keys to Ireland's future and that resources and funding must be set aside, whether or not we are in a recession.

If, then, we are to attempt to provide an employment base for our youth, we must seriously re-examine our educational structures and make appropriate changes and adjustments to our educational system which will better prepare us for the future. The new Information Technologies seem to offer the best solution and it would be opportune to examine their implementation into our educational system.

We must, however, proceed with caution and must examine closely the impacts of Information Technology on education in other countries and learn from their mistakes. We must also create a sound educational environment. This will be difficult when one takes into account the rapid changes in the technology itself. We also need to define educational structures that can easily adapt to change.
The overall educational implications of Information Technology are complex to identify. We do not, at this present time, know exactly how this new technology can affect education in the not too distant future. But, nonetheless, lessons can be learned from computer use today, which indicate a bright future and an ever-increasing role in the use of computer-related technology in education.

Van Weert (206) sees the educational implications of Information Technology as falling into two broad categories. First, those which deal with the technological society in which the education system exists; second, there are the factors which affect the processes of teaching and learning. There are, in addition, implications for the content of what is taught.

If Ireland, as a nation, wishes to take advantage of the new inter-related technologies of telecommunications technology, video technology and the computer, generally linked together as the Information Technology (IT) or Informatics, it is essential that we set about implementing these seriously into our education system in a meaningful way. As previously stated our education system is, at present, over-loaded and mainly out of date. There is an urgent need for reform. The setting up of the Curriculum and Examinations Board
is hopefully the first step towards this reform. A total reform of the curriculum may be needed in order to bring our schools into line with the modern world. Indications from the Curriculum and Examinations Board seem to imply that this may be the case. [207]

It should be obvious that if we are to replace our present educational system, we must have it replaced by something which is educationally sound and which gives an adequate foundation for life to students in our schools. Koenig [208] makes the point that schools of today place emphasis on transmitting information about a finite world, not on developing an ability to tackle difficult problems in a dynamic world.

There is a clear trend in recent years for the traditional Secondary schools to provide more practical type subjects such as Woodwork, Metalwork, Technical Drawing and Building Construction. There is also a trend towards more parental influence in the running of our schools. In this regard, we have the setting up of Parents Councils and the representation of parents on the Boards of Managements of schools.

5.2 EDUCATIONAL USES OF INFORMATION TECHNOLOGY
Van Weert [209] identifies four major educational uses of Information Technology. These are (1) learning about Information Technology (2) learning with the aid of Information Technology (3) learning by means of Information Technology and (4) Information Technology as an aid to school management.

Information Technology itself, in the largest sense, is a subject for study and goes on to suggest an analysis of the territory to be covered based on a four-stage progression from the environment in which Information Technology exists to the 'machinery of the new technologies. Thus we have Social Impact, Applications systems, Problem solving and Program design and Architecture of Programs and Machines.

We can also consider Information Technology as an aid to the learning process, just as we use a blackboard, a calculator or an encyclopedia. Currently, this aid comes in the shape of a computer which can be used as an aid to arithmetic, language teaching, information retrieval, graphical representation, word processing and so on.

Examples of such functions include the performance of extensive calculations, or statistical analysis of sets of data, simulation of
laboratory experiments and 'real life' processes. Visualisation of abstract concepts and of numeric results. Text-processing, information retrieval and test marking. In all these instances, the computer is used as a support or resource, but does not provide a teaching modality.

Information Technology is also used in what is generally called Computer Assisted Instruction (CAI) or Computer Aided Learning (CAL). When a computer is used in CAL, the learning material is (to a large extent) stored in the computer. Individual students have learning experiences in interaction with the computer, and/or a program provides learning materials, possibly by taking the progress of the student into account. Perhaps Computer Managed Learning (CMI) could also be included under this heading. When a computer is used in CMI it supports management and steering tasks for the learning processes. Students' learning performances, for example, are monitored.

This is a rapidly growing area. It is the point at which we are in contact with some of the wider implications of Information Technology, for instance Artificial intelligence, especially expert systems.
As an aid to school management Information Technology is used to support not only financial and personal accounting, but also information retrieval and other tasks for school management. There is also in fact a close link with CMI, in that the ability of the computer to store not only objective data but also diagnostic information concerning students' learning progress will introduce a new sophistication into the organisation of the school. DEVELOPMENTS IN THIS AREA SHOULD NOT BE DISMISSED AS 'PURELY' ADMINISTRATIVE. SINCE IT HAS AN ESSENTIAL CONTRIBUTION TO MAKE TO EDUCATIONAL DEVELOPMENT.

The ability to store and retrieve information on an individual student can lead to a better, more humane system of assessment of his ability. In this manner, a student's strengths and weaknesses can be assessed and necessary remedial action taken.

5.3 INFORMATION TECHNOLOGY AND THE EEC

In this thesis, we are concerned with the impact of Information Technology on the Irish educational sector, but we must take education in its broadest sense and be aware of the impact of Information Technology on employment and the world outside the school. A key element in any Information Technology based curriculum
should in my opinion be a link between schools and industry. This would mean freeing second level students for work experience programmes in industry. Each student at senior level, as part of his course would have to write reports on his work experience in industry and industry would, in turn, also furnish a report on each student who was seconded to them. In this way, a student, on leaving school, would have a better idea as to what type of employment suited him best.

In a rapidly advancing technological society, a key element in all educational needs is that they will constantly change. In employment, it is unlikely that the skills and information base needed for initial employment will be those needed for the same job a few years later. Del Lippert of DIGITAL [210] makes the point that the problem is that the working lifetime of employees is now very much greater than the development and support lifetimes of new technologies. This means that most employees will need to be retrained more than once in their careers in order to remain productive. One must bear this fact in mind when introducing Information Technology to our schools.

As a member of the European Economic Community (EEC), Ireland will
probably be influenced mainly by events in Europe. This does not mean, however, that we should turn our back entirely on what is happening elsewhere in the world, especially in English speaking countries such as the United States, Canada and Australia, nor should it inhibit us from developing our own National structures for the introduction of Information Technology into education.

There is an attempt to coordinate efforts within the EEC to adopt a common approach to the problem of introducing Information Technology into Education, without transgressing national policies. This effort is being spear-headed by the Association for Teacher Education in Europe (ATEE). However, when one takes into account the sometimes independent nationalistic stance of the member states, this task could, at best, be slow and tedious; but, for all that, should not be ignored. [211]

There have been some achievements, particularly in France and Great Britain, which we have already outlined. Denmark has identified an export market for the computer language, COMAL, which was developed particularly for educational use, and is gradually achieving acceptance worldwide.

There is a fear among the European Commission [212] that in the
area of Information Technologies, European industry is under threat. Information Technologies is regarded as the ferment and catalyst of the third industrial revolution, which will profoundly change our society and determine Europe's performance vis-a-vis the rest of the world. It is also claimed that millions of jobs yet to be created or saved are at stake.

Faced with American technological capacity and scale, with Japanese innovation and efficiency and with the productivity of South-East Asia, Europe has so far failed to act in a consistent manner, partly because of the compartmentalised nature of the national programmes and partly as a result of alliances formed with non-European competitors. It is felt, nevertheless, that Europe holds two trump cards: on the one hand, its scientific potential is comparable with that of the USA or Japan and, on the other, its market is the biggest in the world. It is felt that now is the time to act. ESPRIT is the first stage in this attempt by European industry to regain its place in the world market. ESPRIT is detailed in APPENDIX Q. It also is worth noting that President Mitterrand of France pledged over £105M to the Eureka Programme (213), which is a non-military project intended to help Western Europe to keep pace with technological advances in the U.S.A and Japan and that Commissioner Sutherland has produced a new EEC sponsored programme to foster
co-operation between universities and industry in training for the new technologies [214].

The Irish Government prides itself on the achievement of the Industrial Development Authority (IDA) on attracting the major multinational firms involved in the computer/electronics industries to the country. The pride, while justified on the grounds that they can provide much needed employment, should be tempered by the fact that few of these firms engage in significant Research and Development in any of the countries where they have set up. Therefore, besides giving employment and a much needed boost to our employment figures, they provide little grounds for the advancement of a native Irish Informatics/computing/electronics industry. Besides, the majority of the jobs they provide are of the assembly type, with little which have very little emphasis on skill. Indeed, Magaziner [215] pointed out that Ireland was in danger of being being classed as the European equivalent of Hong Kong or Taiwan, in being used as an assembly plant for these multinationals. Without an indigenous base, these industries do little for the prospect of job security or the well-being of the country. Hardiman [216] makes the point that only one in four of the foreign owned companies have some element of marketing and research and development associated with their Irish manufacturing operation.
5.4 THE IRISH EDUCATION SYSTEM—OVERVIEW

Three distinct levels exist in the present Irish Educational system. Children generally spend eight years in a Primary school, entering a Second Level school around the age of twelve or thirteen. Most second level schools now have a five year cycle at the end of which, students sit the Leaving Certificate, after which they enter either a third level institution or enter the job market.

All levels of education are centralised under the Department of Education, but administered under different Branches of that Department. There appears to be very little liaison between the different Branches. Yet, students move from one level to the next, and because of a lack of continuity, it is at these points that the greatest difficulties for the students arise. At the Primary level, the system is pupil-oriented where the emphasis is on teaching the student to learn. At third level, the system is subject-oriented. In each of these cases, the role of the teacher is clear. At second level, the role of the teacher is not as clearly defined. The main criterion governing his appointment may well be his qualification in a certain subject area, yet, in order to fit a timetable, it is possible that he will spend a great deal of his
time teaching subjects in which he hold no formal qualifications. Yet, he is expected to be the middle link in what should be a continuous process. For this reason alone, there is need for reform of the system.

It is hoped that the Curriculum and Examinations Board will go some way towards creating a more streamlined, continuous system. But, it is to Information Technology we must look in order to create the structures which will provide the tools for a more humane, relevant education in line with the Information Age.

In order to do this, it is important to remember that no one State Agency or Department, be it Curriculum and Examinations Board or Department of Education, can on their own, hope to incorporate in any meaningful form, Information Technology into the Irish Education system. The topic is simply too vast.

The introduction of Information Technology into the Irish educational system poses many problems, not only on the basis of cost, but also because its introduction into the curriculum will cause a radical review of our educational structures. The problem is compounded by the fact that these educational structures have not been altered substantially since the system was first set up almost
sixty years ago. The last time that curriculum changes were implemented was in the late sixties when the 'free education' scheme was introduced [217]. The centralised Irish education system does not easily lend itself to reform and has become unwieldy and almost unmanageable. It is acknowledged, even by the Minister, that we cannot keep adding new subjects to an already overcrowded curriculum. The time for change has come and the Minister has taken the positive step towards this goal by establishing the Curriculum and Examinations Board, under whose auspices a review of the curriculum is currently under way.[218]

Ireland has a centralised education system. Hence, all schools follow the same curriculum. This can have the effect of allowing an enlightened Department of Education to begin experiments and pilot schemes on new subject material, if they so wish or giving them the opportunity to do nothing significant and maintain the status quo. While other countries were developing and putting forward plans for the integration of Information Technology into the curriculum, the Irish Department of Education introduced Computer Studies as an OPTIONAL EXTRA on an already overcrowded Mathematics syllabus, and, with effect from the 1985/86 school year, they issued a syllabus for a non-examinable computer module at Junior Cycle [151]. But did little to support a teacher training effort of any
consequence and, as we have seen, made little of the voluntary efforts of the Computer Education Society of Ireland (CESI) in this regard. In the 1981/82 school year 310 APPLE II microcomputers were given out to schools. The schools that received them did not have any computer at the time and were generally unable to use them to their full potential. Events subsequently proved that the Department of Education had no long term plan for the use of computers in education and this leads to the suspicion that the provision of microcomputers to schools had more to do with an attempt to win electoral advantage than with the enhancement and advancement of education. (There was a General Election in 1981.) Schools which had pioneered Computer Studies for many years and who had purchased computers OUT OF THEIR OWN FUNDS were refused a much needed extra computer and had to settle for 'add-ons' to existing systems. In the 1984/85 school year, a further 200 'new' APPLE IIe systems were given out to those schools which did not already have a system regardless of whether or not these schools had a staff member who was competent to use the system.[ 219 ]

The greatest neglect of all has been in the area of teacher education. It is difficult to understand a Department of Education that spends a large sum of money in purchasing expensive computing equipment for schools and then fails to provide the
teachers with the training expertise and guidance necessary for them to use the equipment to its full potential. **Teacher training is the most important ingredient in the provision of the computer literate society of the future.** There is an urgent need to provide all teachers with the skills and competency to overcome a certain amount of fear and anxiety that they may have with regard to computers.

The centralised Irish Education system permits very little input from teachers into the content of courses that are taught in our schools. Schools are expected to follow in a rigid manner whatever syllabus is set out by the Department of Education. That is not to say that teachers are not represented on the syllabus committees which set out these courses, but it is the Department of Education officials who have the final say in the matter.

Thus there is very little scope for experimentation and innovation in the Irish education system. The teacher unions, as a cohesive unit, have not, to date, been to the forefront in seeking more teacher participation in experimental, pilot and innovative schemes. They have been mainly concerned with the issues of pay and conditions for their members, and have succeeded fairly well in this regard in that Irish teachers are now among the best paid - BUT IT
IS AT THE EXPENSE OF HAVING A REAL INPUT INTO THE CURRICULUM THEY TEACH. On the other hand, the Department of Education has attached too much importance to itself. While acknowledging that Departmental officials may be, in many cases, prevented by administrative duties from being thoroughly familiar with the teacher's work in the classroom, they, at the same time, have almost right of veto over the content of any course on the curriculum. They decide, among other things, the allocation of funds for in-service courses in the various subject areas. As we have seen, they have, particularly in the area of Computer Studies, been inflexible and dismissive of the innovative work of CESI, while tending to be highly secretive about their own work in this area. Indeed, the behaviour of the Department of Education, in particular in relation to the introduction of Computer Education into Irish schools, which has been previously discussed, can only lead us to conclude that the Department ON ITS OWN is incapable of introducing computer-related technology into our schools. The experiences of other countries suggest otherwise. France combined the resources of the Department of Education and the Department of Industry, Great Britain combined resources from the Department of Education and Science with that of Industry, and Ontario Province in Canada combined resources from the Department of Education and the Department of Industry and Tourism.
By learning from these experiences Ireland could go a stage further. What is needed is a National Plan. Education in Information Technology cannot be fostered adequately in our schools as long as it is restricted to the Mathematics Departments of our schools, administered under the auspices of the Inspectors of Mathematics and it is funded from the meagre budget from that Department. In this situation there is NO WAY FORWARD.

5.5 EXPERIENCES DRAWN FROM COMPARATIVE STUDIES

From our brief account of the development of Computing in Ontario, in Australia, the U.K., and France, which is contained in Chapter III, lessons can be learned which would be beneficial to Ireland.

Computer Education was introduced with the dual purpose of enhancing the education system and providing for the economic well-being of each country. New structures were necessary because of the fact that existing structures, both financial and resources, were not adequate to satisfy the demands which the introduction of computer education would place upon the system. It was recognised
that a pooling of resources on the part of Government Departments of Education and Industry was necessary. This pooling of resources was done at a National level even where a country did not have a centralised education system as in the U.K. In the case of France, where a centralised education system exists, initiatives and leadership came from the top.

It is now generally recognised that computer education must meet the needs of all children and that all teachers must be given training. However, with the possible exception of France, no country has fully solved the problem of teacher re-training.

For the future standardisation of computer hardware will be important. Standardisation eases the problems of Computer Languages and eases considerably problems associated with courseware transferibility. The trend is to aim towards the provision of industry standard computers for use in schools, or to aim towards a powerful operating system such as UNIX as standard, as is the case in Scotland and Ontario. There is also a recognition of the fact that information Technology is important and has immediate and far-reaching implications for the structures and methods of education systems.
5.6 PLAN OF ACTION

If Ireland is to take advantage of its benefits, Information Technology must be incorporated into the educational system without delay. This can only be done adequately in the context of an overall National Plan or Policy on all aspects of Information Technology to include social, economic and educational needs. The experience, to date, is that Irish authorities have tended to concentrate too closely on limited areas of development, such as programming, and have not taken even the preliminary steps towards recognising the larger scenario. At no time, for example, has the Irish Department of Education recognised the potential of Computer Education as an agent for change across the curriculum.

Irish policy makers must provide a bold, imaginative plan, such as the setting up of an Authority to oversee the introduction of Information Technology into the Educational system. I would propose that this Authority be called An Chomhairle Theicneolaíochta um Oideachas (The Educational Technology Authority) or ACTO, for short. This Authority should be given the power to oversee the introduction of Information Technology into education, in the widest
possible sense, taking into account the social and economic needs of the country. As previously stated, it would be broadly based to include qualified personnel from across a wide spectrum of the industrial and educational field.

As the area of Information Technology is a vast one, embracing all facets of life, our education system needs the benefits that come with Information Technology to provide both the basis for skills needed for the Information-based twenty-first century and the structures of a sound educational system. The sheer magnitude of the Information Technology area and the rapid advances of the technology itself make it impossible for any country to implement the technology into the educational system under present day structures. It is not possible for say, our Department of Education to have at their disposal the means and resources to undertake the task; nor do they have sufficient understanding of what is involved. The fact is that no one Government Department, Agency or for that matter even the electronics/computer industry itself has a totality of knowledge in relation to rapidly changing world of Information Technology. What does exist, however, is a large expanse of discrete knowledge, which, if co-ordinated under a national plan by an Authority such as ACTO, could aim towards a solution to a problem. It is only through a pooling of resources that we can
succed.

What is needed then is a new, fresh approach to education, involving other bodies who up till now have been excluded from the education planning process, yet whose needs education claims to serve. We need financial support from the EEC Social Fund. We need an input from industry, mainly industries in the computer/microelectronics field. We need an input from An Bord Telecom, from the National Board for Science and Technology, the Departments of Industry, Labour and Education, as well as semi-State agencies involved in the Training area, such as AnCO and the Youth Employment Agency. There would also be a very important input from educationalists from all areas, Primary, Second-level and Third level. At Third level, it is important to have personnel from the Computer Science Departments and from the Education Departments of our Universities (who are mainly responsible for teacher training at Second-level), specialist teacher training colleges, and the colleges of education who are responsible for the training of Primary teachers. We must remember that what we are proposing is a co-operative effort for the benefit of Education and the economic well-being of our country.

The strategy, then, should be to set forth guidelines for a two-tier approach to the problem, a short-term approach which would take into account the circumstances that currently exist in the schools.
and a longer term approach which would fully incorporate information Technology into schools. The most important aspect in both approaches is to train the teacher in order that he/she feels comfortable and confident in using the computer. This can only be done by adopting a professional, realistic approach to the problem, which has been absent up to now. It is imperative that teachers at the pre-service level be adequately equipped to teach in the Information Age.

The Department of Education cannot, on its own, cope with the problem of inservice teacher training and the whole area of Information Technology in Education with the meagre resources it has at its disposal. It is, therefore, vital that any policy brought forward recognises the fundamental importance of Information Technology in the country’s future and that, with funding also available from the EEC, many Government Departments, Agencies and private industry share resources and personnel to make the system work. This can only be done within the framework of a National Plan.

5.7 AIMS OF ACTO

It is envisaged that ACTO be set up under a Government Plan. Its
purpose would be to advise the Government on all aspects of Information Technology and would have the STATUTORY powers to oversee the implementation of the Plan. It would be broadly-based enough to keep abreast of the rapid changes in ALL aspects of Information Technology. Its particular brief would be to oversee and co-ordinate the introduction of Information Technology into the educational system, in its broadest sense.

Since Information Technology is all-embracing, it is vital that courses in Information Technology reach out to all students in our schools. This means that its introduction should begin in the Primary school, be continued through Second-level, carry on through third level and provide the opportunity for any student to drop out at any time and re-enter the system at any point throughout his lifetime.

It is only by introducing Information Technology across all subject areas in the curriculum that we can hope to get teachers of all subjects to become literate in Information Technology. This will necessitate a massive teacher training effort, which, if not handled in a proper professional manner could put serious strains on teacher morale and public finances.
5.7.1 TEACHER TRAINING

One of the main areas that ACTO would have to address is the whole area of teacher training. A teacher's role in an information-based society will be quite different from what it is at present. The teacher can, as suggested previously, be presented with tools that can enhance his/her teaching. The main item will be the computer, which can be used as a versatile tool in the students' life. It can be used as a wordprocessor to help in his essay writing or as a Spreadsheet in Commerce subjects. It can help the weak student with remedial applications. Courseware packages can be produced which help reinforce ideas across all subject areas. We have graphics, sound and may soon have efficient voice recognition systems on computers. These are but a few features. We should not, however, allow ourselves to be governed by the technology that is around today. Today's technology, a marvel by yesterday's standard will prove very primitive in comparison with what will be available tomorrow. All these aspects and more must be taken into account when one considers a programme for teacher education requirements for Information Technology. TEACHER EDUCATION TARGETS WILL HAVE TO TAKE INTO ACCOUNT THE PRE-SERVICE AND THE IN-SERVICE REQUIREMENTS OF ALL TEACHERS.
At pre-service level, the needs of teacher training fall into two categories. While the majority of Graduates with a Degree in Computer Science will be attracted to Industry, there will be a minority who may be attracted to teaching. For these, there will be the need to provide a methodology for teaching Information Technology. In all probability, these students would, perhaps, be the future teachers of Computer Science, a technical subject at Senior level, and the general course at Junior level. There is a doubt as to whether these students would come into teaching in sufficient numbers, however. Even if they did, there would still be the need to have Information Technology across all subject areas. Hence, Education Departments of our Universities would also have to put on ab initio courses for the majority of Higher Diploma in Education students.
6 THE DEVELOPMENT OF A NATIONAL PLAN

The aim of the Plan should be to create a society well versed in Information Technology. It is, therefore, necessary to begin when a child first enters Primary school, and continue throughout his years in Primary and Second Level school. As there is presently some development at Second level, it is necessary to make an immediate input into this area as well. It should begin at junior cycle and continue right through. The rapid changes which occur in the Information Technology field will necessitate a constant review of the syllabus content. As pupils from the Primary schools come into second-level schools with a knowledge of Information Technology, the changes will occur at an even more rapid rate.

The Plan should be to set up an Authority such as ACTO, which would be given the STATUTORY powers to co-ordinate the development of Information Technology in both Education and Training. In the author's opinion, without statutory powers the ACTO would not
function effectively. He would envisage that ACTO Board members be drawn from a wide spectrum of experts from the computer, microelectronics, telecommunications, Training and Educational fields, together with the Government Departments of Labour, Education and Industry. People such as these would pool their resources and expertise for the benefit of Education. Through a co-operative effort, and assistance from the EEC, resources, both financial and material, could be made available. Because of the rapid changes in Information Technology, such an Authority must be of a permanent nature. The main function of ACTO would be to set up the necessary structures for the proper implementation of Information Technology into Education. While the situation would have to be kept under review, for now, at least, the priorities are in the areas of teacher training, courseware development, provision of support structures and hardware requirements.

The National Plan proposed in this thesis would be implemented under the direction of ACTO over a ten year period. In this time it is hoped that the general population would be geared towards the Information Age and that an environment would be created whereby the youth of our country would receive a sound education and, at the same time, be equipped to take their place in an Information-based society. The steps needed would be
* to equip and prepare the Teacher Training colleges for Information Technology.
* provide the structures for basic teacher qualification to teach by means of Information Technology for all teachers.
* provide the structures whereby practicing teachers could obtain a more advanced qualification to teach Information Technology.
* provide standards guidelines for hardware and courseware for schools.
* provide for courseware development.
* provide the structures for the provision of hardware and courseware to schools.
* set up and structure Regional Resource Centres.

Within the structures of the Second Level school of the future Information Technology could be implemented in two ways. Firstly, use could be made of Information Technology as a teaching aid across all subject areas, and the changes brought about by Information Technology is also a topic worthy of study. Secondly Computer Science, which would include problem solving by means of algorithms, principles of programming, and principles of software and machine architecture. Every student could learn about the use of
courseware packages through the former, but it should also be compulsory for all Junior students to do the latter as well as, for many, it may be their only opportunity to learn some of the more technical aspects. As we have seen this has been recognised with regard to the syllabus to be followed at Junior Cycle [151]. At Senior Olevel, the computer would be used across all subjects areas, but the Computer Science subject, as outlined as Computer Science above could be an option. As part of their study, students would have to undertake research projects on aspects of Information Technology.

ACTO would be the statutory body responsible for the introduction and co-ordination of Information Technology within the whole of our educational system. It would:

* provide policy advice to the Government on the use of Technology in Education.
* oversee and co-ordinate the introduction of Information Technology into the whole of our educational system and would be given statutory powers to do so.
* keep abreast of the rapid changes in the technological field, mainly through liaison with industry.
* co-ordinate the teacher training effort.
* co-ordinate, set up and fund the setting up of Resource Centres at venues around the country.
* co-ordinate the secondment of groups of teachers to provide courseware materials for use in schools, including subject specific software, teacher notes and student notes.
* co-ordinate an evaluation service on available courseware.
* identify the hardware that is most suitable for schools at a given time.
* co-ordinate a network of Service Centres around the country, where hardware could be brought for repairs.

It is envisaged that funding and support for ACTO would be available from central funds, the EEC social fund, support from industry and private sources.

Members of ACTO would be drawn from agencies and bodies such as:
* Departments of Education, Labour and Industry
* Curriculum and Examinations Board
* AnCO (The Training Authority)
* The Youth Employment Agency
* Computer Science Departments of third level colleges
* Education Departments of Universities
* Specialist Teacher Training Colleges.
* Colleges of Education
* The Industrial Development Authority (IDA)
* An Bord Telecom (The Telephone Authority)
* Radio Telefís Eireann (The Radio/TV Authority)
* National Council for Educational Awards (N.C.E.A)
* The National Board for Science and Technology (NBST)
* Computer/Microelectronics industries
* The Irish Computer Society
* The Irish Computer Services Association
* The Irish Business Equipment and Trade Association (I.B.E.T.A)
* The Distance Learning Unit.
* The Computer Education Society of Ireland (CESI), representing practicing teachers.

C.A.M.E.T., under Professor A.C. Bajpai, Founder President of CESI, having close links with the development of Computer Education in Ireland, could be invited to play a consultative role in relation to ACTO.

An authority such as ACTO should be set up immediately and be given the statutory powers to provide the co-ordination needed to
prepare society so that it is ready and able to take advantage of the opportunities that Information Technology will present. In this matter it would have to liaise closely with the Curriculum and Examinations Board and the Department of Education.

One of the first tasks that ACTO would have to tackle is to identify and co-ordinate the various areas that are currently in progress. These would include teacher training, courseware development, hardware considerations and the provision of teacher support structures.

In this chapter we will consider hardware, courseware development and support structures. These areas are important to the overall Plan. Teacher training, which is of more fundamental importance to the plan will be discussed in Chapter VII.

The Plan should examine the situation from both a long term and short term perspective. The rapid advances of the technology will not permit us to look too far ahead, but, nevertheless, we must attempt to identify some signposts. It is only by a combination of ideas and resources from the broad section of interests such as those outlined that we can even attempt to tackle the problem. Considerable time and money will have to be spent on basic
research in all areas, but especially with regard to current hardware in schools, current courseware being used in schools (sources, evaluation, costs, etc) and teacher training needs.

6.1 INVESTMENT CONSIDERATIONS

The implementation of a National Plan would mean that resources will have to be allocated which will enable the Plan to work smoothly. This inevitably boils down to the allocation of scarce financial resources, which have to be justified, to the scheme. The personnel, mainly due to the work of CESI, are available to make the scheme work. We have teachers, well versed in all aspects of Information Technology who could work as Directors, Assistant Directors, Courseware developers/evaluators in the Resource Centres and teacher trainers. We have programmers and technicians from third level colleges who have been unable to obtain meaningful employment. We have a young population, over 50% under 25, eager and willing to be guided into the Information Age. We are doing a disservice to them to deny them their opportunity in the age of technology by not devising a National Plan for its implementation. The rapid changes brought about by technology means
that education in our schools is rapidly becoming obsolete. The student today, reared in the Age of Technology is not slow to realise that the school is not providing a sufficient grounding for a life in the Information Age. We owe it to our students to provide them with an education which will enhance their prospects in an age where traditional employment cannot provide the jobs.

One of the few areas where job opportunities are expanding is in the computer/electronics and related technology area. The fact that the majority of our second level students do not go on to third level makes it imperative that we make an investment in the area of technology in both Primary and Second level schools on a REALISTIC LEVEL. This does not mean a piece-meal approach nor does it mean that the provision of hardware and little else (as happened in Ireland) is the solution. As the IBI Report (1976) states that:

"Investment in the procurement of hardware systems can easily become a complete waste of money if the necessary funds are not made available for education. The decision on investment in education should be made at the same time as that on investment in hardware and then be equal in the amounts of money made available." [220 (P 18)]
According to the Report it is a hard lesson for most countries that the information which top management and thus Government, receive from the technicians, including the hardware manufacturers and experts in the organisation itself, usually ignores completely or sometimes mentions optimistically the urgent need for the indispenensible funds for education. (221)

Ireland, with a high unemployment rate and an above-average young population, will have to turn to radical solutions if it is to survive economically and get its workforce gainfully employed (or, if we accept that the concept of full employment is no longer a reality, to equip its youth with the skills to cope with life and leisure in the Information Age).

With traditional industries closing down, we, as a country do not have much room for manoeuver. The computer and its associated technologies offer us the best chance of survival. Therefore the need for a National Plan for the introduction of Information Technology into our schools should be of utmost priority. The plan, as outlined, would include the setting up of An Chomhairle Theicneolafochta um Oideachas (ACTO), to co-ordinate the introduction of Information Technology into our schools, beginning at Primary level. Other aspects of ACTO will be discussed later.
this section, we deal, especially with the financial aspects of such a scheme.

Such a scheme will, no doubt, be costly and will have to be implemented over a period of time. We have to remember, however, that the education should be considered an investment rather than an expense. We cannot afford to put off an investment in our children's future (and their future revolves around the the technology of the Information Age). We have have no alternative but to make our Primary and Second level education information based. In so doing, we are creating a society which is able to function in the Technological Age.

In Ireland the lack of a policy has caused a certain amount of confusion among educationalists, who find it hard to comprehend a Department of Education which spends a vast sum of money on hardware, yet contributes so little towards teacher training and courseware development. The apparent inequality of a system whereby schools which had bought equipment out of their own funds got only meagre enhancements, while equipment, which they sorely needs lies idle or underused in other establishments. The lack of policy and direction has also led schools to adopt an unco-ordinated approach to the computer. There are schools, which, in the absence of a policy
see no point in attempting to introduce the computer to their students. On the other hand there appears to be a growing tendency among other schools to purchase a lot of equipment without having given due consideration to how their purchase will be used. In almost all cases where computers are used in schools, there is an over-emphasis on programming at the expense of the wider impact of technology. This is mainly due to the inavailability of sufficient quality courseware.

There is also the growing fear among parents that the computer and its related technology is the 'in' thing and since education does not, at present, cater adequately for the age of technology, they are prepared to spend money on the purchase of microcomputers in the hope that their child will become 'computer literate' and/or spend a vast sum of money to send their child to one of the many computer/technology institutions that claim to be providing computer education. The fact is that these institutions, for the most part, are run solely for monetary gain and have little or no contribution to make to education. But, in the absence of a policy or a National Plan, these institutions are given a semblance of legitimacy.

In Ireland, up to the present, there has been little opportunity for
private industry to play a meaningful role in the educational process. Yet Education claims to prepare the student for the world outside. The recession of recent years has forced Education to seek the support of the industrial sector in the setting up of innovative schemes. Different Ministers of Education have repeatedly made the point in recent years [224] with little success, but with inducements such as tax reliefs for the funding of educational projects, industry could be persuaded to help education.

Despite the fact that industry itself is feeling the brunt of the recession UNDER THE TERMS OF A NATIONAL PLAN, it would rally to the cause of education. It is possible that they would see that by making our young people literate for the age of technology that we are in fact helping industry in the long run and creating a base for new industries. It is only under the terms of a National Plan that industry would become involved. An educated workforce has many spin-offs for industry. Therefore, at this time, the author feels that industry, regardless of the recession, would only be too willing to throw its weight behind a National Plan which would in the long term lift the country economically and socially.

One could argue that the efforts of CESI to involve industry in funding projects have been unsuccessful in the past. In this regard
one could point to the reaction of industry towards the Resources Network proposals of 1981 [122], where, despite massive circulation, the response, in the end, was negative. On the other hand, one could also point out that there was a negative response from the Department of Education towards the secondment of teachers, which may have caused suspicion in the industrial sector that they were, in some way, being asked to assume a role that is normally reserved for the Department of Education, without an input from that quarter.

What is now proposed, under ACTO, is a close co-operation between the public sector (The Departments of Education, Labour and Industry) and the private sector (industry, especially the computer/electronics industry). Such a National Plan represents the only realistic option open to Ireland if we are to survive economically in the Age of Technology. Yet, if handled in a proper manner, stands a good chance of success. Financial assistance from the EEC Social fund, already available to AnCO, could also be made available for this purpose.

Finance and support are especially needed in the areas of courseware development, the establishing and organisation of Support/Resource Centres, hardware, and, above all, for teacher
As a step towards the implementation of a national policy for Education in Information Technology ACTO would be given the task of implementing the plan of co-ordinating available expertise, providing the necessary resources and delegating the authority needed for effective and efficient operation.

Because of the vast spectrum of actions expected to be undertaken it is desirable that it be arranged in such a way that ACTO can be made responsible for all these actions which are: to prepare the society, to educate the individuals and groups indirectly affected, as well as the professional workers who will have a direct employment in Information Technology.

Under present structures, there is no way in which a proposal for a vast radical change in Education could be implemented. The Department of Education's financial resources simply could not cope. In business and industry, efficiency and cost-effectiveness are the keys to success. Education, in its wider concepts of Continuing education and Distance Education, as well as the school-based learning has the potential to become a major industry in the
future. Therefore there exists a need for a co-ordinated effort from many sectors of our society to provide the resources necessary to implement a National Plan. To begin with a co-ordinated effort on the part of the Departments of Education, Labour and Industry to put forward a common approach towards Information Technology in Education and Training is necessary. As stated previously, the gulf between Education and Training has, in most progressive countries, been bridged effectively. An examination of the role of AnCO would suggest that there is some duplicating of resources with the Educational sector. There is also the fact that the money from the European Economic Community (the EEC) goes to the training sector, while the educational sector is starved of funds.

In countries such as the United Kingdom and France, where some success in the implementation of a National Plan for the introduction of Information Technology into schools has been achieved, it was done because a joint effort by the Departments of Education and Industry.

If Ireland, with a relatively small population and a centralised educational system were to do something similar, then progress could be made. Furthermore, we also have a growing industrial base in the Computer/electronics field. There are some possible options
which could be explored in relation to these firms. Personnel with the necessary expertise from these companies could be used to provide specific seminars and specialist training for teachers. The companies would provide up-to-date equipment and information to the Regional Resource Centres, and would help out with the servicing of their equipment. Personnel could be seconded from these companies to help set up a new Educational Technology Industry, somewhat on the lines of the Ministry of Education in Ontario, Canada, but with the emphasis on the Irish situation. These companies could fund research projects by teachers and student teachers in the field of Information Technology. In doing so, they are in a way contributing towards their own future. A skilled and knowledgeable student population has a large spin-off for industry. UNDER THE TERMS OF A NATIONAL PLAN, private industry, could be prevailed upon to sponsor the setting up, organisation and running of the Regional Resource Centres at least. We could, at a later date, investigate the possibility of gathering together the resources necessary to create an "all-Irish" technology environment for schools.

6.2 RESEARCH PROJECTS
There is a vast field of research projects in the area of Information Technology to be tackled. Courseware packages need to be developed and evaluated in all subject areas. The use of the computer as a tool or aid in education needs to be investigated. Hardware needs need to be identified. Educational resources such as videotapes and training films need to be provided. These are but a few of the many areas of research to be tackled.

Valuable research projects such as these would best be carried out by teachers freed from other duties. Colleges such as Thomond College, Limerick can give recognised academic status to such projects. But it is also essential that these projects be adequately funded. Once more, under a National Plan, it would be possible for private industry to fund a certain number of these projects.
As an education system embraces Information Technology, in however small or piecemeal a way, the need for the production and development of courseware materials becomes critical. Information Technology, by its very nature, brings with it the potential to develop new and exciting methods of teaching and learning. The production of high-quality courseware becomes an urgent priority if we are to create an educational environment which is appropriate to students who will live and work in the Information-based twenty first century. By courseware, in the current context, is meant any materials that can be used as aids in the teaching/learning situation. Such materials would include software packages, which may have been developed for a given subject area, as well as materials not developed as Computer Aided Learning (CAL) materials such as word processors and spreadsheets.

While software development is of immediate concern, courseware development would also embrace the development and use of video and television as instructional aids in the classroom. One must not rule out many more developments in this and other areas in the not too distant future. For instance, there could be a great potential for education when Distance Education and the use of satellite
transmission becomes widespread.

6.3.1 COURSEWARE DEVELOPMENT: SOFTWARE

"The benefits of computers ... hinge upon the dedication, persistence and ability of educators as well as courseware developers to use technology as effective tools. ... As educators, we have an obligation and a pressing responsibility to take the forefront in assuring that technological advances enhance the learning environment of our children."

Gordon Ambach
New York Commissioner of Education.

The area of software development is a vast one and needs a lot of planning if it is to succeed in any meaningful way. As it stands, the teachers, heavily involved in their classroom work, do not either have the time or expertise to provide high standard software for schools. On the other hand, there are companies setting about the production of software for schools, who have little or no knowledge
of the needs and requirements of education and are attempting to sell products of dubious educational value to schools at inflated prices. Fortunately, schools cannot afford to buy at present due to budgetary constraints. The ideal situation would be for teachers and industry to come together for the production of educational software. This can only be done satisfactorily by a body such as ACTO under the aegis of National Plan which would ensure an acceptable standard for educational software. The net result of this should ensure that the needs of education are taken into account in the production of educational software.

As there has been no major push in Ireland, up till now, by any software company, an ideal opportunity exists for the setting up of structures for the establishment of a NEW INDUSTRY TO SERVICE EDUCATION. Some may argue that the Irish market is not big enough to support such an industry. This may be so, but we must remember that there is a worldwide shortage of high quality software and, in co-operation with the Irish National Software Centre, ACTO could well find an export market for educational courseware.

This industry would, under the direction of ACTO, co-ordinate all the courseware materials necessary in the implementation of Information Technology in Irish schools. The opportunity exists now
and so does the market. The fact that we are currently in a recession, the high cost and lack of depth and quality of the available software are the major inhibitions at the moment. There is very little native software in existence at the present. As a direct result of the C.A.M.E.T/CESI courseware seminar (1983), CESI has managed to make a limited amount of software available to its members, through its software library. Also in March 1985, the Department of Education made £20 000 available for five courseware projects selected from the areas of Business Studies, Geography, Physics, Mathematics, Chemistry and Biology. The purpose of these projects is to develop courseware exclusively for the APPLE, which is a mistake and the amount of finance allocated is too little to make a significant impact.

The immediate need is for high quality software for all computers that are currently used in Irish schools. At second level these are mainly the APPLE, COMMODORE 64 AND BBC microcomputer. At Primary level we could add microcomputers such as the ATARI, SINCLAIR SPECTRUM and AMSTRAD.

The immediate aim of ACTO, should be to set about providing a wide range of quality courseware for each of these microcomputers at least. These computers are already in the schools and will be used
for some time. ACTO, as part of its brief, would keep abreast of the evolving needs of schools.

In relation to the purchase of software from abroad, one is at the mercy of advertisers, and personal experience underlines the dangers of purchasing software of unknown quality, at high cost, which is often unsuitable for Irish educational needs.

Nordman [224], in relation to Canadian education, identified common educational software deficiencies. They occur under the headings of content, interface, learning theory and implementation. The program content limits or precludes its use in a classroom. The problems include inappropriate, invalid materials with limited links to classroom activities, a lacking in rich real world content, with a focus on low level skills, content lacking a clear goal and an appealing fantasy.

The student/computer link is poor, often due to the fact that programs emulate text books, with unattractive displays and poor readability. The programs also have limited user control and provide limited compensation for physical or mental lacks of the end user; neither are they appealing to sensory or cognitive curiosity. Nordman [225] makes the point that the use of
graphics, sound, animation, windows, hidden
screens/helps, scores, multiple entry levels, challenge, feedback (reward and diagnostic) are possible remedies.

The flaws that Nordman perceives with regard to Learning Theory include use of only convergent thinking activities, limited branching capabilities and consequently poor reactions to differing student abilities, and a lack of diagnostic helps. He feels that this could be addressed by open ended software, with editors (sound, shape, colour and words). In the classroom situation, the program does not get full or adequate use. This may be because the program assumes a static curriculum, is only useful for perhaps one class a year or a single activity, and is, therefore, cost ineffective. Overpricing by a producer can also be a problem.

Nordman feels that this can be remedied by tool type software. In Canada, at least, the hardware presently in schools will be there for another two years at least. He also makes the point that software developers should write for the present market as after development the material may have at least a six month life-span and with good links to the present curriculum, a developer can feed new activities by building on a track record.
Norris (1983) [133] on behalf of CESI drafted a set of guidelines for the benefit of teachers wishing to purchase educational software. This draft appears in full in Appendix M and is, in essence, a check-list of questions to be asked about a particular software package.

6.3.2 ACTO AND COURSEWARE DEVELOPMENT

Under the terms of a National Plan, ACTO would have the task of co-ordinating the whole area of Information Technology into the education system. In the area of courseware development, it would be necessary to second teachers for a specified period of time in order to work with experts from the industrial sector on the provision of courseware materials for schools. The secondment should be open to TEACHERS OF ALL DISCIPLINES as Information Technology embraces all subject areas. The secondment would be of two types (1) Full-time secondment for those teachers who are actively engaged in the development of the courseware, including Databases and (2) ‘Half’ secondment for those teachers who would be used to evaluate the courseware in their schools.
The author would propose that ACTO adopt a model somewhat on the Scottish lines and form a close liaison between the seconded teachers and the programmers employed at the Regional Resource Centres. He would also envisage that ACTO Regional Resource Centres would be in a position to receive and evaluate courseware from other sources, such as private individuals, teachers, computer industry and even second and third level students.

The Scottish plan of supported and non-supported courseware is one that could be readily adopted by ACTO for Irish education. Supported courseware, in Scotland, had to pass rigorous assessment and testing [131]. Courseware meeting these requirements was supported, which meant that it would be maintained and, if necessary, modified by the SDMP. Unsupported courseware was available, but was not maintained. ACTO would do well to adopt a similar policy for Ireland.

ACTO would evaluate any courseware submitted. Such courseware would either be supported, unsupported or rejected. In the case of supported courseware, ACTO would reserve the right to make any modifications necessary and would retain copyright. The author would be acknowledged in documentation and would receive payment for his work. In the case of unsupported courseware, copyright would remain
also with ACTO and relative payment may be made to the author. In
the case of courseware from abroad, ACTO could seek and evaluate
its suitability for Irish conditions and, if satisfactory, could come
to a distribution arrangement with the publisher.

There would be the need to monitor closely the developments so that
there would be no overlapping. This could be done, in the short
term, by having ACTO distribute to its regional centres the
projects and tasks to be undertaken. This activity could be
co-ordinated by ACTO Head Office.

In the short-term, there is the need for a large-scale development
of educational courseware. This situation may not always be as
critical, and should be reviewed periodically. It may happen
that, after a period of time that sufficient courseware is
generated, in which case, all Regional Centres need not, necessarily,
be concerned with courseware development. That is for the
future, however.

It could also happen that ACTO, at a later date, would wish to
distribute the various tasks throughout the system. Some centres
would be responsible for courseware development and others for the
production of video training films and still more for evaluation.
Information Technology, being all pervasive, can also transcend national boundaries and frontiers. Indeed, within an EEC context, efforts are being made to bring about some uniformity [226]. A continuous concern of the Association for Teacher Education in Europe (ATEE) is the exchange of curriculum material beyond the borders of different countries and cultural barriers. In regard to Information Technology this means especially the transfer of programs for Computer Aided Learning (CAL). It is one of the goals of the ATEE Working Group to encourage the international and national institutions in Europe to establish one or several 'clearing houses' for courseware. A number of obstacles exist, mainly, the incompatibilities in current hardware and systems software and the singular nationalistic approach of the EEC partners, which conspire to suggest that this uniformity is for the future, if it ever happens. For all that, it should not be entirely ignored.

A balanced policy should be adopted towards other countries. We can learn from their experiences and avoid their mistakes. We must, at the same time, be careful that we are not too unduly influenced by the happening in other countries to the extent that we adopt their systems in toto or hold up their courseware as a model, since there
is little else available. This is the easy way out. Like all courseware, there are some good, some bad and some unsuitable for Irish use. One of the tasks of ACTO would be to create a discriminating attitude, through thorough evaluation procedures, towards all courseware among the Irish teaching population. ACTO would also undertake to publish comprehensive reviews of available courseware and distribute them to schools at regular intervals.

Each courseware package that is produced should be user friendly and should contain the facility whereby the user would be in a position to modify the content at will. There is the fear among software producers that their profits may be eroded by the unauthorised copying of their work and this has lead them to take overelaborate precautions, sometimes rendering the software difficult to use. This problem could be countered fairly effectively in Ireland. We have a centralised educational system and a relatively small population. All courseware for education use would have to undergo rigorous evaluation procedures at an ACTO Regional Centre. This should provide the incentive to courseware producers to provide high-quality software for schools. On the other hand, one has to doubt that the Irish market for such software is a viable one: ACTO, like the MEP or SMDP in the U.K., would distribute materials developed within the State free to schools. Again, like
Britain, ACTO could come to an arrangement with the commercial software producers whereby they would be licenced sell ACTO produced courseware outside the State. In the case of courseware from abroad, the situation would be a little different. Depending on the distributer, ACTO could, if suitable, either purchase the licence for distribution in Ireland or purchase materials in bulk and distribute them at a reduced rate to Irish schools.

6.3.3 COURSEWARE MATERIALS : SUPPORT STRUCTURES

In the production of any courseware materials, it is vital that they be accompanied by appropriate documentation. Let us examine some of the aspects of the documentation. When a courseware package is developed for educational use, the documentation that comes with it can make the difference between a good and a bad package. The documentation should at least contain a user manual for the package, outlining the aims and objectives of the package. The manual should guide the user, in a clear unambiguous fashion through the working of the package. The package itself should be user friendly and the user should be able to make modifications easily to the package.
The rapid advances in Information Technology will have a significant effect on society and consequently on schools syllabi. The current situation is that textbooks, written on aspects of Information Technology can realistically be, at least partially, out of date between the time they are written and their publication date. Consequently, in the long-term, the role of textbooks in relation to Information Technology may become less significant, and with it, in an Information based schools curriculum, books in general could well become a thing of the past. What will replace them will be a highly sophisticated information network, where students and teachers can readily access information on any topic whatsoever and hard copies of this information can be provided at will, either by a student or a teacher. Thus it is possible that a new type of author will be needed: one who can transmit his/her 'text' electronically and continually update and re-assess the work in the light of technological change. This is the way that present day publishers may have to go, if they are to survive. Powerful wordprocessing facilities will also be available to the teacher, enabling him/her to provide relevant, up to date, classnotes on any topic in a short period of time.
Computer magazines and journals also provide the teacher with fairly current relevant information, and it is envisaged that the Computing Resource Centres set up under An Chomhairle Theicneolaiochta um Oideachas (ACTO) be in a position to provide samples of what is available in this area and have a DATA BANK of information on each, such as:

- Name of magazine/journal.
- Address/phone number of publisher/distributers.
- Cost per annum.
- Number of issues per annum
- Indication as to who the magazine/journal is aimed at.
- Report of the ACTO evaluation/review board.

It would be important for ACTO to publish a Journal/periodical, giving up-to-date information and distribute it to schools on a regular basis.

6.3.4 COURSEWARE: AUDIO-VISUAL : VIDEO

In a technologically-oriented society, education must use every
means at its disposal to make itself relevant to the world outside the school. This means that all possible aspects of technology must be utilised to enhance education. The video recorder has the potential to present the teacher with a powerful medium which can enhance education. The video could be used to advantage in the preparation of teacher training programmes, presenting material to students in the classroom, reinforcing skills, as an aid to revision, and in presenting specialist topics from industry and work. For example, robots are used in the manufacture of cars. It could happen that a student could visit a car-manufacturing plant and see them in action for himself. But not all students would have such an opportunity. Hence the video would allow these students to experience the concept indirectly. Indeed for those who had already visited the factory, the video would serve as a revision aid and would provide the student with a further insight into the concept involved. Of course, video would have other more widespread uses.

The provision of educational videos to schools would require special expertise, but one must not rule out the fact that useful work may be done in this area at school level, under the auspices of the Media Studies Department. Like the courseware, it is necessary to have a central body, such as ACTO, to co-ordinate the effort, thus avoiding duplication of resources. The work would be done by a
designated centre. In this case, however, the centre would more than likely be a third level college or a Teachers' Centre, which is equipped with audio-visual facilities. There could be an input from seconded teachers and technical advice from the technicians at the centre. The choice of subject matter would be up to the teachers involved with the centre, who would act in accordance with the needs of teachers. These needs would be identified through consultation and surveys.

The designated centre would be responsible for the maintenance and distribution of the videos and would issue a list of available videos to schools at regular intervals. The videos would remain the property of ACTO and would be loaned out to schools for a given period at a nominal fee.

6.3.5 TELEVISION, FILM: USE IN EDUCATION

The television as a medium in education has never been fully utilised. There was the promise in the 1960's that with the advent of Telefís Scoile, education was about to enter a new era. This potential, however, never realised. One reason could be that television at that time was a new medium in Ireland, had not
infiltrated every home and was rather limited in its presentation. The situation today is radically different. We have coloured television, an ever increasing variety of programmes, a choice of television stations, allowing us to access television programmes from Britain as well. Satellite television is promised in the not too distant future, enabling us to access television world-wide. We can now see is no longer the limited medium of the sixties, but a vibrant, expanding medium which has great potential in many aspects of life. It has, of course, great potential in the schools.

Television could be used to provide educational programmes to schools, especially in the area of Information Technology. Programmes could be developed in a variety of ways, by the National Television Service, Radio Teilifís Éireann (RTE), teacher organisations, the computer/electronic industry and so on. Videos could, of course, be used to tape programmes for use at a more appropriate time.

The television or film is more of a passive medium than either the computer itself or the video recorder, in the sense that it cannot be controlled easily by the user. It, therefore, should be used in a more selective manner. Television or films could be used in more specialist areas and could, for example, help keep schools abreast
of developments in technology, and could demonstrate the industrial uses of Information Technology.

Through television it is also possible to access vast data bases by means of the Information systems, such as Teletext or View Data in Britain. With the advent of Satellite television, it should be possible for Ireland to access even more data banks in other countries. It is also vital that each country or community of countries, such as the EEC, to develop their own information systems and to preserve some semblance of national identity.

Films could also be developed for use in education. The role of the film would be somewhat on the lines of the television, and can have a useful role in the education system. It may not be as effective as the video, but the craft of the film maker has indeed a role to play in education.

When a video is made and distributed for educational use, documentation should be provided to schools. This documentation should include students' notes and teachers notes, outlining the aims of the video and a summary of the content. The same could be done in the case of EDUCATIONAL TELEVISION OR FILMS. The documentation need not be all that comprehensive, but should outline the main ideas in the video, film or T.V. programme.
6.3.6 PRODUCTION OF A RESOURCE LIST

There will also be a need for a group within ACTO to provide, update and maintain a resource list of all available educational materials in the Information Technology field. This list would be distributed via the Resource Centres to all schools on a regular basis. Schools could then choose from the list and either buy or get on loan any item.

The teacher in the age of technology must avail of all available resources. The most important of all is, perhaps, is to join the teacher organisations, become active in their work and avail of the expertise available. In Ireland, that organisation is CESI and CESI has been promised consultation in any future moves towards the implementation of Information Technology in Irish schools.
6.4 SUPPORT CENTRES FOR INFORMATION TECHNOLOGY

If Information Technology is to be introduced into our education system in any meaningful form, it is necessary to provide teachers with as comprehensive a back-up service as possible. It is essential that, under a National Plan, ACTO would set about creating the structures to co-ordinate our achievements to date and to provide the necessary support to make further achievements possible. There is an urgent and immediate need to co-ordinate the many pieces of individual work that is presently going on, standardise the efforts and eliminate duplication. The introduction of Information Technology in its widest form will necessitate that teachers will need a source of information, advice and updates.

The most efficient way for ACTO to provide support for teachers would be to set up a network of Resource or Support centres around the country. As Information Technology by its nature constantly changes, these centres would have to be of a permanent nature.

The two-tier approach, suggested under the CESI Outline Plan provides, perhaps, the best strategy for Ireland. This involves the setting up of Regional Resource Centres and Local Resource Centres.
The Regional Resource Centres would be established in the centres of largest population, Dublin, Cork, Limerick and Galway. A special case for a Regional Centre could be made for the Sligo/Donegal region in view of its relative isolation from the other proposed Resource Centres and the potential of a link-up to resource centres in Northern Ireland, such as Derry and Coleraine. The population of Dublin suggests the setting up of two Regional Resource Centres, one north and one south of the Liffey. One of these Dublin Regional Resource Centres could also serve as ACTO Head Office.

The Regional Resource Centres could be linked with each other and with Local Resource Centres and schools by means of an Information Network system, based in one of the Regional Resource Centres, which could itself be linked to Information networks abroad.

This gives a total of six Regional Resource centres, for a start.

Each Regional Resource Centre should, at least, have

1. A full-time Director
2. An Assistant Director
3. Courseware developers/evaluators
4. Service technician(s)
5. Librarian/information agent
6. A secretary.

The Director would be appointed on the basis that he/she is a full-time teacher with a teacher qualification diploma/degree in Information Technology who has at least five years experience in teaching. The Director would be SECOND on a full-time basis from school to run the Resource Centre for a maximum period of five years, after which he/she would return to classroom work.

The duties of the Director would include the running and organisation of the Resource Centre, working in close co-operation with the Directors of the other Regional Resource Centres to ensure that there is no wasteful overlap of resources, providing background research for policy makers, implementing policy decisions and working in close co-operation with the staff of the Resource Centre to ensure that all schools in the Region are provided with up to date information.

The author would not envisage the post of Director as being in the permanent possession of one person as the very nature of
Information Technology will call for fresh ideas and fresh approaches. Consequently he would propose that the demanding job of Director would be rotated and transferred to someone else, possibly to the Assistant Director, at the end of the five year period. In that way we are providing the framework for the introduction of new ideas and methodology. A previous Director would, of course, be eligible for appointment at a later date.

The Assistant Director would be appointed on a PART-SECONDMENT basis. This means that he/she would work part-time in school and part-time at the Regional Resource Centre. The role of the Assistant Director would be to assist the Director in the running and organisation of the Resource Centre. But the main task that an Assistant Director would have, for the immediate future at least, would be to co-ordinate the development and evaluation of Courseware materials. This would mean, among other things, liaising with the other Regional Resource Centres, to ensure no duplication of resources/projects, and liaising with schools in the evaluation of materials. This would involve visiting schools and liaising with teachers at the Resource Centre.

The provision of good educational courseware materials is most important if we are to educate our students to take their place in
the Information Age. When setting up Resource Centres, ACTO should also set up a unit whereby courseware could be tested and evaluated. This task of evaluation could be designated to one Regional Resource Centre, possibly the one situated at Head Office at a later stage. For the immediate future, however, because of the scarcity of quality courseware, an input will be needed from all Resource Centres for the foreseeable future.

A team could be assembled at each Centre which would set about providing courseware materials. This team would be headed by the Assistant Director and would also consist of at least one teacher seconded for a particular purpose and at least two programmers, who would be graduates in the Information Technology area from a Third Level College.

The materials developed at the Resource Centres would be of a high standard and would have to pass a strict evaluation test. Materials would be rigorously evaluated both in the schools and in other Resource Centres before the final version would be sent out to education establishments.

At the present time, the cost of maintaining and repairing the computers in schools is rather prohibitive. Schools cannot afford to
have their computers maintained at regular intervals, and only seek repairs when it is absolutely necessary to do so. Therefore there is an absolute need for ACTO to provide a maintenance service for schools. Such a service would be located in the Regional Resource Centres. Service technicians, with appropriate qualifications from Third Level colleges would be employed in the Resource Centres. Their role would be two-fold. They would repair/service equipment brought into the Centre from schools and would visit schools on request and give advice on the use and working of equipment.

Their role would be flexible in that, if feasible, minor repairs could be carried out on the school premises. Service technicians may also share responsibility for maintaining and servicing the equipment within the Centre under an arrangement with firms donating or sponsoring such equipment. Standardisation of equipment in schools could, at a later date, reduce costs as replacement parts could be bought in bulk, as happened in Western Australia.

There would be one Librarian/Information agent employed in each Regional Resource Centre, whose role would be to co-ordinate and distribute available courseware to schools. Each librarian would provide schools with regular lists of available
courseware (software, video, books, periodicals, films). Each list should outline the target group and aims of the courseware.

The Librarian would liaise with other Resource Centres. Some courseware which may come in from other sources such as commercial firms or individuals, would be distributed for evaluation to the appropriate Resource Centre by the Librarian.

The Director of each Resource Centre should have the full-time assistance of a Secretary, who would also work as secretary to the Centre. The Secretary should have a qualification from a secretarial school and have the ability to operate wordprocessing systems.

6.4.1 LOCAL RESOURCE CENTRES

Local Resource Centres could be provided in areas around the country as the need arises. They would be smaller than the Regional Resource Centres, but would be linked to them. They would be manned on a part-time basis, perhaps by members of CESI on a rota basis. Courseware materials could be made available through the Regional Resource Centres to the Local Resource Centres and should
an area show sufficient demand, steps could be taken to upgrade a
Local Resource Centre to a Regional Resource Centre.

The Regional Resource Centres, being a new undertaking, will require
special attention. It is envisaged that new structures, in line with
new educational concepts will have to be borne in mind when setting
up these Resource Centres. These concepts, made possible by the
computer and related technologies do not fit into current
educational patterns. Therefore it is necessary, when deciding on
locations for the setting up of Resource Centres to provide
locations where some innovative educational projects are
possible, such as the colleges of Education at Primary
level, Education Departments of universities, or specialist teacher
training colleges, such as Thomond College in Limerick. Where it is
not possible to set up Regional Resource Centres in these
locations, a building will have to be provided to house the Regional
Resource Centre.

Local Resource Centres could be located in the existing Teachers’
Centres, or other institutions which in the past have provided
resources/facilities to teachers and existing centres, such as
Ionad Riomhaireachta na Scol in Cork. Third level colleges, involved
in education which are not designated as Regional Resource
Centres, could become Local Resource Centres as the involvement of colleges engaged in the pre-service training of teachers is critical.

It is also important that the Director of the Regional Resource Centres has a free hand in the operation of his/her work. If a proposed Regional Resource Centre is to be set up steps should be taken to avoid any possible areas of conflict and all interests should be consulted prior to the setting up of the Centre.
6.5 HARDWARE CONSIDERATIONS

There are many possible methods of providing schools with access to suitable hardware to enable them to engage in computer activities. When we speak of hardware we must take into account the items that are available today. It should be the goal of ACTO to provide schools with the best possible hardware available at a given time, in so far as this is feasible. The rapid advances in the hardware and the constant shortage of courseware field presently prove an obstacle to schools who wish to keep abreast of developments in technology.

Batch processing using various forms of card input, time sharing by means of terminals attached to a central computer and, since the late seventies, the microcomputer have all been tried with varying levels of success. The batch processing facility as yesterday's technology is irrelevant to the world of today. Though used in the early days of computing in Ireland, that is the early 1970's it was quickly abandoned when the microcomputer became available.

Time-sharing terminals which connect to a central computer are currently used by a small number of schools, the majority of them supplied by a private computer firm to schools in their local
environment (mainly DEC in Galway and Clonmel). Time-sharing terminals, probably via microcomputers, may have a significant effect on educational computing at a future date.

Therefore, for now and the foreseeable future, the dominant hardware for schools will be the microcomputer. Frequently the advocates of a particular type of hardware have pushed that hardware as 'the solution' to schools computing hardware problems. Hardware suppliers are currently spending vast sums of money in attempting to influence potential buyers in the education field. There is the danger that some academics, consultants, and so-called experts have an interest in this field too. A conflict of interest may exist. They are employed by computer firms and at the same time they are attempting to advise schools on the acquisition and implementation of educational computing.

There is no one solution to computer hardware problems for schools. The truth is that the things that have proved successful at a particular time, may be components of an evolutionary solution to the schools computing problem, but they are not a complete solution for all time and never can be.

In seeking an 'ideal' solution to schools hardware, it is necessary
to examine what is presently available, see the problem areas and hope that the next generation of microcomputers or whatever will eliminate some or all of them. The constant evolution of technology will ensure that our expectations will never be satisfied, that the computers of today are but a shade of what may be available tomorrow and will have a normal life-span of at most 3-5 years.

6.5.1 HARDWARE PROVISION

The present situation with regard to computing in Irish schools is one of confusion. Every second level school in the country now has at least one microcomputer. The APPLE II or, more recently, the APPLE IIe, were the only microcomputers distributed by the Department of Education and, APPLE compatible courseware only is currently being sponsored by the Department. The manner in which the hardware was distributed whereby schools which had bought equipment out of their own funds only received enhancements produced a certain amount of bitterness, which makes it virtually impossible for the Department of Education to ascertain the true picture of what is currently happening in schools, especially with regard to the amount of hardware and curricular use of
computers. The fear is that by such disclosures, a school may be disqualifying itself from acquiring further equipment from the Department of Education. This fear has also filtered down to the Primary level, despite assurances from the Department of Education that no computers will be distributed by them to schools.

Schools realise that computers have a role in education, but need guidance as to how to use them in a proper manner. As of now, no such guidance is available outside CESI. Schools, mainly second level, have, in the last year or so, have invested quite heavily in the purchase of hardware. As the cost of the APPLE was prohibitive, schools turned towards 'networked' systems such as the COMMODORE 64 or the BBC to give them the much needed extra equipment. Both the Smith/Winning Report (1985) [156] and the ASTI survey (1985) on computers in second level schools [157] clearly illustrate that in the schools where more than one microcomputer exists, the majority microcomputer is not the APPLE. ACTO would have to take this situation into account.

In relation to the equipment supplied by the Department, there appears to have been a difference of opinion between APPLE and the Department as which of them was responsible for maintaining the systems during the period of warranty. The result was that
Consequently, in the case of all systems, the cost of maintenance falls on the school. It is impracticable for a school to take out a maintenance contract on the grounds of cost.

The issue of what type of computer is best suited to the Irish educational situation would be a matter for An Comhairle Theicneolaiochta um Oideachas (ACTO). However, for now at least, the current situation would have to be taken into account. The problem that currently exists is that none of the available microcomputers are compatible with each other. The software for one will not necessarily run on another. This can necessitate the purchase of a separate set of software for each make of microcomputer, which is a costly exercise. There is also the fact that the microcomputers that are currently available, with the exception of the BBC microcomputer, were not specially built for educational purposes. They are general purpose computers for the general public, who will use them for a variety of applications, in business (invoicing, word processing, data retrieval, control for example), in the home (games, budgeting, accounts for example). The manufacturer's aim is to maximise sales by selling to as wide an audience as possible. The educational sector represents a vast potential market, with the spin-off effect on the home computer.
market. (Parents would be more eager to buy a similar type computer for the home.)

The very general nature of the microcomputers available today makes it almost impossible for the manufacturer to service adequately any one sector. A serious software problem exists on all levels. This is particularly true with regard to education. There is a scarcity of software: what commercial software there is is not of a very high standard and is mainly unsuitable and educationally unsound for the age group that it is intended for. As well as that, much of this software has to be imported from abroad, particularly from the U.K or the U.S.A. which means that the purchaser may not have the opportunity of reviewing the suitability of the product before purchase. The cost of available software is also a major inhibiting factor.

Under a National Plan, it may be that all these features would have to be considered in relation to any hardware made available to schools. The hardware would, in the long term, also have to be standardised in some way, ideally so that the same software could be used on all hardware. This may mean, as in Ontario, Canada, that a new microcomputer for educational use may have to be commissioned AS A LONG TERM INVESTMENT, with a potential spin-off effect of a new
industrial sector. As we have seen centralised educational systems such as those of France and Western Australia have seen the advantages of standardisation.

In the short to medium term, at least, it will mean that some code of standards will have to be adopted for microcomputers which are to be used in schools for educational purposes. This may mean that, for the present at least, different versions of courseware would have to be supplied as is the case in the U.K.

The centrally controlled Irish educational system means that computing equipment acquired by a school can be standardised and a network of Resource Centres can be set up, which, among other things, can employ maintenance technicians. The standardisation of equipment can reduce the problems of incompatible software and the bulk purchase of equipment means that the cost per unit is largely reduced. As of now, the present situation will have to be acknowledged. The standardisation of equipment, as the author sees it, does not mean, at the moment, that we adopt one type of microcomputer as the standard, thus giving a monopoly in the education market to one manufacturer, but that we lay down minimum standards for a microcomputer to be listed as an educational microcomputer. These standards would need to be continually updated.
in keeping with the pace of technological change and updates to existing equipment should be made available to schools at nominal cost. The half-price offers of the U.K and Western Australia would prove very attractive to Irish schools. The trend, as in Ontario and Scotland, towards standardisation through the use of a powerful operating system, such as UNIX, is also a long term possible option for Ireland.

6.5.2 HARDWARE: PRACTICAL ISSUES

At school, those students who learn programming should develop style and technique in both high-level and low-level languages. The centralised Irish education would do well to standardise, as did the French, on one powerful language, without dialects.

In France when the Computer Science Department of Ecole Superieure de L’Education received a contract from the Ministere de l’Education for developing a programming language for schools, the following specifications laid down were [228]:

* that the language use the French vocabulary,
* that it be highly interactive,
* that it be simple enough for a beginner to learn easily, yet sufficiently sophisticated to be effective for experienced programmers.

* it should have an extensive set of functions on character strings for literary disciplines.

* it should also have a sophisticated file-handling system and have a very extensive set of error messages.

Western Australia also has a centralised Education system and as part of their policy of standardisation the Education Department requires the machines approved for use in its schools must support a sufficiently powerful version of BASIC 'so as to allow the principles of sound programming design to be adopted'. [229]

Norris (1983) [230] calls for a structured BASIC with a line editor, syntax checking at program time, structure checking at run time, MERGE and CHAIN facilities, procedures which can be closed, and executed only deliberately, repetition structures which can be terminated at the start, middle or end of the structure, meaningful variable names and indentation of structures.

With the distribution of the original microcomputers, schools were...
also given the COMPUTER language COMAL, which is a structured BASIC developed in Denmark for educational purposes. COMAL operates on the APPLE under the CP/M operating system, needing 64K of memory, which meant that, for the original APPLE II systems a further 16k memory card and a 2-80 card had to be purchased. The language card and 2-80 card were issued for one APPLE only. Thus a school wishing to use COMAL on all APPLE systems had to purchase the up-grades themselves. This could add up to £400 per APPLE system and could put a severe strain on a school's financial resources. In the case of other computers, the COMMODORE 64 has a version of COMAL. Unfortunately, it is not readily available, is not entirely compatible with the APPLE version and documentation is scarce, while COMAL for the BBC has just become available.

The author having upgraded four APPLE II microcomputers to take COMAL and having used COMAL extensively agrees that it does provide students with good programming techniques and habits and on those ground is most suitable for educational purposes at second level. He must, however, express regret that because of the costs involved and the lack of support for COMAL on the part of the Department of Education, the language has not, to date, achieved widespread use in schools. The reason for this can be traced to the fact that COMAL was introduced to schools by the Department of Education without
the provision of adequate structures in terms of teacher
training, materials and support.

For the 1985 week long summer courses in computing, organised by the
Department of Education for second level schools, the course content
included the APPLEWORKS package of generic software and the
introduction of yet another programming language called
micro-PROLOG. Concern must be expressed that tutors on these courses
received but one week’s training themselves in a totally new area
before giving the courses. While accepting that the technology is
advancing at a rapid rate, one must question that Department’s
over-emphasis on programming, especially the use of a language that
is not that easily available on all microcomputers that are
currently available in the schools. Micro-Prolog, as issued by the
Department runs on the APPLE IIe does not run easily on an APPLE II
or on any of the other microcomputers that are currently in our
schools. As with COMAL, the structures do not exist for the
implementation of micro-PROLOG in schools.

It appears that, for the present at any rate, that microcomputer
configurations for schools will be considered in terms of their
economic, management and educational features. With any type of
equipment, there will be advantages and disadvantages in relation to
the use for which the equipment is intended. In the school situation there is scope for network and standalone configurations. The 'networks' installed in schools are the COMMODORE 64, the BBC and, more recently, the APPLE. Nearly all second level schools also have their standalone APPLE.

The concept of a Local area network (LAN) of microcomputers is relatively new, but is an important one in the area of classroom computing. A LAN usually consists of a number of microcomputer workstations linked together to enable them to communicate with each other and to share the use of disk and printer units. A workstation consists of a microcomputer and a visual display unit.

Mc Lean [231] defines a network as an interconnection of computer equipment to obtain increased functionality from separate devices. Components of a network can include microcomputers, mainframes, shared peripheral devices such as disks and printers, and communications equipment. A network, by definition extends over some geographic area. Extensive networks may take in the whole world. This, however, is not the definition of a 'network' in the present Irish context.

A LAN spans a limited geographic area, typically limited to one
building. The LAN, like all other options is not the complete schools solution to the hardware problem, but it has features that are of value in some classroom situations. The simplest justification for networks is that they can save money, through sharing of equipment. The type of computing configuration that is available influences the nature of classroom interactions that may occur. Standalone and LAN configurations each have their advantages and disadvantages for particular applications.

The ability to share some of the hardware components between users is one obvious advantage. At present, the 'network' systems that are within a school’s budget (in Ireland this is typically the COMMODORE 64 and BBC network systems) do not permit access to a hard disk, because of the costs involved.

A hard disk does allow more effective LAN use by providing faster access to stored information as well as access to a greater amount of information. Schools cannot, at present afford to purchase a hard disk. It is, however, possible, within the framework of a National Plan, that schools would be provided with access to hard disks, located centrally. We must bear in mind that the schools network that are around today will be greatly enhanced in the not too distant future. In most classroom applications the printer is used
infrequently by the students. The network offers the practical solution of allowing a shared use of one or more printers.

The LAN provides the teacher in charge with a powerful classroom management tool. A menu-driven user access facility can be set up to allow students access to programs that the teacher has planned for them to work on. By setting up appropriate procedures, students of different levels can be offered different menu options, some rigidly defined, others more open.

With the standalone microcomputers in a classroom/laboratory situation, problems arise with the management of disks. The problem of maintaining a class set of disks, with back-up copies is enormous. The LAN overcomes these equipment management problems. Users can be provided with access to separate files or they can be allowed to work on a shared file, with access to continually updated information. This is not possible with stand-alone microcomputers. The BBC/ECONET system allows a number of other interesting management facilities. The teacher can disable student work-stations when the attention of the class is required. Several LANs allow the loading of software from workstations to be controlled by a teacher from one of the stations on the network. A network can then be prepared for class use with a
minimum of physical movement by teacher or student if this is required.

The majority of schools set up the initial LAN equipment in one room. As the school use becomes more widespread, ideally the network could be extended to include nodes in nearby locations into which workstations can be attached when the need arises. This is not possible with all network types. The concept of a total school network is for the future as is the advent of truly portable microcomputers.

The existence of communications facilities on a network would allow for remote access to and from the LAN system. This option is not a reality with the networks currently in the schools, mainly on the grounds of cost. The ideal LAN would be the one which allowed more than one type of microcomputer to be connected to a network. It is unlikely that this will happen in the foreseeable future, if at all.

The installation of LAN in a school requires a room (which can be difficult) and will usually require some modifications to the electrics, general environment (installation of benches, workspaces, etc.) and security arrangements. A LAN will also require network wiring to be installed. Once installed, it is not easy to move a LAN
around from room to room, a fact that may influence approaches that are used in the classroom.

The teacher, operating a network will require certain skills. The skill level depends on the sophistication of the network and the degree to which the more sophisticated features are used. It should be possible to run a network as a 'turn-key' system, which means that when the equipment is turned on a menu appears on each workstation to tell the user what to do next. This, so far, does not appear to have happened.

The standalone microcomputer system is transportable and can be used in any location where there is an appropriate power supply. The transportability is paid for by the additional cost of individual disks and, possibly, print units for each system.

Multiple standalone systems used in a class situation may require multiple copies of software on disks, or may require that disks be passed around between users. For some applications this problem is decreased by the availability of software in Read Only Memory (ROM) form.

The best possible combination that a school could have at the
present time, would appear to be a combination of standalone systems and a network. Among the priorities for the future, it is the provision of more powerful sophisticated microcomputers as they become available and the reduction of telecommunications charges to enable educational establishments to link up to networks and Databases and to each other.

Statements about the specific cost/performance features of microcomputer equipment will not remain valid for any great period of time. In general, it can be anticipated that users will continue to be provided with more computing power per unit cost hardware. Software advances will also be made. Some of the features available on the more expensive systems will continue to migrate down to the lower price systems. Some of the cheaper microcomputers are really consumer items offered in a very competitive, volatile market. Where the cost of a microcomputer is under £200, issues such as the repair of equipment, against replacement, take on a different perspective to that for £2000 systems, but in the current school situation, where finances are scarce, maintenance costs must still be a consideration.

Limitations with regard to features do not necessarily hold for all low-cost microcomputers, particularly for systems that achieve a
large market penetration and hence attract the attention of peripheral and software manufacturers. The APPLE, Commodore 64 and the BBC systems are examples.

In Irish second level schools, the current most popular equipment are the APPLE II, the Commodore 64 and the BBC microcomputer and this situation is likely to remain for some time. There is no way, under present structures, that the computing power available on, for example, the APPLE LISA or the IBM PC, be utilised in schools. The cost is prohibitive, even though the greater computing power of these systems provide the user with facilities that are simply not feasible on lower cost systems.

To the question of the number of computers per school there is no one answer. It depends on the degree to which the computer is used to complement or replace manual information processing tasks. If we were to consider the target position as being the case where every student in a school would require the use of a computer during the school day, then we should be discussing the provision of computer laboratory facilities in our schools. With regard to existing schools, this brief would fall to ACTO under the provisions of a National Plan, as has been already discussed. Sanction would then be needed to build extra rooms. In the case of new schools, it could be
made a necessary pre-condition that that computer laboratories be included in the overall plans of the school, as are Science laboratories at present. The number of laboratories necessary would really depend on how the Information Technologies are incorporated into the school curriculum and the size of the school.

Let us assume, for the moment, that every school in the country was, under a National Plan, adopting an Information based curriculum, thus creating the need for the provision of appropriate hardware. The amount of hardware required would then depend on the school size. The first problem to be encountered is the question of student access to the machine.

Chester [233] creates a simple equation relating the number of available keyboards (K) and the total time for which they are available to the students during the week (T), with the number of students taking computing (N) and the length of time each student is allowed to use the computer (t)

\[ K \times T = N \times t \]  

(1)

He then takes a couple of examples to show some of the extreme
possibilities. In a school where just 50 Leaving Certificate students (two classes) take computing for 1.5 hours per class, with just one APPLE II available during those classes, then each student would obtain:

\[
\frac{K \times T}{N} = \frac{1 \times 180 \text{ mins}}{50} = \frac{180}{50} = 3.6 \text{ mins}
\]

at the keyboard. Extending availability by 2 hours per day (after school hours) would add an extra 12 minutes to a pupil's exclusive use of the computer. If each of the 50 students were to have one half hour's use of the computer per week, during class time then:

\[
\frac{N \times t}{K} = \frac{50 \times \frac{1}{2}}{3} = \frac{25}{3} = 8 \text{ computers}
\]

would be required.

By using equation (1), Chester claims that any school may thus
calculate the amount of use that each student may have, or the quantity of hardware needed to support a given level of activity (viz. total student numbers, total class time etc).

Sandery [234], on the other hand argues as follows:

If a total of one hour per day is assumed, and it is also assumed that the computer time available can be rostered, and that half of this time can be effectively used with the computer, then for a school of 250 students 125 hours/day access time is required. This can realistically occur in a 7 hour day leading to a need for 18 workstations, that is one microcomputer is required for every 14 students. For a school of 750 students, a total of 54 microcomputers would provide half an hour per day per student. Sandery also argues that all the micros need not all be the same: a range of systems would provide support for a range of activities.

6.5.3 NEEDS OF IRISH SCHOOLS

If Ireland is to adopt an Information based curriculum, then it is essential that optimum use be made of the available hardware. In
such a curriculum, each student must have access to a computer for at least 1/2 hour per week. This should underline the need for computer laboratory conditions. Not all school work will necessitate the use of a computer. Other school activities will necessitate either pre-computer preparation or activities not associated with computer use at all.

Since typical class size in Irish Second level schools is, on average, 30-40 students, it would be necessary to have, at least, one computer between each two students. This means that each class would need, on average, 15 workstations. On the assumption that a school of 600 students had three computer laboratories, a class could be timetabled for each laboratory for each period of each day. This would mean that a minimum of 45 workstations would be needed for a school of this size. The number of workstations would vary according to the size of the school and the intended use of the computer equipment.

These workstations, in the long term, would need to be all of the same type or support the same software. We could have different applications: terminals, possibly microcomputers, could be linked to mainframe computers situated in other locations such as Regional Resource Centres and third level colleges or schools could also
have access to databases located at a central point such as a Regional Resource Centre. There could also be the facility for schools to link up with each other and share resources, such as software and courseware in co-operation with a Regional Resource Centre.

The procuring of equipment is one of the great obstacles that must be overcome if we are to provide a society that is able to function in the Information Age. The only way that the problem can be, even partially, overcome is, under the terms of a National Plan, in which the costs of resources are spread among various groups and organisations. Among these would be included Government Departments of Industry, Labour and Education, the EEC Social Fund, the Youth Employment Agency, AnCO, Private Industry and Parents Associations. It is only through a co-ordinated effort on the part of all interested groups that schools will be able to adequately equip themselves for the Information Age.

There will have to be incentives to Industry to encourage them to sponsor computer equipment to schools. Some incentives could also be provided for individuals, such as teachers and school authorities, who wish to purchase equipment for educational use. This could be through a generous system of tax reliefs, as has been done in the
One of the basic considerations must be to ensure that all children are given the same opportunity for advancement in the Information Age. It is likely that students from the lower income families will have no opportunity to gain access to a computer other than the time made available at school, whereas children from higher and middle income groups will have the use of computers at home. Therefore, when distributing computer resources, it is most important that schools which cater for the lower income groups, should not be disadvantaged. For example, it is unlikely that Parents Associations could afford to furnish these schools with computers. It is also likely that business interests would gravitate towards schools catering for the other social classes.

If this were to happen, an even wider gulf than at present, would be created between the advantaged and disadvantaged members of our society. The National Plan must ensure equality of opportunity for all.

Schools may have to reach a compromise between the computer resources that they may consider to be desirable and the need to fund other resources. Several priority options may be
They may purchase the greatest number of units to provide at least some hands-on experience for the greatest possible number of students at a time or make use of available equipment spread thinly over a wide curriculum range or make use of available equipment in as in-depth manner as possible in a limited range of applications. It is vital that teachers be adequately prepared as an ESSENTIAL first step.

Experience indicates that as computer-related skills are acquired, the users' horizons expand and greater computing power is a generally expressed need. As student access to microcomputers increases, visual display units should meet appropriate standards set for industry, desks and chairs should be appropriate for computer use, and the computer laboratory environment should have appropriate lighting, good acoustics and be kept clean and tidy.
6.6 NATIONAL PLAN: FINANCIAL IMPLICATIONS

In attempting to estimate the costs involved in implementing a National Plan for the provision of Information Technology in our schools, it may be helpful to break them down into the following areas:

* Teacher training/secondment of teachers
* Provision of Resource Centres
* Courseware development
* Provision of hardware
* Financing of research projects
* Grants to teacher training colleges
* Administration

6.6.1 START UP COSTS

Under the terms of a National Plan, it would be necessary to give the Colleges of Education and University Education Departments, together with Specialist teacher training colleges an
increased role in the provision of teacher training. As well giving as pre-service training, such colleges would also become more formally involved in the area of in-service education. To begin with, the teacher training institutions would have to be equipped with laboratory facilities for the Information Age. This would mean the provision of a wide variety of equipment that would be currently used in schools, together with quality courseware either developed by or passed as standard by ACTO. In the case where a Teacher Training College was not a Regional Resource Centre, finance for this operation may have to come from Central Funds.

Under a National Plan it is vital that Teacher Training institutions be equipped at the earliest possible time. In relation to the Colleges of Education (who are involved at the Primary level), this would initially necessitate the installation and up-grading of a relatively small number of computers and, of course, the provision of extra personnel.

It is envisaged under the proposed Plan that teachers, seconded from schools, would be replaced by newly trained teachers who would have a good grounding in Information Technology IN ITS WIDEST SENSE AND ACROSS ALL SUBJECT AREAS.
In the course of their studies, trainee teachers would also work on research projects which would benefit teaching in the long run.

A radical change in policy on the part of the Department of Education towards the secondment of teachers would be necessary for the National Plan to work. Teachers would need to be freed from classroom duty at Primary and Secondary level for the following reasons:

* To take positions as Directors of Regional Resource Centres
* To take positions as Assistant Directors of Regional Resource Centres
* To take positions as courseware developers/evaluators at Regional Resource Centres
* To evaluate hardware for use in schools
* To take up positions as trainers of other teachers.
* To attend courses of at least one year duration, in order to obtain a basic qualification to teach Information Technology in school.

The secondment would be for teachers at Primary and Secondary level. Suppose that ACTO embarked now on a ten year plan to
introduce Information Technology across the board in all Primary and Second level schools. This would mean that by 1996 every teacher in every Primary and Second level school would have to be trained to a minimum level by then.

The costs involved would be, assuming that seconded teachers would retain incremental salary, be that of teacher replacement. As these replacement teachers would be, in the main, young teachers straight from training colleges, they would come in at the bottom of the salary scale. Assuming six Regional Resource Centres, the average cost would be in the region of £204 000 per annum, as can be seen from TABLE A.

### TABLE A

SECONDMENT COSTS AT REGIONAL RESOURCE CENTRES

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 x £9 000 = £54 000</td>
<td>Director replacement in schools.</td>
</tr>
<tr>
<td>6 x £7 000 = £42 000</td>
<td>Assistant Director replacement</td>
</tr>
<tr>
<td>12 x £9 000 = £108 000</td>
<td>replacement for courseware</td>
</tr>
</tbody>
</table>
With regard to Regional Resource Centres there would be the set up cost (wiring, furniture, telephone and so on). The cost here would be approximately £2,500 per Regional Centre giving a total of £15,000 for six centres.

If there were initially 10 Local Resource Centres, these could be set up for an average of £1,000 each, as some of them could be sited in existing Teachers' Centres.

At the Regional Resource Centres it may be necessary to employ a secretary. In some cases, where a centre is attached to a Teacher Training College, it may be possible to obtain secretarial assistance on a part-time basis. Thus at maximum six secretaries would be necessary at the Regional Resource Centres. The cost here would be approximately £8,000 per centre. In the case of Local Resource Centres, secretarial assistance may be available in places such as Teachers' Centres. In other cases part-time secretarial assistance may have to be obtained.

The Resource Centres would be heavily dependent on the
computer/telecommunications industries for support. Under the terms of a National Plan, it may be possible for computer firms to provide the centres with all possible computer equipment that is currently used in schools. A wide variety of equipment is most important in order to avoid a monopoly situation in education. The firms which donate or sponsor equipment to the Resource Centres could also be responsible for its maintenance. As such centres would be linked to each other and to schools and third level institutions, the communications costs could be great. Therefore, under a National Plan, the Telephone Authority, TELECOM EIREANN, could waive or reduce charges for educational use. Running costs could be in the region of £3 000 per centre.

Each Regional Resource Centre would need to employ two service technicians at approximately £10 000 each.

6.6.2. **COURSEWARE DEVELOPMENT/EVALUATION**

Each of the six designated Regional Resource Centres would have perhaps two teachers on secondment for the purpose of developing or evaluating courseware for use in schools. In order to avoid duplication of scarce resources, each Centre would assume responsibility for certain sections.
Under the terms of a National Plan, strict courseware standards would have to be adhered to. It should not be the intention of courseware developers in the Resource Centres to attempt to produce all materials for use in schools. That is an impossible task. It can be assumed that the commercial sector and private individuals would wish to become involved in marketing courseware to the educational sector. It is important, then, that all courseware materials would be evaluated at Regional Resource Centre before being marketed to schools. This can be mutually advantageous to both parties. Schools will know that courseware of high standard is available and be able to identify the target group. Commercial courseware developers, on the other hand, will be encouraged to develop high-quality software. This approach has been successful in the State of New York. [236]

The Regional Resource Centres would each need financing to support running costs of approximately £4 000 per annum for the running and organisation of workshops/seminars and the purchase of materials, such as magazine, books and courseware from abroad.

6.6.3 TEACHER TRAINING NEEDS
There are approximately 40,000 teachers employed in Irish Primary and Second level schools. Of these over 20,000 are employed in the Primary sector. Therefore the task of training all teachers is an enormous one. Yet, the task must be tackled if schools must be brought into the Information Age. Unfortunately, financial constraints do not permit a mass secondment of teachers. Nevertheless, training must be provided for as many teachers as possible.

There are at least twenty third level colleges which could be equipped and given the personnel to conduct such courses. These include the Colleges of Education, Universities (Education and Computer Science Departments combining), Specialist teacher training colleges, the N.I.H.Es at Limerick and Dublin, and the Regional Technical Colleges. It may be possible that some AnCO training Centres could be made available as well.

Teacher training institutions must be equipped and staffed with extra personnel from a teaching background with a knowledge of Information Technology and a core of teacher trainers must be identified and used in the training of their colleagues.
One way to obtain such a group of teacher trainers would be to set up courses on the lines of Guidance Counsellors in all designated teacher training establishments. Such teachers would be seconded for one year from schools (on full pay) in order to attend the course. These teachers could then be used to train other teachers either in their own locality or their own school. This process would continue until all the teachers had some training. After that, the situation would be reviewed and perhaps, retraining would be necessary.

It is not possible to give accurate figures for the cost of teacher training, but if 4,000 teachers could be seconded for each of ten years, the cost of replacing them could be estimated at £40M per year. (They would be replaced by young teachers fresh from training colleges, with a knowledge of the educational uses of Information Technology).

6.6.4 SUMMARY

In all it may cost in the region of half a million pounds to set up the resource centres. It may cost approximately £20–£40 million per annum over a ten year period if we are to re-train all the teachers to adapt their teaching to the Information Age. When one
considers that £900M is currently being spent on education and that there is a wasteful overlap of resources with the Training sector, if one includes the purchase of hardware for schools, it should be possible to find another £100-£200m through a re-distribution of resources from Education, Training and Industry, money from the EEC Social Fund and the Youth Employment Agency. The youth of our country are our greatest resource. The money spent on their education is money well spent.

In order to get the plan into action, money would have to be spent on a large-scale publicity campaign to convince parents, teachers, teacher unions, school management and the industrial sector that it is vital that a sound Information Technology base be established in our education sector and that everything possible must be done to create conditions favourable to its introduction.
CHAPTER VII

7 TEACHER TRAINING

Now that most second level schools in Ireland have at least one microcomputer system the most urgent task to be tackled is the provision of an adequate structure of teacher training courses to cater not only for present needs but also for future needs. There is an immediate need to provide many teachers in schools with at least an elementary degree of knowledge of the use and functions of computers in Education.

Many computers given out by the Department to schools in the 1981/82 periods are to this day either under-utilized or not utilized at all. This phenomenon is known as "the computer in the cupboard syndrome" and is familiar to those of us who have been involved in computer education for some time. If one reflects for a moment on the apparent political expediency which brought the scheme into being initially one should not be too surprised at the results (there was a General Election in 1981 and two in 1982). The schemes were devised to give the maximum political advantage and
did not appear to be too concerned about the use of educational or otherwise. The microcomputers were put to within the schools. Consequently, many schools were ill-prepared to receive the expensive computer equipment they were allocated, not having the personnel who had adequate knowledge to pass onto their students or the commitment to acquire this knowledge. Meanwhile those schools, where a certain level of expertise existed and who had bought computer equipment out of their own funds were discriminated against. They received no computer. During the 1984/85 school year APPLE Ile microcomputer systems were issued to those remaining second level schools who had not already received an APPLE system from the Department. These systems were not allocated, even as enhancements, to all the other second level schools in the country. The APPLE Ile systems are up-grades of the original APPLE II microcomputers, which meant that the software for the new systems was not always compatible with that of the APPLE II, which caused still more confusion among the teaching population. To sum up, these schemes appear to have been hastily devised and ill-planned and display many of the aspects, which, in relation to the introduction of Computer Studies, are best avoided.

The teacher training effort, as has already been outlined, has been largely borne by members of CESI, who have given their time.
voluntarily over the years. While this situation was manageable, but unsatisfactory when interest was small in the initial years, the current situation, with little or no official support from the Department of Education is completely intolerable. The summer courses conducted by the Department since 1981 have done little to provide teachers with the confidence needed to use their systems to the full, having concentrated on mainly programming in COMAL and PROLOG on the APPLE.

There are now many courses springing up to cater for the needs of teachers. The problem that currently exists is that there is no proper structuring, standardising and monitoring of such courses. O’Connell[237] makes the point that there is an immediate need for as many teachers as possible to attend properly supervised and accredited courses.

The Department of Education would, perhaps, claim to be tackling the problem of in-service education. It is, after all, within their brief. As we have seen the effort is totally inadequate and does not involve the training of all teachers. Something more is needed if we are to undertake the massive teacher re-training that is necessary if we are to provide the children in our care with the tools
necessary to take their places in the Information-based twenty
first century. The identifying of evolving teacher needs and the
coo-ordinating and standardisation of teacher training courses would
be another of the major tasks that, under the terms of a National
Plan, would involve an authority such as ACTO. It is vital that a
PROPER TEACHER QUALIFICATION in Information Technology be
implemented.

7.1 EVOLUTION OF COURSES FOR TEACHERS.

In chapter IV we have briefly discussed the courses provided for
teachers up from 1971 up till now. It is our intention in this
section to discuss the content of these courses in more detail. The
ever early courses were organised by the Department of Education and
conducted under the direction of Professor Bajpai at University
College, Galway. As was the trend at the time, these courses were
organised for teachers of Mathematics and Science
subjects. Teachers, in the main, learned the basics of programming in
FORTRAN. In these pre-micro days, the expectations of teachers were
not high. Computer Education was a new topic. There was no expertise
in the schools, and very little knowledge, certainly in the area of
computers in Education existed in Ireland. Teachers who attended these courses were greatly encouraged by the enthusiasm, advice and practical expertise exhibited by Professor Bajpai and his team. Because of this, teachers on these courses were motivated to see the necessity for Computer Education for the future. As a direct result of these courses the Computer Education Society of Ireland (CESI) was born, and since then CESI has been primarily responsible for the promotion of Computer Education in Ireland. It can be said that these early courses laid the foundation for Computer Education in Ireland. As well as providing for the establishment of CESI, the courses also provided a certain core of native expertise, who subsequently went on to provide other courses. It is most important to remember that, at this time, there was active encouragement and support from the Department of Education, which ultimately led to the pilot scheme of 1974.

CESI very quickly became aware of the need to provide further courses. Courses were organised MAINLY IN DUBLIN under the Mathematics Teachers Association, and the Diploma Course in Computer Practice commenced at Trinity College came into being as a direct result of this perceived need. The need to obtain processing facilities was an urgent one and many avenues were investigated. CESI were attracted to the ICL-CES scheme in th
U.I. and co-operated with the Department of Education in organising a one week training course for teachers. in whose schools the pilot scheme was to be conducted. At this course, CESI members first provided lectures for their colleagues. CESI had obtained a certain stature. The course used CESIL, which was a LOW LEVEL language, used on ICL computers. Thirteen schools took part in the pilot scheme, which proved quite stimulating for the teachers involved. The success of the scheme can be attributed in no small way to the active support of industry. Firms which had ICL computers provided the punching or processing facilities free of charge.

When the pilot scheme was not continued the following year, CESI were disappointed. But the greatest disappointment of all was the inability of the Department to provide the necessary finances for inservice courses in 1975. Previous to this, as has been pointed out already, teachers who attend inservice courses are entitled to travel and subsistence allowances. (Inservice courses are generally held over a five day period during the summer vacation and the total Departmental financial allocation to such course is dependent on the budgetary constraints of a given year. From this allocation must come travel and subsistence allowances and all other costs, including lecturers' fees.)
A motivating factor in getting teachers to attend inservice courses is the payment of travel and subsistence allowances. Thus in 1975, the withdrawal of the Department from inservice courses posed a problem for CESI. Bajpai had strongly emphasised to CESI that Computer Education in Ireland is best promoted by the Irish themselves and that CESI as the representatives of practicing teachers had a vital role to play. On the other hand, all computer courses had until then been approved by the Department of Education. Therefore, CESI came to the conclusion that it was important that the awareness of Computer Education that had been created be maintained. It therefore organised a course at Colaiste Cholm.Swords, Co. Dublin, and from then until 1981, when the Department again became involved in the organisation of computer courses, it was left to CESI to organise the courses for teachers interested in computing.

In reality, the early thrust of the teacher training effort was in or around Dublin. There was, in particular, the Trinity College Diploma Course and the 1976 CES/CESI pilot scheme involving Dublin schools. The Trinity course had a particular influence on the spread of computer expertise in Dublin schools, and it is not surprising that the teachers with the most expertise are located in this area. It was at a later stage that CESI members organised courses.
elsewhere in the country.

In the mid 1970s new third level colleges (Regional Technical Colleges (RTCs) were built. At this time also, the National Institute for Higher Education (N.I.H.E) was becoming operational. Each of these colleges was equipped with a Digital PDP8 Minicomputer. CESI investigated the possibility of getting 'hands on' experience at these colleges. The response was favourable, and in many cases, teachers did manage to gain access to these facilities. In 1976, CESI in an effort to promote computer education outside Dublin opted to use the facilities at the N.I.H.E. Limerick. From 1976 to 1980, CESI organised a course in Limerick, which was the only inservice course in computing at that time. The courses, in the main catered for around fifty teachers, evolved over time, and many lessons were learned (the main one being that practicing teachers learn best from their colleagues). At this time, the computer language, BASIC, was considered most suitable for educational purposes. The idea of a LOW-LEVEL language was receding. BASIC was now available on the PDP Minicomputers in third level colleges. Digital, who had manufacturing plants in Galway and Clonmel, were interested in becoming involved in education, and as a follow-up to their LOW-LEVEL language, CESIL, BASIC was available on ICL computers.
Initially the courses were two tier (beginners and intermediate) and by 1980 had become three tier (beginners, intermediate and advanced). Generally CESI provided lecturers for the beginners course. For the others it availed of the expertise of the ICL-CES team from the U.K. and C.C.H Dawkins (a former vice-Chairman of CESI) who was then based in Felsted in England.

By 1978, the microcomputer was beginning to make its mark in education. For the first time, schools now had the possibility of acquiring their own processing equipment, and this influenced the course content. Courses were still in BASIC but became more micro-oriented. In 1980, for example, many of the CESI courses were totally micro-based. Participants, in many cases, were in a position to bring their own micros, a fact which made the courses more relevant to their immediate needs.

The introduction of the 'interim' course in 1980 caused a new breed of teacher to seek courses. Up till then the teachers who had attended the CESI organised courses had been mainly the enthusiast type and were mainly from a Mathematics and Science background. In 1980, for the first time teachers attended courses with a different outlook. They wished to use the computer more as a tool within their
own subject area or attended because they had been appointed by their school as the 'computer person' and needed to know something about computers.

The courses provided to date in no way cater for teachers such as these. The content still remains the same, that is predominantly programming. **IT MUST BE SAID THAT THE GENERAL USE OF 'COMPUTERS IN EDUCATION' CANNOT BE ADEQUATELY FOSTERED UNDER PRESENT DAY STRUCTURES.** The expertise is not available; neither is there an abundant supply of the necessary quality courseware across all subject areas. Indeed, the high 'turnover' of course participants on all courses, especially since 1980, suggests that such courses are not satisfying the needs of teachers. In the absence of a policy, no proper structures exist for adequate teacher training. Consequently, we have only provided teachers with limited, half-baked information on Computer Education. The general body of teachers are not equipped to either teach about the technology or apply the technology to their own subject area.

The inservice courses which have been organised by the Department of Education since 1981 are totally inadequate. They are too short, under financed and inadequately structured. They are dependent on the meagre budgetary considerations of a particular year. The
course content has also been insensitive to the needs of teachers. They do not take into account that most teachers now seek a role for the computer in education. Yet these courses emphasise programming skills. The emphasis has been on programming in COMAL since 1981, and more recently in MICRO-PROLOG. Neither COMAL or MICRO-PROLOG are readily available on microcomputers other than the APPLE. As well as that, there is little emphasis on the application of the technology to education.

Various third level institutions have been providing inservice courses (for second-level teachers) since 1980, in particular. The problem here is that there is no standardisation of courses and each institution adopts an independent line, depending on what it perceives as the needs of education. Once again, the course content consists mainly of programming, and ignores the wider implications of the technology. There was an added complication in that courses were conducted using main-frame computers, which were a world away from the school micro.

Ireland has made the mistake of not formulating a policy on Information Technology. A microcomputer has been supplied to every Second-level school before teachers were able to use them in the education process. Then a 'suitable' language (COMAL) is...
selected, even though the necessary support structure are not provided. As if that was not enough, a second computer language (MICRO-PROLOG) was also deemed suitable. The teacher, the most important consideration of all, has been neglected and ignored. Computers should be about people. Exposure to technology without the adequate back-up structures may yet prove to be a major barrier in the future. In the author's opinion, the teacher should be the main consideration. Teachers need to see the relevance of technology to their normal work in the school.

A clear and unambiguous policy should spell out the wide-ranging implications of Information Technology in education and outline the practicalities, benefits and problems associated with its introduction. In order to counter possible teacher resistance to the introduction of Information Technology, it will be vital that ACTO engage in quite a lot of preliminary Public Relations work in order to convince teachers, teacher unions and school management that Information Technology has a prominent role to play in education for the future. Therefore, one of the first tasks which would face ACTO would be to restore confidence among the teaching profession which has been eroded by successive decisions of the Department of Education.
It is sad that, despite the fact that Ministers for Education authorised their Department officials to provide microcomputer systems to schools, there is not, as yet, any plans to introduce a comprehensive teacher training scheme or even to initiate a philosophical discussion for the introduction of computers in education. Despite the fact that now, as well as the 'interim' course at Senior level, a Junior Cycle syllabus has just been issued by the Department of Education.

The urgency of teacher training is all the more important at the present time as it is becoming ever more evident that the technological age is creating an ever widening gap between education, as presented in our schools, and the world of work. Furthermore, there could, in the not too distant future, be a situation where the curriculum of Irish schools would be out of touch with reality. Witness how many homes now have personal computers. Many children now have access to a computer either in their own homes, in friends homes, or in schools.

The reality is that Irish second level (or even Primary) students can, if given the opportunity, provide the basis for an Irish computer industry. Young people, unlike adults, have no inhibitions about the new technology. To them, it is there to be used and to be
experienced with. Students, however, need the guiding hand of responsible teachers, who themselves have at least an elementary knowledge of how to use computers. Schools should reflect the needs of society. Computers are making an ever increasing impact on society. Therefore schools have a prominent role to play in guiding our students towards a proper appreciation of the use and potential of computers. Hence, the need for a comprehensive teacher training programme.

The Dutch [238] stress that Information Technology in Education serves two aims:

* making all citizens acquainted with Information Technology, and

* the creation of 'human capital' to strengthen the market sector.

In order to do this it is important 'to pay attention quickly and on a large scale to training, inservice training and educational support.' [239] This, they claim, is a necessary condition for a broad base introduction of and a meaningful use of hardware and software.
In the author's opinion at inservice level, there is an immediate need for a three prong attack on the problem of teacher training for the Information Age. We need teachers with a Leadership qualification who could be used to train their colleagues, the general body of teachers would need a need a 'Computers-in Education' qualification, while Specialist Teacher would need a qualification in Computer Science.

ACTO, as the statutory Authority, would have the task of ensuring that a sufficient number of trained teachers were available at any given time. The Specialist teachers would in most cases have a Degree in Computer Science. But if not enough of these Graduates entered the Teaching Profession, ACTO may have to put on special courses in third level colleges. Leadership courses would take place in third level colleges and are a priority in order to train teachers, so that they could then train their colleagues. Ideally, the 'Computers in Education' courses should also be held in third level colleges. But, if this proves to be impossible, then they could be held in local areas, possibly in Resource Centres.

7.2 TEACHER TRAINING STRATEGY
Pre-service and inservice teacher training should take place simultaneously. If we are serious about bringing our educational system into the technological age, it should be clear that the computer will play a central role in the transition.

In the ideal school of the future, every teacher should, at least, know how to use the computer. Each teacher should be able to access the vast banks of information that will soon be available to users. Lessons can be prepared by computer. Wordprocessors could be used to provide up to date notes for students. Essays could be written by means of a wordprocessor and specialist teachers would be made available to provide suitable courseware for all subjects areas at all levels, especially at remedial level.

Therefore, it is imperative that any policy on teacher training should clearly spell out that computer education is for ALL teachers and not just for teachers of mathematics and science subjects. It is vital, if computing in schools is to realise its full potential, that computers be made available to ALL teachers in a school. It may take some time for this message to filter through, but if a clear unambiguous policy of intent were announced, under the terms of a National Plan by a statutory Authority such as ACTO, as
already happened in France, then progress could be made on this issue.

It does not necessarily mean that all teachers should each have the same level of competence with regard to computers, but that there should be a basic minimum competence necessary in order to enter the teaching profession.

Information Technology, in the author's opinion, should be viewed in two ways. Firstly as a tool throughout the educational system and secondly as an object of study at Senior Cycle. At Senior Cycle, there would be a need for Specialist teachers. These would be, in the main, graduates with a Degree in Computer Science. If the present trend continues whereby the majority of these Graduates are more attracted to Industry, special courses may have to be organised. As envisaged, it is doubtful if enough hours would be available within a school to teach Computer Science type courses. Such teachers would therefore have to teach by means of Information Technology as well. Initially, there will be a need special LEADERSHIP COURSES for those teacher who are to train their colleagues. Special Post-Graduate courses could be conducted in third level institutions to give teachers a qualification to teach through Information Technology.
7.3 THE COMPUTER AS A TOOL

The use of a computer as a tool really depends on what use it has been put to. The absence of a National Plan has created a situation of unco-ordinated computer activities in schools. Too few people within the Irish Educational system realise the liberating role Information can have within our Educational system. The publication of a syllabus for Junior Cycle second level students is a start, but problems arise in Ireland due to a lack of awareness, the incompatability of the hardware, inadequate teacher training and a lack of a vast amount of quality courseware.

It may be worth considering a model of modern educational software as perceived by Sandery [240], which have a general application over all areas of the curriculum. This includes:

* a wordprocessor designed to be used without the need for extensive training,

* a database package that allows users to construct their own files and to interrogate or update prepared files with an appropriate query language,
* a communications package that allows the microcomputer to act as a terminal into another computer via the telephone system. This opens the door to remote databases, electronic mail, etc.

* a graphics package that allows the user to construct diagrams from combinations of standard shapes, or 'free-hand' lines and to present data in graphical form.

* a set of computer languages, LOGO, BASIC, PASCAL, etc and

* the possibility of an electronic spreadsheet package.

7.4 INGREDIENTS OF TEACHER TRAINING

In providing all teachers with a basic knowledge five possible aspects of Information Technology can be identified. These are (1) the impact of Information Technology on society (2) practical work with software applications (3) introduction to problem solving by means of algorithms (4) the introduction to the architecture of Information Technology systems and (5) the methodology of teaching by means of Information Technology.

It seems reasonable that future teacher education would include Sandery's model and these aspects in all courses. It is important
that pre-service teacher education would include Information Technology as a basis for their courses if we are to set about changing our education system and making it information-based. This would be one of the first tasks facing ACTO. We will need an input from young enthusiastic teachers fresh from training colleges in order to put Information Technology firmly on the curriculum. As this would take some time, the urgency of the situation makes it imperative that we act now and equip the teacher Training Colleges. At a future date, students now entering the educational system will, hopefully, be literate in Information Technology by the time they are trained as teachers. When selecting from the course areas this emerging literacy in Information Technology should be taken into account.

Developments in Information Technology are very rapid and will influence the course content. It would be beneficial if future teachers could, at some point in their training have a compulsory work experience in the computer industry. This would enrich their training with practical experience from the world of work. It would be most beneficial for trainee teachers in the Education Departments of our Universities to have lectures in common with Computer Science and Electrical Engineering students and work in close co-operation with them. As the Report of the interim
Curriculum and Examinations Board to the Minister for Education states:

"Many of the certainties of previous generations will not apply in the future. This is due to the changing patterns of enterprise and employment, changing interpretations of work and job, increasingly diverse and expanding opportunities for leisure, perceptions of gender roles and rapid developments in technology and information processing. All these factors demand an imaginative response from the education system." [241]

7.5 METHOD OF IMPLEMENTATION: SECONDMENT

In the area of in-service education, of vital concern is that the teacher be freed from school for a period of time in order to obtain a qualification in Information Technology. This would require a change of policy with regard to the secondment of teachers on the part of the Department of Education. If a teacher has to obtain a full qualification this cannot be done on a part-time basis. Therefore the secondment of teachers for a year ON FULL-PAY would be an important issue in the implementation of Information Technology into schools. This could be done on the lines of the
Careers Guidance Diploma courses that are currently taking place, but with all available third level colleges being used. These teachers could then be used to train their colleagues in their own local area. Teachers would also need to be seconded or half-seconded to develop and evaluate courseware materials.

This would have to be a gradual process over, say ten years. We have in Ireland a core of teachers, mainly CESI members who have been active in the computer education field since 1973. These people, with a background in education, could having obtained distinction from a Leadership course, be used in cooperation with specialists from the computer/microelectronics industry and third level colleges to provide these courses. Under the terms of a National Plan the necessary courses could be held in any bona fide educational institution that had the facilities, organisation and personnel to run them.

ACTO would act as a standardising agency and would provide personnel to monitor each course. It is important to have an input from practising teachers on these courses, as they have experience at this level would have the effect of moderating the course content towards education at their own level.
The French multiplier system whereby qualified teachers were subsequently used to train other teachers could be used with effect in Ireland. The teachers from the Leadership courses could be used to train other teachers until such time as the whole teacher profession had a qualification in Information Technology. At that stage, the need will arise for refresher and update courses. These could be held in the same institutions or under the auspices of the Resource Centres that are proposed under this plan.
7.6 TEACHER TRAINING (GENERAL)

At second level, graduates who wish to enter the teaching profession, generally have to attend a one-year course for their Higher Diploma in Education (H.D.E.). These courses are conducted in our Universities over the academic year. Higher Diploma courses have tended, over the years, to mirror what was happening in second level schools. Their brief is to prepare students for teaching in second level schools. Education Departments in our Universities, have not acted as catalysts for the new technologies in schools nor have they been to the forefront in seeking changes in the second level curriculum.

Now, however, with the job prospects in teaching for graduates diminishing, Education Departments in our Universities are beginning to take a second look at their course contents and include aspects of computing. One of the major obstacles to be encountered in all University Education Departments is the provision of staff with a knowledge of computers and an interest in their uses in Education. In the short term, this may prove rather difficult because of the present cut-backs in education. It is something that our University Education Departments will have to look to in the not
too distant future. If Education Departments are to be relevant to the school of the future laboratory facilities will have to be made available to student teachers. The computer laboratory should be stocked with as many microcomputer systems as possible (for now at least), and covering as wide a variety of systems as are currently available in Second Level schools. The computer systems should be constantly updated as newer systems become available and the laboratory should also contain a well stocked resource centre, where students could browse through a wide variety of materials relating to computer education (such materials consisting of books, magazines, brochures and good quality courseware). A discriminating attitude towards courseware should be developed as should the development of a pedagogy and methodology for the teaching with Information Technology.

At the present time a few universities provide some lectures on Computer Education for their H.D.E students, while others employ outside lecturers, mostly CESI members, to provide a series of lectures on computers in education. This is not enough, but, at least it is a start. As Information Technology becomes more prevalent throughout our second level schools, Education Departments in our Universities should begin to embrace more and more the technology of the future.
The needs of pre-service teachers attending Higher Diploma in Education classes at our universities would be two-fold. Firstly, Graduates who have obtained a Degree in Computer Science would only need a methodology for teaching computing and practical 'hands-on' experience. We must bear in mind that there may not be enough hours available to employ a teacher full-time in the area of Computer Science, which is envisaged in this thesis as an optional subject at Senior Level. Therefore, the main consideration must be given to the provision of training for teachers in the use of the computer as a teaching aid.

The National Council for Educational Awards (N.C.E.A.) have issued a policy document [93] with regard to the training of Specialist teachers of Computer Studies. At the pre-service level, students who graduate in Computer Applications from a number of designated institutions, and who subsequently obtain the H.D.E would be eligible for appointment as teachers of Computer Studies.

On the other hand, Graduates who have not obtained a Degree in Computer Science would need a special ab initio course which would incorporate methodology, pedagogical training, and an appropriate amount of computing to use the computer as an aid, at least in their
own subject area.

The newer Colleges of Education, such as Thomond College of Education, did not have any of the traditional inhibitions about the introduction of computer technology into their courses. Therefore, graduates can emerge from these colleges with a degree containing Computer Science, as do their counterparts in the universities, the one difference being that their training is more geared towards education.

7.7 PRIMARY LEVEL:

While there is some movement, spearheaded by CESI, towards the introduction of computers into second level schools and some progress has been made, it is only recently that any moves were made toward providing courses for teachers at Primary level. A Pilot scheme, involving thirty Primary schools was initiated by the Department of Education in 1984. [178]

In 1984 a National Primary Education Group was formed under the umbrella of CESI and in the summer of 1985, this group co-operated
in the organisation and running of nineteen courses for Primary teachers around the country. [ 176 ]

The Teacher Training Colleges for Primary teachers in Dublin and Limerick are better equipped to provide computer courses for their students than the Education Departments of most Irish Universities. Most of these colleges have bought in at least one computer system or a network of systems. Therefore the student who graduates from one of these training colleges can, at least, obtain a familiarity with computers to pass on to their classes when required.

According to Ragsdale [ 243 ], within the Primary school, we would expect computers to be used as follows:

* There will be explicit (as well as implicit) instruction about computers.
* There will be considerable instruction which is transmitted through computers.
* There should be substantial use of computers as tools, including the use of the computer as a tutee.

The level at which students are trained to use the computer is difficult to set in isolation from other information. If there is a
computer available, either in the home or in the classroom, children will be acquiring information which will enable them to operate the computer, even if it is not intended that they operate it.

According to Ragsdale [244], teaching by means of computers should begin in the first year of Primary school, as students acquire a number of skills that will form the foundation of their later learning. Cameron [202] supports this view. While the use of computers as an instructional machine to present Computer Assisted Learning (CAL) material will be strong throughout the elementary years, and the instruction about computers will increase in intensity, the real growth in computer usage should come with the use of computers as tools. One advantage of the tool application is that it can reach across subject matter areas. The work of Papert (in LOGO), for example, is especially aimed at children in Primary schools. Once again, an abundance of quality courseware is needed.

There is some dispute about the skills which Primary teachers must acquire in order to prepare their students to take maximum advantage of the availability of computers. The main item of dispute is in the area of programming skills. Taylor, Poirot, and Powell [245] list three sets of computing competencies which all must have, regardless of level or discipline, while the second includes those
needed only by those teachers who teach computing as a subject. The third set is for teachers who use computing to support or enhance instruction in subjects other than computing. They feel that every teacher should acquire the competencies of the first set AND one of the other sets.

The first list of competencies includes the ability to read and write simple programs, experience in using educational packages, familiarity with computing technology, and knowledge about the problems and potentials of using computers, as well as some of the history of computing. The second set, they argue, is distinguished by a more detailed knowledge of computer programming and architecture, as well as the topics which are suitable for and the techniques of computer science. The third set is least specific, and includes some general skills in the use and evaluation of various computer systems as tools in instruction, along with skills which are level- or subject specific, such as the techniques for computerless preparation in the primary grades.

In the setting up of a list of required skills for Primary teachers, some doubt the necessity for programming skills at all. Indeed, at a course for Primary teachers at Newman College, Birmingham (1983) there was a long discussion on whether Primary
school children should be introduced to programming or not. While there was no agreement on this point, the general feeling was that they should not. [246]

There is the argument that all will not need to program, and that the anxiety generated by such a requirement may do more harm than could be offset by the increased skill that some teachers would acquire. Some argue that teachers need programming skills so that they can modify instructional programs. A more practical alternative may be to set the standards for instructional programs so that these programs can be modified by people with little or no programming skills. Ragsdale [247] maintains that it would seem more reasonable that elementary teachers require the ability to read programs, so that they can understand how instructional programs operate. They can use the skill that some of their students may develop, and they can provide feedback to students regarding the clarity of their programs. In this way, even though teachers may not teach programming, they can still assist those students to acquire the skills needed to make their programs clear and readable.

All teachers should be aware of computer limitations and possibilities. The skills which are particularly necessary for Primary school teachers, include experience with computerless
preparation for programming, games and simulations, tutorials, systems, and exploratory programming systems.

Primary teachers will have to acquire the organisational skills that are needed to implement an effective programme of computer use. They will need to decide on the proper locations in the classroom, how to schedule student use, and, for too many years, how to manage with inadequate computer resources.

The work required at pre-service level involves two stages of effort. In order to provide student teachers with the appropriate experiences and training, the staff of the Teacher Training Colleges must receive appropriate training themselves. Changes necessary would mean that sufficient staff and time be allotted so that each student teacher receives an introduction to computer applications in education. Relevant materials relating to computer applications in the various subject areas must be made available.

The introduction to computer applications should contain historical information, strengths and weaknesses of computers, program reading, and techniques for pre-computer instruction. It should also provide an overview of computer uses in various discipline areas. The use of
sample CAI packages should also be included, together with an overview of CAI packages, and the computer applications that seem appropriate. For the elementary student teacher, there should be additional emphasis on teaching students about computers, including the pre-computing techniques and methods for improving programming practice. The CAI portions of the elementary level course would focus on basic skill packages, while the computer tool portion would emphasise the use of wordprocessing and LOGO type applications, while also devoting some time to simulations and other tool applications.

Inservice courses at Primary level, as with all courses should be properly structured and planned. As yet, there is no policy with regard to Computer Education at any level. The Colleges of Education, have, in recent years, provided week-long inservice summer courses in computing. St. Patrick’s College, Drumcondra at present provides in-term inservice courses in computing at an introductory and advanced level. During the 1985/86 school year, Mary Immaculate Training College, Limerick is providing a Diploma Course in Computing for Primary teachers.

It might, therefore, be worth setting out some of the
aims;structures,and goals of inservice courses for primary teachers. There can be no doubt that, as computers proliferate more and more throughout society that the schools will, very soon have to take stock of their situation and bring the curriculum into line with the modern world. Schools should reflect the needs of society. Computers are now playing a major role in almost every aspect of our lives and it is imperative that our young people be given the opportunity to master the technology that will shape their future lives.

Computing in Primary schools may depend ultimately on young enthusiastic teachers, the majority of them fresh from the training colleges, with a good grounding in the educational uses of computers. However, because of diminishing job prospects due to educational cut-backs and the urgency of the situation, the main emphasis must be placed on properly structured inservice courses. In this regard, one is very hampered by the lack of computers in Primary schools.

Assuming that Primary schools had access to hardware, a programme of instruction might involve three stages. The first stage might involve a familiarisation course, provided by the vendor, perhaps, but preferably by an outside unbiased person. These
courses should include basic operation of computer systems and familiarisation with the keyboard using pre-programmed packages. The second stage might include a longer series of seminars for teachers in up to ten schools at a time. Such seminars could be held in one of the participating schools on a rotation basis. The seminars could be of indefinite duration, but should be not less than ten weeks. It is also to be recommended that free time facilities be provided for participants on the seminars.

The third stage, could also be called the back-up stage would emphasise the setting up of courses and seminars in response to the needs of classroom teachers. This would involve the setting up of Resource Centres as advocated in this thesis. As we have already pointed out, full time officers would have to be appointed in order to provide the back-up facilities needed for schools.

Present inservice courses for Primary teachers differ somewhat from those of Second level teachers, mainly for the following reasons:

* any group can apply to the Department of Education (Primary Branch), submitting a syllabus and asking that their course be recognised.

* a list of approved courses are forwarded to schools about
Easter time.

* a teacher then applies to a course organiser for a place on a course.

* a teacher attending an approved course for Primary teachers has to pay a fee and, in return for attending the five day course, is allowed three days personal leave during the year.

There is generally no co-ordination of courses and, consequently, varying standards prevail. In the area of computing, CESI did attempt to provide some co-ordination and standardisation on courses in which they co-operated. [248] This involved the provision of a syllabus guideline and the sharing of available courseware materials.

The handling of in-service courses for teachers is likely to become more critical as time passes. One reason for this is that the need will be greater, with more computing resources and more students expecting to use computers in the school. Ragsdale [249], maintains that this increased need will put greater pressure on teachers to acquire computer knowledge, which may have negative
consequences for their learning efficiency.

Computing at Primary level is new and for the present, most experience with in-service has centred around those teachers who were relatively eager to use computers. As the inservice programme reaches more reluctant users, there may be a greater need for a different type of approach, one that puts less emphasis on the self-motivation of the learner.

While we in Ireland are at a very early stage in the preparation of Primary teachers of computing, nevertheless, we should take into account the experiences of other countries. First of all, we need a comprehensive overall plan. If this is not forthcoming within a short period of time, then bodies such as CESI and teachers at Primary level will have to attempt to train teachers themselves. It is to be hoped that this situation is to be avoided, as it places an unfair burden on too few enthusiastic teachers.

As outlined previously, the French multiplier system, whereby teachers could be used to train other teachers, could be adopted very easily into the Irish school system, thus giving teachers a real sense of responsibility and motivation.
In particular, materials will have to be created to put computer applications in the context of the learner and thus give teachers a more concrete example of how computers can have a positive effect on the teacher's life, with minimal effort on the teacher's part.

Ragsdale [250] suggests that throughout the elementary years, there will be teaching through computers to assist the students in acquiring a solid foundation of skills on which to build their later learning. Their use of computers as tools will also develop skills which make them more effective learners in these and later years.

In order to assist students, the teachers will have to become sufficiently familiar with computers that they can read and understand computer programs, use program packages, and be familiar with computer terminology, potentials and limitations, and the history of computing. The necessary training to provide these skills should be a part of their pre-service training for new teachers in the future, but must be a part of in-service programs for current teachers. The in-service programs must be carefully constructed to reach those teachers who have little enthusiasm for computer applications.
The skills and knowledge that a child picks up early in life have a great effect on future learning, yet society often puts greater emphasis on secondary schools. The use of computers has been no exception to this practice, but this view must change if our future students are to become effective adults. The first step in creating future adults who make effective use of computers, is to provide adequate support for today's Primary teachers.

7.8 SECOND LEVEL COMPUTER APPLICATIONS

Computer applications at second level could, in time be affected by the greater emphasis and training at Primary level.

If students have had a thorough introduction to computer history, possibilities, limitations, use and programming in Primary school, considerably more time could then be devoted to more sophisticated uses of Information Technology. That, however, is for the future. At the present, initial moves are being made at Primary level and so, it will take some time to filter through.

One of the major drawbacks to the introduction of computing across the curriculum in second level schools has been the fact that the
computer was assigned to the mathematics teachers and their department. This situation is, by no means, unique to Ireland, but has the effect of undermining the confidence of teachers of other subjects in their ability to use computers. It is also the case that many present computer studies teachers are ill-equipped to take the subject to any serious level, not having any qualifications themselves.

Most graduates with a degree in Computer Science are attracted by the higher salaries offered by industry and do not find their way into the teaching profession. There could, in the future, be a serious crisis in schools because of the shortage of qualified computer science/studies teachers. It is, therefore, an urgent problem to train as many teachers as possible.

There is a potential for more advanced study in Computer Studies at second level, and some material which is now taught at third level might move down, but it is most likely that second level schools will have a severe problem in hiring suitable staff. Hence there is an urgent need for training at in-service level.

Teaching about computers should be an issue across all subject...
There would be material on other courses, which would include social issues such as the relationship between computers and personal privacy, the effect of computers on history, and on scientific discovery. The impact of the new technologies on the social fabric of society in general should also be a major topic on any course.

The skills that second level teachers will require in the future fall into two main categories, those for teachers of computer related subjects, and those for teachers in non-computer subjects. Polrot, Taylor and Powell (251) not only offer a list of competencies for all teachers, but also a list of subject specific competencies which are general for all disciplines, plus some examples of competencies which are specific to a particular discipline area. Their general subject-specific competencies include the ability to use and evaluate the general capabilities of the computer as a tool, the ability to use and evaluate alternative systems designed as tutors or teacher aids, familiarity with alternative systems for school administrative applications, and familiarity with information and quantitative techniques for study in the teacher's subject. Ragsdale would attach more importance to the use of computers as tools and techniques for subject study than to dealing with the familiarity with a range of computer systems.
As with the Primary teachers, training of second level teachers should take two forms (1) pre-service training and (2) in-service training. Although, some work has been done at second level, mainly through CESI, since 1971, there is much more to be done in this area. As we have seen current teacher training programmes are inadequate for present needs.

In nearly all teacher courses, up to the present, the majority attending came from a very narrow base, mainly Mathematics and Science. Therefore, the majority of teachers currently involved in the teaching of computing come from that same background. While it is true to say that computers can play a major role in the teaching of these subjects, it is unwise to give the impression that computers can only be used by teachers who have a Mathematics or Science background. Such may have been the case some years ago, but is no longer so.

It is unfortunate that when computers were first introduced into Irish schools, that they were introduced as an optional extra on the Mathematics syllabus at senior level. The introduction of this option was ill-conceived and was introduced with little apparent planning. The Department's inspectorate cannot cope with the
monitoring of the scheme and many students are presented with certificates without ever being examined.

While it was hoped to convince Department of Education officials of the role of the computer across the curriculum, indications in 1984, with the issuing of the Department's options (APPENDIX K) seemed to confirm the belief that the Department was then considering the introduction of computing as a subset of the Mathematics or Science syllabus, certainly at senior level. A more hopeful sign emerged, however, from the deliberations of the Junior Cycle Syllabus Committee which suggests that the Department of Education is at least willing to consider computing on a broader scale at this level, but again this syllabus is listed under the heading of Mathematics.[151]

With the setting up of the Curriculum and Examinations Board, there is now at least, the possibility of a change in emphasis and a re-examination of the potential and role of the computer in education. It is to be hoped that this will be the case. As of February 1986, the Curriculum and Examinations Board have taken over the responsibility for curriculum from the Department of Education.[252]
It can be said that the teachers currently involved in computing at second level come from too narrow a base and, in many cases tend to look at computers from a narrow perspective. An input from all discipline and subject areas is a necessity in order to fully realise the potential of the computer as an educational tool. We have not, in Ireland, a policy on computer education. We need a policy urgently. The world is becoming more computerised and if we do not begin to motivate our children positively in the area of computers, we could, in a short period of time, find ourselves out on a limb.

7.9 IMMEDIATE NEEDS

When we think of what must be done, we should consider both the present needs and the future needs. If and when a policy on computer education is developed, it will more than likely mainly affect the second level curriculum initially. This is because the major activities are now concentrated in second level schools. There will come a time when the computer is widely used in the Primary school and this, of course will affect the second level curriculum as well as may the increased use of computers in the home. It will, however, take some years for Primary teachers to begin to use computers in
their schools to any significant level.

The pre-service training needs of second-level teachers is more or less the same as for Primary teachers. The competencies that are required by all teachers, apply to both Primary and Second level teachers, although some second level teachers may need to know programming and use it to develop subject related packages for their teaching. Student teachers should be exposed to the history of computers, strengths and weaknesses of computers, program reading, and overviews of specific application areas.

The student should be able to choose from a number of courses developed along subject lines. In one subject oriented course, the prospective language teacher would be learning about the use of computers to create written works, the use of the computer to diagnose and correct faults in written works, and the use of computers to analyse the content of written works, among other applications. At the same time, science teachers would investigate the use of computers as laboratory supplements through simulation, as laboratory aids through computational assistance, and as information retrieval tools in research. In both these courses, and others as well, the students would be looking at CAI applications in their curriculum areas.
The majority of those who enter the teaching profession at second level, have first to obtain the Higher Diploma in Education. This course is organised on a part-time basis by the Education Departments of the Universities. There does not, as yet, appear to be any major moves on the part of the universities to provide an adequate section on the use of Information Technology in schools. The reasons for this may be that the Education Departments do not, at present, feel any great urgency to introduce technology into their curriculum, seeing that there is little movement on the part of the Department of Education on the matter. It could also be that the potential impact of computer technology on education and the changes that it may bring are not fully understood. There is also the basic fact that most Education Departments of Universities do not, in general, have the personnel with the knowledge and expertise to cope with the new technologies nor have they got the finance to employ such expertise on any meaningful basis or to provide computer laboratory facilities for their students.

Ideally, the Education Departments of our Universities who provide teacher training for entry into second level teaching, should be equipped with the most modern up to date computer equipment and
should be well stocked with as much educational courseware as possible. The computers on display should be of as wide a variety as are currently used in schools. It is possible that, UNDER THE TERMS OF A NATIONAL PLAN, that computer firms may be willing to sponsor or partially sponsor such equipment to universities and other teacher training colleges for this purpose and there is no reason to suspect that software houses would not do likewise. As part of their training a student teacher would be required to develop courseware by means of projects.

Education Departments in Universities could obtain time on the college computer. There should be no reason why such facilities could not be made available to Higher Diploma students. The one negative aspect of this, in the present situation is that the vast majority of schools do not have access to a mainframe computer. This may not always be the case, however, and exposure to the computer, in whatever form, should be eagerly accepted.

A pre-service training course would have extra benefits for Higher Diploma in Education students if links could be forged between students of education and computer science students. The link could involve both sets of students attending common lectures on computer related topics and undertaking common computer

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projects, each project group having members drawn from both sets of students. This would be beneficial in that students of education would gain some insight into the world of computers and gain valuable experience which would be of immense benefit in their teaching.

One must bear in mind that any changes in curriculum must take into account the power and opportunities offered by the computer and related technologies. Indeed, the Minister for Education in announcing the proposed Curriculum and Examinations Board, made this very point. No longer can training and education be kept apart and future teachers must get as much insight into the world of work as possible, if they hope to acquire the knowledge necessary to carry out their job efficiently. A link up with computer science students would be a start. It should be noted that Commissioner Sutherland recently announced an EEC-sponsored programme to foster co-operation between universities and industry in training for new technologies. It should not be too much to expect that an EEC programme such as this could not be organised to cater for schools.

EEC Member States in their deliberations on the New Information Technologies seem to be coming to the conclusion that "all
teachers without distinction (must be trained), given that NIT (New Information Technology) is not an ordinate of culture, but rather a bedrock." [14] It is up to each Member State to develop its own strategies for teacher training. As we have seen Ireland has not done adequately.

The needs are immediate. Properly structured and standardised courses, which lead to a qualification, have to be set up. In order to do this courseware has got to be developed, Resource Centres have to set up to provide the support structures needed, leaders have to be identified, and third level colleges will have to be provided with the facilities and staff necessary for their role in the training of teachers.
We have outlined the aims and scope of this Research Project in Chapter I. The development of effective use of Information Technology throughout the Irish Educational System is the primary aim of the project. In order to do this we have looked at developments in Ireland to date, identified successes and failures, and pointed the direction that Ireland must take if it is to effectively use the technology within the educational system. We must also view developments in Ireland within the context of international developments and our membership of the European Economic Community (EEC). To this end we have examined developments in the Canadian Province of Ontario, Australia, the U.K. and France. In all these cases lessons can be learned. The development of Computer Education in Ireland itself is worthy of study; it is in itself of value as a case study and may also serve as a model for developing countries.
The contribution of CESI to Computer Education in Ireland illustrates how a 'grass roots' organisation, working in a voluntary capacity can, with knowledge and determination, influence educational policy. There may be developing countries which, like Ireland, are not rich in material resources and inherited a British system of education who may see the situation in Ireland as a parallel to their own. They too, may have a rigid centralised Educational system, which allows little scope for innovation. Hence, the work of CESI may be of interest.

The scheme discussed in this thesis is the one, which, in the author's opinion, offers the best solution to Ireland's problems both in the Education and Training sectors. This model provides the basis for a new information-based curriculum, which is relevant to the age in which we live. The strategy must involve the setting up of a statutory Authority, such as ACTO, which would oversee the introduction of Information Technology into all aspects of Education and Training. A body such as ACTO, in order to function properly, must have statutory powers to oversee all activities of Education and Training in Information Technology in the country. Because of rapid developments in the technology, such an Authority would have to be of a permanent nature. It is envisaged
that, under ACTO there would be a co-operative effort on the part of many Government Departments, Government Agencies, and Industry to work together for the good of Education and the economic well-being of the country. This would imply the involvement of the professional workers in Information Technology in activities organised within the formal education system.

The National Board for Science and Technology (NBST) in their Report (1981) [34] recommended that the Department of Education intensify the activities aimed at promoting computing and electronics in secondary schools, and in particular (1) define equipment standards (2) define teaching standards, and provide for teacher training, (3) provide support towards the cost of equipment, and (4) review all of these regularly to ensure that they remain relevant. As we enter 1986, none of these recommendations have been implemented.

As we have seen, with the possible exception of providing equipment, the Department of Education have not performed adequately. The fact is:

IT IS NOT UNDERSTOOD AT OFFICIAL LEVEL THAT THE DEPARTMENT
OF EDUCATION CANNOT ON ITS OWN PROVIDE THE SUPPORT NECESSARY TO INCORPORATE INFORMATION TECHNOLOGY IN ITS WIDEST FORM ACROSS THE CURRICULUM.

As we have emphasised throughout the thesis, Ireland suffers from a lack of policy with regard to Information Technology. The net result of this has been a large amount of unco-ordinated activities on the part of the Department of Education itself, institutions and individuals, with a possible duplication of effort. The nature of Information Technology suggests that no one organisation, be it Government Department or whatever has the ability, resources or knowledge on its own to implement Information Technology across the whole curriculum. IT IS ONLY BY A POOLING OF RESOURCES AND EXPERTISE THAT WE CAN SUCCEED and this goal can only be achieved under the terms of a National Plan with regard to Information Technology in Education.

We have seen from our Comparative Study in Chapter III that:

* The announcement of an official policy/plan regarding the introduction of Information Technology into schools is necessary to provide the stimulus for a co-ordinated effort.
* Adequate investment is essential.
In all cases the introduction of Information Technology into schools served a dual purpose (1) to enhance the Educational system and (2) to provide the country with a microelectronics base, which it was hoped would improve the country's economic growth and competitiveness.

These new structures call for the establishment of new State sponsored structures such as the MEP in the U.K.

The Dutch Government, for example, intends that within five to ten years all pupils will be taught about and with computers for their future profession, for participation in society and for their personal development.[254] Australia is meantime making an effort to bring a high standard of technical awareness and skill among all Australian children.[255] In all cases there was a sharing of resources among many Government Departments and Agencies.

As it is we in Ireland have failed to realise the full potential of Information Technology in the education system. It is true that each second level school now has at least one APPLE microcomputer, but it is equally true that schools have received little by way of training, guidance or advice as how microcomputers can best be used in Education. Little by way of courseware exists. There is an abundance of courses, but none of them adequately satisfy the needs.
of teachers. There is no central agency to standardise the courses. The main emphasis of courses has been on programming, whereas most teachers now wish to use computers as an aid to the teaching process. There are no training courses available to train teachers who wish to incorporate the computer and related technologies into the school curriculum, no facilities for courseware development exist and no proper Resource Centres which would give schools the benefit of technical support and access to courseware and software packages have been set up.

Mackey [256] makes the point that we have been unable to deliver quality education on anything approaching an egalitarian scale and that we never will until such time as we utilise the new technologies to enable us to create such a system. The only way that this can be done is by the proper integration of Information Technology into the Education system. The computer, particularly in its convergence with other information technologies is less of a subject and MORE A WHOLE NEW CONCEPT OF EDUCATION.

We must not accept the introduction of Computer Studies as a new subject EXCLUSIVELY, but, in order to cater for the vast majority of our students, we must approach the new technology through its
applications. By doing so, we are

...starting from a base of existing knowledge and hence building towards a technical knowledge, i.e., to begin by using the computer in a cultural context with which the student is familiar. (257)

CESI pointed out, for example, to the Curriculum and Examinations Board (who have taken over responsibility for syllabus content from the Department of Education) that it could make a major contribution to development by shifting the emphasis from computing as a subject only to the creation of some structures which would allow Computer Education expertise to be made available in our schools by the majority of our educators. (258).

In a submission (1982) to the Ministers for Education, Labour and Industry, CESI pointed out that one of Ireland's greatest problems stems from the rigid demarcation line that the country has drawn between Education and Training. The very nature of the New Information Technologies will not allow for these clear distinctions, certainly in the case of the infra-structure which will be needed to support both. Ireland alone among the European Countries still seem to be following the
"separate development" system. Communications from the European Commission [32] refer to the great need for "Education and Training" in the new technologies, and this has been followed in most European countries by an effort to integrate these technologies into the formal education system. Here in Ireland we are spending millions on training schemes, while our education system is on the verge of bankruptcy. Our formal education system is rapidly losing its relevance, while the resources necessary to revitalise it are being spent on developing alternatives in the training sector. It hardly seems wise to spend £900 Million a year on the Education system, and to apply all our development funds on the Training sector. It would be better to spend some of these funds on developing the existing system, especially when the lines of demarcation between the two are very thin. Because of the structures that currently exist, we are wasting a great resource.

"If we believe in a Concept of Computer Literacy—that is, the need for the next generation to be literate in the sense that they can function in an information Society, or if we simply believe, from a purely Economic viewpoint, that we need to develop expertise in Information Technology, then surely we must apply the technological infra-structure in such a way that it will produce the maximum result—and under
our present system the only way in which it can reach not just a minority, but practically all of our youth, is by integrating it into the formal education system." [259]

Current European thinking places the emphasis on learning by discovery, learning by doing and pupil centered education. In essence the emphasis is on the micro as a catalyst for group activity, just another learning tool. This means that those people in this country who have advocated the modular approach to the computer in education may not be that much out of line with our EEC partners. We have already discussed the need to adopt this approach. As Dr. Edward Walsh, Chairman of The Curriculum and Examinations Board [260] puts it:

"Ireland’s active membership of the European Community alters perceptions of the world at large and evolving structures on this island give reason to review conventions. New technology, increased urbanisation and basic changes in industry, agriculture, business and the professions close off many traditional career opportunities, while potentially opening others. The vibrancy of Irish youth creates an urgency to turn old problems into new opportunities: to see in the decline of traditional business
and industry the opportunity for new enterprise."

Walsh also points out that while previous generations could complain that the absence of raw materials kept us from competing with other developing nations, appropriate education and training are now the keys to economic success. Raw materials are no longer essential: in the information age appropriate knowledge and skills are the strategic resources. Japan has long realised this and her national programme revolves around the development of a new technology that embodies knowledge as its central feature and that this knowledge will transform its holder's small advantage into a big, powerful, and eventually decisive advantage in any competition. The Japanese are planning. Their product comes not from normal sources such as mines, seas or oil but from their brains. The product is knowledge and they are already working on the Fifth Generation of computers. Their goal is to develop computers for the 1990s and beyond - intelligent computers that will be able to converse with humans in natural language and understand speech and pictures. The Japanese Government has pledged $450M over the next decade, and Japanese industry are expected to at least match this amount.

Ireland can learn a lot from the Japanese experience. As Tsongas
Japan often performs as if it were acting under centralised guidance. In Ireland such guidance can only come by means of a National Plan. It is time that Ireland co-ordinated all education and training efforts in relation to Information Technology under the terms of a National Plan. Nearer home, much can be learned from the National Plan for microcomputers in Scottish schools produced in 1985. In order to promote the use of Information Technology in our schools it is vital that an immediate input be made particularly in the areas of Teacher Training, Courseware Development, the provision of a network of support structures and hardware provision.

With regard to teacher training, there is an urgent need for properly structured courses which address the needs of teachers. It is most important that teachers of the future obtain a qualification to teach by means of Information Technology. The Scottish National Plan offers the best model so far. In sets the competencies for all teachers as:

* An awareness of the use and potential of microcomputers in the classroom.
* Basic technical competence in using equipment.
* Classroom management of equipment (fitting into timetable, methodology and control).
* Awareness of available hardware and software resources.
* The ability to identify where the microcomputer is the best teaching aid to use and when other methods are more appropriate.
* The ability to evaluate software packages.

The author sees Information Technology as being implemented in two ways in schools: (1) as a tool across all existing subject areas and (2) as an object of study at senior cycle. At senior level, Information Technology would be a specialist subject, but its main impact would be its use as a tool. Under the proposed Plan, ACTO as the statutory authority would undertake the task of catering for all teachers' needs, including teacher training. It would co-ordinate and standardise courses as the needs arise. The Plan discussed here depends on:

* the provision of trained personnel and adequate equipment to all teacher training colleges.
* the utilisation of all available third level institution for teacher training purposes.
* a generous policy with regard to secondment of teachers.
* the provision of a large quantity of quality courseware.
There is an immediate need for leadership courses. Participants on these courses would be those at Primary or Post-Primary level who had shown enthusiasm over the years and who could now be used to train their colleagues. The shortage of Computer Science Graduates entering the teaching profession may mean that other teachers might have to be trained in order to develop the skills necessary to teach Information Technology as a subject. If courses such as these were deemed necessary, then they and the Leadership courses, could be run along the lines of the Guidance Counsellors (these are one year full-time courses). It is important, however, that secondment on full pay be implemented. In the case of the elementary qualification, it would be better if secondment could also be arranged. If not, it is possible that teachers from the leadership course arrange to hold courses over a longer period of time in a local area.

It is vital that a vast quantity of courseware be developed immediately. The success or failure of Information Technology in schools will ultimately depend on the quality of the courseware produced. As we have discussed in our plan, courseware must be developed by practicing teachers in co-operation with experts from the computer industry. This would be done under the authority of ACTO in each of the resource centres initially, but would be
monitored and subject to periodic review.

The provision of a network of Resource Centres to provide practical support for teachers is important. These Centres would closely relate to schools in the area and provide the necessary support by way of courseware, information and technical advice.

Under the proposed National Plan, ACTO, would urgently need to formulate a policy with regard to hardware. This may ultimately mean that it may recommend the development of a computer especially equipped for educational use. But for now, at least, it must take into account the computers that are currently in our schools. While there may be advantages in the diversity of machines, if we are to make a smooth transition to the next generation of computer equipment, it will not be possible to rely on unplanned developments. This means that we will need to provide some standardisation of computer equipment in schools. The Scottish National Plan [66] suggests that the best way at present of achieving such a standardisation is that of standardisation by defining the functions of the hardware and the operating system to be used. Initially, like the Scots, we should recommend, perhaps, that only the APPLE, BBC and COMMODORE 64/128 be used at second level (at primary level we could add the AMSTRAD and ATARI) and that these machines alone should be supported.
Much needs to be done by way of Research Projects. Thus one of the many tasks to be undertaken by ACTO would be to research and develop relevant modules for inclusion in existing subject areas, testing their acceptance by teachers and pupils, and above all their relevance and effectiveness. As very little research has been done to date, there is a wide range of projects which could also be undertaken. These would include:

* an analysis of current computer usage in Irish schools.
* A comprehensive analysis of hardware needs.
* Courseware/software development.
* The use of the computer as an Educational Aid.
* Wordprocessing in Education.
* Monitoring and Control in the Educational environment.
* The computer applied to the problem areas of education, such as Remedial Education, teaching basic English, and mixed ability teaching.

It would be much more beneficial if these research projects could be carried out within the normal educational system.
Under the terms of a National Plan, it would be possible to conduct and properly supervise pilot schemes around the country. Pilot schemes could be undertaken in many areas including:

* Development and testing of courseware.
* Teacher training strategies.
* Testing the effectiveness of materials
* Testing the effectiveness of certain hardware.

The only way forward for Ireland is to produce a National Plan in relation to Information Technology and produce a policy on the lines indicated in this thesis. Such a plan would draw on the resources and expertise of a number of government departments, government agencies, the EEC and private industry. Such a plan needs adequate funding. As we have seen such funding is not available through the meagre resources of the Department of Education. As we have seen, no one Department or Agency can on its own, hope to support all the necessary functions needed to introduce Information Technology into the education and training sectors.

T.P. Hardiman [265], then Chairman of the National Board for
Science and Technology stated emphatically that Science and Technology were the keys to Ireland's future and that resources and funding must be set aside, whether or not we are in a recession.

'IT IS NOT A QUESTION OF SPECIAL PLEADING TO SAY THAT IN THE IRELAND OF THE 1980'S, AN ABSOLUTE CRITICAL NECESSITY IS THAT WE SHOULD NOT SHORT-CHANGE OURSELVES ON SCIENCE AND TECHNOLOGY. THEY ARE THE KEY TO OUR FUTURE. WE DON'T HAVE A FUTURE WITHOUT THEM'.

Because we are still broadly unaware at political and administrative level of the connections between science, technology and economic development, the question of funding has to be pressed extremely hard.

The consultative document of the Curriculum and Examinations Board [146], offers hope for the future. However, the Statutory Board is not scheduled by the Minister until 1986 at least. As long as the Board remains an Interim one curriculum development will be impeded. Much needs to be done in all areas, but especially in the area of Information Technology in education. The need for a National Plan is an urgent one. The educational system needs reform and the
economic well-being of the country depends on it. It is to be hoped that despite the recession that additional resources can be found for education because of its strategic importance for national development.
DRAFT SYLLABUS FOR A COURSE IN COMPUTER STUDIES AT SECOND LEVEL

(Approved by the CESI Executive Committee for submission to the Department, February 1977)

AIMS:

This course in Computer Studies aims at:
(a) developing skills in problem analysis and problem solution.
(b) developing an awareness of the social impact of the computer.

OBJECTIVES

At the end of their course, it is hoped that the students will:
1) Be aware of how the computer will affect them in their life after school:
2) Understand how the computer works
3) (a) Understand the process of problem analysis and problem solution by means of algorithms;
   (b) Be able to use this process to solve problems:
4) Understand the role played by the computer in the problem-solving process, and the limitations of that role;
5) (a) Understand the man-machine communication problem:
   (b) Be able to communicate with a computer by means of at least one programming language:
6) Know the history of the evolution of the computer.

CONTENT

(A) PROBLEM-SOLVING
   (objective 3)

2) Difference between a SOLUTION and an ANSWER to a problem. (e.g. area of a rectangular field: the SOLUTION is multiply length by breadth, and the ANSWER is what one gets when specific values of the length and breadth are used)
3) Examples of problems with easy solutions (e.g. making a telephone call)
4) Analysis of problems where the solution is not readily seen (e.g. directing a stranger to one's home or school)
5) Algorithm: statement of a list of steps which are taken to solve a problem.
6) Flowcharts: diagrammatic representations of algorithms (Note: problem analysis and solving, as in this outline, need not be
confined to computer applications)

7) Need for algorithms in computing: the computer must be "told" very precisely how to do a job.

(B) STRUCTURE OF A COMPUTER (COMPUTER HARDWARE)

(objective 2)

1) Outline functional diagram of main computer components: input, CPU, output.
2) Structure of the CPU: main store, arithmetic/logical unit, control unit.
3) Backing store: serial and random access - magnetic tape, disks, drums, paper tape, cards.
4) Input/Output: tape and card-punches and readers, magnetic tape devices, hard copy printers, VDUs, graph plotters, teletypes, mark sense devices, character recognition devices, etc.

(C) INFORMATICS AND DATA PROCESSING

(objective 2, 4)

1) Distinction between data and information.
2) Storage and transmission of data: man-machine communication, leading to coding schemes.
3) The problem of linking data and information.

(D) COMPUTER CONTROL

(objective 2.4)

1) Control of the data storage by the operating system.
2) Instruction execution.

(E) PROGRAMMING LANGUAGES

(objectives 5.2.4)

1) A program as a form of algorithm.
2) General discussion of computer coding:
   (a) High-level languages e.g. BASIC, FORTRAN, ALGOL, COBOL, PL/I.
   (b) Low-level languages e.g. CSSP, CESIL
   (c) Compilers, assemblers, machine code.
3) Practical use of a high level language to solve problems.

(F) HISTORY: EVOLUTION OF THE COMPUTER

(objective 6)

1) Brief history of calculating aids: abacus, Napier's bones, logarithms, Pascal and Leibnitz calculators, Babbage's machines, Jacquard and Hollerith cards.

(G) USES OF THE COMPUTER

1) Brief qualitative examination of a wide range of computer applications. With an in-depth study of one or two. E.g.:
   a) Computers in education
   b) Computers in science
   c) Library
   d) Traffic control
   e) Payrolling
   f) Stock control
   g) Banking
   h) Seat reservation
   i) Design
   j) Production control
   k) Invoicing
   l) Market research
   m) Medicine
   n) Law and police

2) Computer personnel: careers in computing.
SOCIAL IMPLICATIONS OF COMPUTERISATION

(objective 1)

1) Computer problems and implications

   a) Employment, information creation, storage and retrieval, sensitive data banks, security, privacy:

   b) Indispensability of the computer in modern conditions:

   c) Use in solving global problems

2) The future; increased leisure, "information explosion", computerised environment, home and business, mass production of computers, artificial intelligence.
The Trinity College Diploma Course on Computer Practice.


1) Introduction: the question of the necessity for a computer course in computer appreciation in Irish schools: the possibility of courses in computer science: prospects for the future in Irish education.

2) The history of the computer: its role in society: its impact on the field of education.

3) The modern digital computer: what it is, and what it can and cannot do.

4) Problem analysis and flowcharting techniques. Applications to a variety of problems, particularly of a non-mathematical nature. The investigation of how this topic can be taught to young secondary school pupils by teachers of all disciplines.

5) Computer programming and computer languages: the problem with communication with a computer: an example of the use of machine language: programming in a low level student language CSSP: programming in a high level language suitable for an educational environment, BASIC.
6) Computer hardware: storage; input and output devices.
7) Computer logic and binary arithmetic.
8) The computer and the world of commerce: an introduction to D.P. manager, the system analyst, the programmer: careers in the field of data processing.
9) The computer in the field of education in general: the computer in the classroom: CAI, CMI, simulation and games.
10) The computer in the natural sciences and in the humanities.
11) The computer and tomorrow's world: the human implications of the use of computers: the problem of privacy and the implications of data banks containing files of sensitive data.
The Minister for Education, as previously announced, has set up a Departmental committee to advise him on the question of introducing Computer Studies into the curriculum of post-primary schools. In the interim, in order to facilitate those schools which are already working in the area of Computer Studies or are planning to do so, the Minister, having consulted the Mathematics syllabus committee, has made the following arrangement in respect of the school-year 1980/81 and until further notice.

The enclosed passage will be appended to the syllabuses in Leaving Certificate Mathematics, Ordinary and Higher Levels, in the Rules and Programme for Secondary Schools. You are requested to bring this circular to the notice of all teachers concerned as soon as possible.

L. O’LAHRIN,
Ríocht.
Féileabr, 1980.
COMPUTER STUDIES

This section is optional. It will not form part of the Leaving Certificate examination but pupils who take it, and perform satisfactorily, will be given a statement to that effect by the Department. School Authorities who wish their pupils to receive such a statement must complete an application form, which may be had from the Department of Education, Post-Primary Branch (Inspection Section), Hawkins House (floor 3), Dublin 2.

As part of the application form schools will be asked to give details of the syllabus they propose to follow. The syllabus should include the following aspects:-

Problem analysis. Communicating with the computer. One low level language, where feasible, such as CCL or CSSP.
One high level language such as BASIC. Emphasis on input, control, process, output, testing, branching, loops, functions. Types of input/output devices.

It is envisaged that pupils would spend about 35 hours on this section in the course of one school-year.

Each pupil should write and successfully run about ten programmes. Two or more pupils may undertake joint projects. Records of the work done must be available for monitoring by the Department.

Application forms in respect of the school-year 1980/81 should be returned to the Department in good time, preferably by 1 May, 1980.
APPENDIX D

REPORT ON THE CES-CESI DUBLIN PROJECT 1975-76

(Reprinted from CESI Newsletter No. 4, 1976)

This Report is based on questionnaires completed by participating teachers.

Preamble

In July 1975, International Computers Ltd. approached the Executive Committee of CESI with an offer of help in mounting a project in Computer Studies in schools in the Dublin area. ICL offered:

a) To negotiate the use of data preparation and program processing with several firms using ICL equipment.

b) To assist in the management of the scheme.

c) To assist in the training of teachers involved in the project.

The Committee of CESI accepted this generous offer and preparations for the experiment took place during the last term of 1975. A two
A day training course for teachers took place in early January 1976. This was given by Mr. Stephen Bacon, a member of the Computer Education in Schools' Staff in Britain.

The experiment ran from January to April 1976, and the following Report prepared by Mr. Jim Walsh for the Committee of CESi presents the main features of the scheme.

It must be understood that the project was limited in scope and effectiveness by a number of circumscribing factors:

1) Classes were held for the most part outside normal school hours and in competition with other more traditional school pursuits.
2) Small numbers of students were involved.
3) The experiment took place over a relatively short time span.
4) The overcoming of routine practical difficulties (e.g., the establishing of fluid communications with the D.P. Centres) inevitably attendant on such a scheme reduced still further the time available for effective advancement.

In view of these difficulties, it was considered best to leave the
experiment as open and flexible as possible, and a list of specific objectives was not drawn up.

Despite the limitations, the experiment was a success in that it provided much needed and very valuable practical computing experience for teachers and students. As is clearly evident from the Report, the co-operation of the firms involved was remarkably generous.

PARTICIPATING COMPUTER INSTALLATIONS

Irish Sugar Company
Irish Biscuits Ltd.
Irish Shell/BP.
Dublin County Council.
Clondalkin Paper Mills.

PARTICIPATING TEACHERS AND SCHOOLS

J. Kelly, Vocational School, Wicklow.
R. Kennedy, Templeogue, College, Dublin 6.
INTRODUCTION

This Report is based on questionnaires completed by teachers in seven of the schools which participated in the CESI-CES schools computing project 1975-76.

The conclusions drawn are about what I consider to be the important aspects of the project and in areas where there are sufficient responses on which to make a comment with general application. The teachers comments are recorded in this Report and appear in the summary sections.

AIM OF THE PROJECT

This project, which was suggested and introduced by Mr. John Drumm

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of ICL for ICL-CES and run by CESI, was to be of benefit to both organisations. The aim was:

To enable classes about computers and their use to be held in some schools in the Dublin area and, by using CES materials, the usefulness and suitability of these materials for use in Irish schools could be gauged.

CONCLUSIONS

The first part of the aim has been achieved. The classes have been held and no teacher has indicated his intention of giving up, in spite of the fact that some teachers were critical of their achievements so far.

The major change needed to bring about improvements in the courses is the extent of the time per week spent in class. The only definite change in course content that has emerged is that some teachers will devote more time to programming in future. The high interest shown by the students in programming suggests that it could be the mainstream of a Computer Studies course, with the other topics introduced when the teacher thinks appropriate.
The CES books were widely used and were received for the most part favourably. There seems to be no reason why they should not be used throughout the country, when the subject is widespread, provided that facilities for the use of CESIL and BASIC are available. The other CES materials were not adequately tested in this project.

From the readiness with which the companies involved gave their facilities and time, I believe that many more throughout the country would act similarly if they were asked to do so.
APPENDIX E

Schools on the Post-Primary Pilot scheme on Computers 1974.

Ashton School, Cork.
Christian Brothers College, Cork.
Colaiste Iognaid, Galway.
Colaiste an Spioraid Naoimh, Bishopstown, Cork.
Laurel Hill Convent, F.C.J., Limerick.
Loreto Convent, Mullingar.
Loreto Convent, Navan.
Oatlands College, Dublin.
Presentation College, Cork.
St. Fintan's C.B.S., Sutton, Co. Dublin.
St. Mary's College, Rathmines, Dublin 6.
St. Paul's College, Raheny, Dublin.
Vocational School, Wicklow.
APPENDIX F

DEPARTMENT OF EDUCATION,
POST-PRIMARY BRANCH,
HANKINS HOUSE (3rd Floor),
DUBLIN, 2.

To the Authorities of Post-Primary Schools,

M38/84.

Computer Studies

The Department of Education has sought the views of the school and teacher organisations on how the place of Computer Studies in the second-level curriculum can best be arranged, and the Department is looking forward to receiving the views of the organisations on different options suggested.

In the meantime the Department has decided to allow a suitable module on Computer Studies to be taken at junior level, with effect from the beginning of the 1984/85 school-year.

It is intended to set up a Syllabus Committee to draw up such a Computer Studies module. Pending consideration of recommendations from the proposed Syllabus Committee a module similar in content and duration to that at present included in the Leaving Certificate Mathematics syllabus will be accepted as part of an approved syllabus in Mathematics at junior level.

The Computer Studies module will not form part of the Certificate examinations and statements will not be issued to junior pupils taking it. The existing arrangements for Computer Studies at senior level remain in force for the present.

The Department also wishes to inform School Authorities that the report of a Study Team on Structured Programming is being prepared for distribution to the schools.

You are requested to bring this circular to the notice of the teachers concerned.

L. C. Leidhin
Rínaí
29 Benltinge, 1984.

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COMPUTER EDUCATION SOCIETY
OF IRELAND

Draft
Constitution and Rules

NAME
1 The society shall be called the Computer Education Society of Ireland (CESI).

MEMBERSHIP
2 Full membership of the society shall be open to any person over eighteen years of age. Candidates for membership must be proposed by two existing fully paid-up members of the society.
3 Associate membership is open to persons under twenty years of age where proposed by two existing fully paid-up members of the society.
4 Honorary membership may be conferred on persons in exceptional circumstances.

AIMS
5 The aims of the Society shall be as follows:
   5.1 The promotion of computer education in Ireland in a manner consistent with the best principles of education.
   5.2 The provision of facilities in computing for teachers in order that they may acquire knowledge and experience in the operation of computers and impart this knowledge in an appropriate way to the students in their care.
   5.3 To advise and inform the public generally on the matter of computer education and extend the general awareness in this area.
   5.4 To provide a forum whereby the various aspects of computer education shall be examined and discussed, courses arranged, seminar and guest lectures arranged, policies formulated, recommendations made to appropriate authorities and discussions held with other bodies.

EXECUTIVE COMMITTEE
6 The affairs of the society shall be administered by an executive committee, the members of which shall normally be elected by simple majority at an annual general meeting of the society.
7 The executive committee shall consist of the following officers:
   7.1 Cathaoirleach
   7.2 Leas Cathaoirleach
   7.3 Treasurer
   7.4 Secretary
   7.5 Two trustees
   7.6 Four other members of the society.
8 Candidates for election to the executive committee must be fully paid-up members of the society for at least two years standing.
9 The secretary, treasurer and trustees shall continue in office at the pleasure of the society and be removable by resolution of a summoned meeting or an annual general meeting.
10 The cathaoirleach shall hold office for no more than three consecutive years but shall become eligible for re-election one year after any such three year period.
11 The executive committee shall be empowered to co-opt additional members to the committee as required to carry out the work of the society and as agreed at an annual general meeting.

PRESIDENT
12 The society shall have a President who shall be nominated by the executive committee and who shall hold office at the pleasure of the society.
13 The President shall be an honorary member of the society.

FUNDS
14 Each member of the society, apart from honorary members, shall pay an annual membership fee of an amount proposed by the executive committee and agreed by a simple majority of the members present at an annual general meeting.
15 The necessary expenses of management of the society shall be provided for by the fees and such other funds as may be available.
16 The treasurer shall conduct the financial affairs of the society and present an accurate and clear account of the finances at each annual general meeting.

MEETINGS
17 There shall be an annual general meeting each year.
18 The executive committee shall meet no less than four times each year.
19 Special general meetings shall be held at such time and place as shall be decided by the cathaoirleach of the executive committee or as requested in writing by twenty or more fully paid-up members.
20 Resolutions for annual general meetings or special general meetings must be submitted in writing to the executive committee at least one month before such meetings and must be notified to all fully paid-up members by the secretary.
21 Only fully paid-up members are eligible to vote on resolutions or in elections at general meetings.

BRANCHES
22 The society shall encourage the formation of local branches in centres throughout the country.
23 Branches shall operate under the rules of the society and such other rules as do not conflict with the constitution and rules of the society.
Details of hardware facilities provided.

In addition to the Basic 48K APPLE II System, there is a 16K Language Card. Two disk drives, a monitor, a 2-80 card, a Centronics Printer, plus a communications interface card providing a facility for communication with other computers.

The Centronics company supplying the printer has a manufacturing base in Drogheda.

This 48K APPLE II System has two microprocessors in the one machine which will enable almost all software written for micro computers to be run on the system.

The system will be supported by an adequate supply of software and high quality documentation. This documentation is of critical importance for implementing computer studies in schools.

Under this connection the system is capable of running the following languages:
Assembler (two versions)

BASIC (three versions)

COMAL-80 (a structured BASIC up to full current COMAL standards)

PILOT (standard author language)

In addition the following languages can be run on the system if the appropriate software is provided:

PASCAL (standard USCD or C/PM)

FORTRAN (ANSI 1977 standard- UCSD system)

COBOL (current standard subset)

LOGO (a recent highly interactive language for educational applications)

CSSP(K) (a recent low level teaching language of Irish authorship)

It is expected that it will be possible to programme in the Irish language using a special variant of COMAL.
APPENDIX 1

HARDWARE PROVIDED, NOVEMBER 22, 1984

DETAILS OF FACILITIES PROVIDED.

The basic system consists of an APPLE IIe (containing 64K of RAM), a 12" Monitor and two disk drives.

In addition to the basic system an additional 64K of RAM, an 80 column card, a VIA interface card, a time clock, and a U.H.F. modulator are also provided.

The serial card will allow the computer to communicate with other computers and will facilitate the attachment of a printer to the system; the VIA card and the clock will facilitate use of the system for monitoring and controlling other physical devices and the U.H.F. modulator will allow the signals from the system to be displayed on TV as well as on purpose-built monitors. The system also includes the following operating systems, low and high level languages and data management packages.

OPERATING SYSTEMS
PRODOS (an APPLE proprietary product)
CP/M (version 2.2)
UCSD (version 2.0)

The latter are the two most widely used machine-independent operating systems for 8-bit computers.

LOW-LEVEL LANGUAGES

Assembler for 6502 microprocessor
Assembler for z-80 microprocessor.

HIGH-LEVEL LANGUAGES

BASIC (three versions)
LOGO (full standard LOGO)
COMAL-80 (five versions, including a high resolution graphics version)
PASCAL (UCSD version)

DATA MANAGEMENT PACKAGES

APPLEWORKS (a three-in-one package covering spreadsheet, database and wordprocessing modules)
Business Graphics

In addition the following languages can be run on the system if the appropriate software is provided:

CSSP(K) (a teaching language of Irish authorship)
FORTRAN (ANSI 1977 version - UCSD system)
FORTH (several versions)
COBOL (current standard subset)
Micro-PROLOG (a version of a new fifth generation language)
LISP (a CP/M version of a language used in artificial intelligence applications)
C (a CP/M standard subset)
PILOT (a popular authoring language)

As this system contains two microprocessors in one cabinet a vast range of educational software written for microcomputers can run on the system.

A disk based tutorial for APPLEWORKS will provide an excellent introduction to this three-in-one data management system.

The system is supported by high quality documentation, which is of critical importance for implementing computer studies in schools.
MEMBERS OF THE SYLLABUS COMMITTEE

COMPUTER STUDIES, JUNIOR CYCLE 1984-85

Representing the Department of Education:
Mr. C.C. Ó Caoimh, Dr. Brendan O'Regan.

Representing Management:
Fr Nicholas Flavin, St. Kieran's College, Kilkenny.
Sr. Eileen Keane, Convent F.C.J., Bunclody, Co. Wexford.
Mr. John Blunnie, Chief Executive Officer, Co. Leitrim, Vocational Education Committee.
Representing the Association of Secondary Teachers, Ireland (A.S.T.I.):
Padraig Breathnach, St. Macartan's College, Monaghan.

Representing the Teachers Union of Ireland (TUI):
Mr. Brendan Mackey, Vocational School, Wexford. (Ms Bride Rosney, Rosmini College, Dublin 9 was appointed TUI representative after the first meeting)

Representing CESI:
Mr. Art Anglin, St. Kieran's College, Kilkenny.
Mr. B. Mackey,
Chairman,
Computer Education Society of Ireland,
Vocational School,
Wexford.

December, 1983.

A Chara,

The present Computer Studies Option in the Leaving Certificate programme was introduced as an interim measure in 1980 in order to enable pupils to become familiar with the use of computers at an elementary level. The Department is now considering how the place of Computer Studies in the second-level curriculum in the future should best be arranged.

For your information I am enclosing a list of possible future options for Computer Studies in Post-Primary schools which are currently being considered.

Mise, le meas,

D. O hEalaisti,
Príomh Chigire Chunta.
LIST OF POSSIBLE OPTIONS

FOR

COMPUTER STUDIES IN POST-PRIMARY SCHOOLS

1. Familiarisation Course in Junior Cycle.
   A non-examination course of about 50 hours duration.

SENIOR CYCLE

2. Computer Studies as a full Leaving Certificate subject examined at two levels, Higher and Ordinary.

3. Computer Studies as a full Leaving Certificate subject examined at Ordinary level only.

4. Computer Studies as an optional component of a revised Applied Mathematics programme.
   At present the Applied Mathematics programme consists mainly of Statics and Dynamics. If Statistics and Computer Studies were to be included in a revised programme then pupils could opt to study any two of the following components:
   STATICS, DYNAMICS, STATISTICS, COMPUTER STUDIES.

5. Computer Studies as an optional component of a revised Physics and Chemistry programme.
   Pupils could opt to study any two of the following components:
   PHYSICS, CHEMISTRY, COMPUTER STUDIES.
6. Computer Studies as an optional component of a revised Mathematics programme.

Pupils could opt to study any two of the following components:

MATHEMATICS I, MATHEMATICS II, COMPUTER STUDIES.

7. Computer Studies to remain as it is.
APPENDIX L

AN ROINN OIDEACHAIS,
BRAINSE AN IARBHUNOIDEACHAIS.
TEACH HÁIN (30 Uriar),
BAILE ÁTHA CLIATH, 2.

DEPARTMENT OF EDUCATION,
POST-PRIMARY BRANCH,
HAWKINS HOUSE (3rd Floor),
DUBLIN, 2.

Fúin (1) Eudh de 71431
Fóirne (Eudh)…………………………
Tábhacht (Ref.)…………………………
D.O.TAG (Your Ref.)………M62/85

D’Odaréar Iarbhunscoileanna

Modul ar Riomhstaidéar – Timthriall Sóisearach

Ag tagairt d’Imliitir M39/84, is mian leis an Roinn Oideachais a chur in iúl d’Odaréar Iarbhunscoileanna go bhfuil An Coiste Siollabais cuí ar Éis an modul (iniata) sa Riomhstaidéar don leibhéal sóisearach iarbhunSCOile a dhreachadh.

Is féidir an modul seo a thabhairt mar chuid de sheilíollas faofa sa Mhatamaitic ar an leibhéal sóisearach ó thús na scóilbhliana 1985/86. Faoi mar a chuirtear in iúl in Imliitir M39/84, ní bheidh an modul seo ina chuid de na Scrúduithe Teistiméireacha.

Tá leagan Gaeilge den modúl a ullmhú.

Iarrtar ort an imliitir seo a chur ar a n-aire do na m.inteoirí a mbaineann an scéal leo.

To the Authorities of Post-Primary Schools

Computer Studies Module – Junior Cycle

Further to Circular M39/84, The Department of Education wishes to inform The Authorities of Post-Primary Schools that the enclosed Computer Studies Module for The Junior Cycle has been drawn up by the Syllabus Committee set up for that purpose.

This module may be taken as part of an approved syllabus in Mathematics at junior level with effect from the beginning of the 1985/86 school-year. As stated in Circular M39/84 the module will not form part of the Certificate Examinations.

An Irish version of the module is being prepared.

You are requested to bring this circular to the notice of the teachers concerned.

D. ó BRÁONÁIN
RÓHÁIN.


490
This first syllabus has evolved after much discussion and consultation. It integrates the up-to-date development of the subject with the interests and capabilities of the pupil. It is not envisaged that each pupil studies all aspects and it is left to the teacher to choose according to ability and available resources. The syllabus indicates a possible order of treatment but discretion will determine the final sequence. The topics and order of treatment are set out as concisely as possible to enable the reader to see at a glance the overall course. Notes are appended to indicate depth of treatment and a possible pedagogy.

The aims and objectives of the syllabus are that a pupil should:

- find the work interesting and enjoyable
- be skilled in the full use of the Computer system available in the School
- be able to receive, transfer and manipulate information
- develop algorithms and be able to communicate them efficiently to the machine using a high level structured language
- appreciate the role and the limitations of a Computer System
- be aware of issues such as security and privacy
- have some knowledge of the historical background associated with computer development
- develop habits of care and attention when using the computer

Note: It is envisaged that pupils would spend about 70 hours on this module in the course of the Junior Cycle.
SYLLABUS

DATA : Meaning of data. Collection and presentation of data into forms which can easily be understood. Meaning of a database. Interrogation of a database.

COMPUTER SYSTEM : Emphasis on the school system. Keyboard.
Disc drive and discs. Tape. Cartridge. Memory - ROM, RAM.
Information flow:
e.g. disc → memory → monitor
keyboard → memory → disc or printer.
Input devices: e.g. keyboard, joystick.
Output devices: e.g. monitor (VDU), printer,
plotter, analogue / digital and digital / analogue converters. Central processor unit (CPU).

DESCRIPTIVE PROGRAMMING : Entering and interrogating databases relevant to the pupils' interests and experiences.
Developing rules to increase information retrieval.
Structured data. Matching and searching.

GENERIC SOFTWARE : Spreadsheet. Wordprocessor.
Database. Graphics. etc.

IMPERATIVE PROGRAMMING : Immediate and programming modes. Arithmetic operations. Read data. Print, tab function.
CONTROL AND MONITORING: Sensors. Binary counter and a memory device. Logic circuits to detect inputs from sensors and control output devices. Use of computer to monitor the states of sensors and control output devices.

HISTORY: Progress of development from machine (binary) code in the first generation computer to high level structured languages in today's fourth generation. Reference might be made when suitable to the work of Babbage (1791 - 1871), Boole (1815 - 1869), Turing (1912 - 1954) and others. Present and proposed future developments. Application in society might refer to: Library, Aer Lingus, Business, Garda Síochána, Army, House-hold bills, Car factory, Weaving, Washing Machines.

NOTE: The creative skills of the pupils are best developed and tested by undertaking projects which use and apply some combination of the above topics.
The ability to receive, transfer and manipulate data through the use and operation of a computer system is essential if the pupil is to develop into a computer literate citizen. As a first step to this end the pupils should develop their own database. An example of a database is given in Appendix 1. Questions which might be set on this database as home exercises for the pupils are:

- How many study Art and English?
- How many study three science subjects?
- Who plays chess?
- Who studies Art and Music but not Spanish?

The word Database as used in the syllabus covers three different types:

(i) A database that is not computer-based.
   cf. Database example in Appendix 1.
(ii) A commercially-produced database.
   cf. Notes on Generic Software.
(iii) A simple database, for the computer, created by the student/teacher, using a descriptive language like PROLOG.
   cf. Notes on Descriptive Programming.

Much familiarisation is necessary for those who have had no experience of typing. Particular attention should be given to the 'return key', 'space bar' and 'shift key'. It is recommended that pupils be exposed to the use of a menu driven program already prepared by the teacher (using a commercial package if available). Use might also be made of:

- turtle graphics as implemented in LOGO, for example;
- educational software and games;
- simulation and other packages in science and in mathematics;
- database in history and utility packages in Geography. Using the computer as a calculator is an example of immediate mode (PRINT 5 +
DESCRIPTIVE PROGRAMMING:

The knowledge and skills of the pupils should be developed in the use and operation of hardware elements that allow the presentation, storage, retrieval and communication of information and reference might be made to the facilities afforded by the MOUSE and the LIGHT PEN.

This type of programming allows the pupil to concentrate on the logic of the problem while the computer looks after its own control instructions.

An example of a database is:

- meat contains protein.
- milk contains protein.
- eggs contains protein.
- grain contains protein.
- grain contains starch.
- meat contains fats.
- eggs contains fats.
- milk contains fats.
- grain contains roughage.

Some questions which might be asked:

- What foods contain protein?
- What does grain contain?
- What foods contain protein but not fats?

A suitable language for this purpose is microPROLOG (MITSI).

 GENERIC SOFTWARE:

Spreadsheet: Pupils should be able to enter data into specific places on the grid. They should be able to evaluate formulae and to replicate columns.
Wordprocessor: Pupils should be able to:

- create, save or replace and retrieve documents
- insert, delete, correct and replace words and sentences
- move sentences and paragraphs from one place to another
- merge and link files.

Database: Emphasis should be placed on the structure of the database so as to facilitate interrogation.

Graphics: Statistical representation using bar charts, piecharts and trend graphs are involved here.

**IMPERATIVE PROGRAMMING:**

An example of what might be feasible is given in Appendix 2. A discussion of the problem and a plan of campaign (algorithm) should be undertaken before any programming is attempted. Structured algorithms are essential when programs progress beyond the very simple. COMAL is recommended as a suitable language.

Ideas of modularity are also well illustrated by procedures in LOGO and can be done using Turtle graphics. Confining pupils to Turtle graphics alone may hinder their appreciation of the full power of LOGO.

**CONTROL AND MONITORING:**

The types of sensors intended are those with two states e.g. switches, light and heat detectors etc.
Simple output devices intended are lights, alarms and relays.

Pupils should be familiar with a real but simple memory device and how, for example, the states of sensors could be read into the memory.

Access may be had to different memory locations by an address as set up on a simple binary counter.

Only the AND, OR and NOT logic circuits need be considered.

Not more than two inputs to the logic circuit are intended.

The decision making facility of the computer and in main memory storage might be called upon to gain more extensive control of the devices being used.

It is not intended that pupils be given a full historical background of computer development. The three forces which accelerated progress were space travel, military applications and commercial considerations.

It is usual to outline the development as follows:

1st. generation: Use of valves/relays in large machines
c. (1945 - 1955)

2nd. generation: Use of transistors
c. (1955 - 1965)

3rd. generation: Use of integrated circuits
c. (1965 - 1975)

4th. generation: Use of very large scale integration
c. (1975 - )
The fifth generation computer may use artificial intelligence in expert systems and may have pattern, including voice, recognition. Research along these lines is now taking place.

Mention might also be made of:
- the abacus which is in existence for 5000 years
- John Napier and his logarithms of the 17th century
- Pascal's calculating machine of 1640
- Leibnitz and his multiplier wheel of 1672
- ENIAC (Electronic Numerical Integrator and Calculator) the machine which ushered in the computer age in 1947.
### SUBJECTS

1. Irish  
2. English  
3. Mathematics  
4. History  
5. Geography  
6. Biology  
7. Physics  
8. Chemistry  
9. Agricultural Science  
10. Economics  
11. Accountancy  
12. Business Organisation  
13. Economic History  
14. Art  
15. Music  
16. Italian  
17. Spanish  
18. French  
19. Home Economics.

### EXTRA CURRICULAR ACTIVITIES

H: Hurling  
G: Gaelic Football  
Sw: Swimming  
C: Chess  
S: Soccer  
T: Tennis  
Tr: Track.

### SCHOOL TIMETABLE

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APPENDIX 2.

The following programs written in COMAL indicate a possible depth of treatment.

PROGRAM 1

5 Rem Average of three given members
10 INPUT A, B, C
20 R: = A + B + C
30 Z:= R/3
40 Print Z
50 End

PROGRAM 2

5 Rem Read and print data
10 Dim N$ of 10, H $ of 10
20 For I = 1 to 3 Do
30 Read N$, H$, N
40 Print N$, H$, N
50 Data "Mary", "Wexford", 34568
60 Data "John", "Dublin", 896998
70 Data "Michael", "Galway", 432117
80 Next I
90 End

PROGRAM 3

5 Rem Add a given number of natural numbers and show results in two columns
10 I:=0
20 T:=0
30 Input "Type in the top number": N
40 Print Tab (15), "NO.", TAB (30), "Total"
50 Repeat
60 I: = I + 1
70 T:= T + I
80 Print Tab (15), I; Tab (30), T
90 Until I = N
100 End
PROGRAM 4
10 Rem Payslip program
20 Dim N$ of 20
30 Input "Type person's name": N$
40 Input "Type reference number": N
50 Input "Type hours worked": H
60 Input "Type rate per hour": R
70 Input "Type tax rate": TR
80 Input "Type PRSI rate": P
90 Rem Calculate gross pay
100 GP: = H * R
110 Rem Calculate tax
120 T: = GP * TR/100
130 Rem Calculate PRSI
140 S: = GP * P/100
150 Rem Calculate nett pay
160 NP: = GP - T-S
170 Rem Print output
180 Print Tab (5), "Name": N$; Tab (20), "Number": N
190 Rem Leave blank lines
200 Print
210 Print
220 Print Tab (5), "Hours worked": H; Tab (20), "Rate per hour": R
230 Print
240 Print
250 Print Tab (5), "Tax": T; Tab (20), "PRSI": S
260 Print
270 Print Tab (5), "Gross": GP; Tab (20), "Nett": NP
280 End

NOTE 1: To take account of the tax free allowance we must include the following lines
85 INPUT "Taxfree allowance": TFA
102 Rem Calculate taxable income
104 TE: = GP - TFA
and line 120 now becomes
120 T: = TE * TR/100

/...
Note 2: Account might also be taken of the case where the tax free allowance is greater than the gross pay. The following changes would then be necessary

113 IF TFA > GP then T := 0
115 Else
117 T := CE * TR/100
120 Endif

Note 3: To clear the screen before printing the output we write (in the case of the APPLE)

175 HOME

Note 4: If overtime is involved, the different rates obtaining need to be calculated as well as the overtime in hours in excess of a fixed number. Weekend, night and shiftwork rates would also have to be included. These developments are suitable for the better pupils only and they give the opportunity for developing individual potential.
These notes are written primarily for the benefit of teachers wishing to purchase educational software. They constitute a check-list of questions to be asked about particular software packages. In this sense, they may also serve usefully as guidelines for the producers of such packages.

This draft is based largely on the guidelines written by W. T. Beveridge, HMI, and distributed by the Scottish Microelectronics Development Programme.

1. Description

   Name of Package:
   Publisher/Supplier:
   Price:

   Target computer:
   System requirements:
   VDU required: (monitor, TV, RGB, TTL, colour):

   Medium (tape, disc, ROM):
   Is a dongle required?
   Operating system:
   Language:

   Is a backup copy available?
   If so, how?
   License (school wide, confined to one system, etc):

   Have you seen the package running on your system?
2. **Educational Objectives**

In what course(s) can the package be used?
What topics are covered?
Age level(s) (primary, junior cycle, senior cycle, 3rd level)
Are the objectives clearly stated?
How is the attainment of the objectives to be gauged?
  e.g. work book
  managerial function in package
  teacher gives test
  discussion
  other
Is the teaching style appropriate (note language used etc.)?

3. **Use of Package in Practice**

What are the advantages of using a computer for this application?
Type of interaction (class, group, individual):
Duration (maximum and minimum):
  Can the package be used in parts?
  If so, can data be retained?
Location of computer (classroom, laboratory, outdoor):
Ease of running: is it turnkey?
  is much reference to manual needed?
  are there adequate error traps?
  can data be lost?
Learning style: demonstration
data acquisition/retrieval
drill
tutorial
modelling
simulation
game
other
Preparation required: by teacher
by students
Are sample runs provided?
Can different levels of difficulty be selected or built in?

4. Package Structure

Is the package self-explanatory?
Are objectives listed at the start?
Is there feed-back at the end of the session (managerial function)?
Is normal forward progress easily maintained throughout?
    e.g. 'Yes' to go forward, 'No' to go back
Are the response standardised?

5. Interaction

Is the interaction suitable to the ability level?
Are various correct answers allowed (e.g. upper/lower case)?
Are free-format or long answers allowed?
Is slang of the day used?
Is the package conversational?
Is the learner required to type large amounts of information?
Are appropriate 'rewards' given?

6. Screen Layout

Is too much text used?
Are broad margins and double spacing used?
Is the layout easy to comprehend?
Is emphasis used intelligently e.g. inverse, flash, underline?
Is the screen cleared between pages of text?
7. **Learner Control**

Is the package menu-driven?
Is the learner in control of progress?
Can the user back-step?
Is there a HELP facility?
   If so, how specific is it?
   Is HELP really needed?
Is there an 'escape' facility?
Typing mistakes: are normal cursor moves permitted?
Are all available options listed at each point?
Are the available options consistent throughout the package?
Are hints supplied when a wrong answer is given?

8. **Programming Robustness**

Can a wrong key-press cause the program to crash?
Are all keys disabled apart from those which can legally be typed?
Is the package proof against disc errors e.g. disc drive door open, wrong disc in drive, etc.
Is the user protected from system messages?
How was the package tested?
Can the package be modified easily?
What software support is provided?
APPENDIX N

PRODUCTION OF NEWSLETTER 1980-81

Michael Moynihan, as editor of the Journal gave a breakdown of the costs involved in producing the CESI Newsletter.

"Four newsletters were produced (in 1980/81 school year). Each newsletter was run off on a plain paper copier at Caliste an Spioraid Naomh, (Bishopstown, Cork). It takes ONE HOUR to run off 1000 copies of each page, a further 16 hours to collate the pages; stamping, putting on the sticky labels and readying the envelopes takes another 10 hours.

The following is a breakdown of the time spent by me on the newsletters:

    NOVEMBER 1980  31 PAGES = 31 HOURS
    COLLATING = 16 HOURS
    STAMPING = 10 HOURS
    ENVELOPES, ETC

    TOTAL 57 HOURS

    JANUARY 1981  34 PAGES = 34 HOURS
COLLATING = 16 HOURS
STAMPING = 10 HOURS
ENVELOPES, ETC

TOTAL 60 HOURS

MARCH 1981 34 PAGES = 34 HOURS
COLLATING = 16 HOURS
STAMPING = 10 HOURS
ENVELOPES, ETC

TOTAL 60 HOURS

MAY 1981 38 PAGES = 38 HOURS
COLLATING = 16 HOURS
STAMPING = 10 HOURS
ENVELOPES, ETC

TOTAL 64 HOURS

GRAND TOTAL = 241 HOURS

This is on top of my normal school work and my work as
Chairman of CESI!

(Moynihan, who was Chairman of CESI (1978-81) took over the Editorship of the newsletter in 1979, as there was no one else on the Executive who was willing to take on the job, and he felt that it was important that CESI maintain an organ of publicity).
APPENDIX O
Na Scolleanna á la páirteach sa Scéim Phiulóta: Níos choisíte sa Dhunioideasach: '84/'85

<table>
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APPENDIX P

COMPUTER EDUCATION SOCIETY OF IRELAND

(PRIMARY EDUCATION GROUP)

A SUBMISSION ON
COMPUTERS IN PRIMARY EDUCATION
TO THE CURRICULUM AND EXAMINATIONS BOARD
(PRIMARY REVIEW COMMITTEE)

January 1985
INTRODUCTION

The Curriculum and Examinations Board, which was established by the Minister for Education in January 1984, has set up a Primary Review Committee to review the existing research on the primary school curriculum, identify areas for further research and propose initiatives, and to identify problems and propose appropriate strategies for solving them. This Committee has invited CESI to bring to its attention any development projects relating to the primary curriculum in which it is involved.

The Computer Education Society of Ireland, which was established in 1973 as a voluntary organisation of people interested in promoting computer education, set up a Primary Education Group in June 1984 "to coordinate activities of interest to members in primary schools in order to assist the development of computing in this area. The invitation from the Primary Review Committee, which was received by CESI Chairman, Mike Norris of UCD Computer Centre, was passed for reply to the Steering Committee of the Primary Education Group. This response has been prepared by the Chairman of the Primary Education Group, Gerard Enright of Mary Immaculate College, Limerick, in consultation with the members of the Steering Committee.

EDUCATION AND THE TECHNOLOGICAL REVOLUTION

In a contribution to the debate on the establishment of a Curriculum and Examinations Board in 1982, the CESI, speaking in the context of "making the best possible provision for the children in our schools", stated that

"The technological revolution in which the computer is playing such an important part has started already; it is almost certainly bound to cause fundamental changes in our lifestyles and hence in our schools." (6)

This comment highlights the changes that are taking place in our society and, recognising the role of education in preparing people for society, focuses attention on the need for a response to these changes from the education system. This need is recognised by the Minister for Education, who lists the following as one of the principles underlying the Programme for Action in Education:

"Education should be continuously updated to make it relevant to the modern world, to developments in technology, to changing employment opportunities and patterns as well as to increased leisure time." (5)

It is also acknowledged by the Curriculum and Examinations Board in whose Consultative Document of September 1984 the following statement appears:

"The Board recognises the significance of the basic sciences and the new technologies in the lives of all our people today, and the central role
they have to play in the economic and social development of the country. The Board would wish to have these views reflected in the school experience of young people at first:and second levels." (3)

COMPUTERS IN PRIMARY SCHOOLS

"In its 1982 submission (6), CESI considered the role of the computer in education under various headings. These included the following:

- Computer Studies: a subject in which the student learns about computers as a preparation for life, as an intellectual challenge and as a highly enjoyable and motivating experience. We suggested that there was great scope for development in this area at primary level with emphasis on creative and exploratory aspects.

- Computers in Administration: processing student records, timetabling, accounting, word processing, evaluation.

- Computer Based Learning: computer-managed and computer-assisted learning, involving the use of structured packages designed for a variety of topics and applications.

- Computers in Guidance: information storage and retrieval, testing.

The computer's potential as an educational resource, as a teaching and learning aid, as an administrative assistant and as a worthwhile object of study will not be achieved merely by the provision of computer equipment to schools. Great care must be taken in the choice of hardware and most especially in the choice of educational software. Schools and teachers must prepare themselves for the arrival of computers and must be advised on the best possible use of the new technology. Technical and educational backup services must be provided. Fundamental changes in the curriculum and in teaching methods may be required. Rather than regarding the computer as a tool for our present work, let us see it as a challenge. Let us examine how material is presented, taught and learned, and let us consider whether there are better ways: whether the computer might allow for the creation of an improved educational environment.

"CESI is anxious that the new technology should not be forced into old, unsuitable frameworks. Rather, it should be seen for what it is: an important means by which the education of our children can be enriched, and indeed can keep pace with the changing society in which we live."

(6)
With regard to primary schools, we are proceeding with appropriate caution at present. In the Action Plan, the Minister proposed

"to establish pilot projects on the teaching of science and on the use of computers in a selected number of national schools. The schools selected in the latter context will include a number of special schools." (5)

The computer projects have already begun in 30 chosen schools. These and other projects should help us to plan for the introduction of computers in schools and for their proper use. John O'Connell of the Maynooth College Computer Centre has written the following:

"Computers should be used in an educational environment only when they will result in an improvement in the existing procedures. All of the users must accept that such an application offers a unique solution to a particular educational problem. Such systems should not be implemented unless sufficient resources, including human and equipment, are available to ensure that the implementation will be well designed and properly supported." (4)

---

**TEACHER EDUCATION**

At pre-service level, CESI is pleased to note that the Colleges of Education have begun to introduce student teachers to computers and to explore their potential for primary education. This work must be continued and expanded. Students must be afforded the opportunity to learn about and to experiment with computers. Such pre-service experience will enable them to begin to use computers in their schools and to assist teacher colleagues in this area.

The need for in-service education of teachers is also recognised. In the Action Plan (5), the Minister states that

"Pilot projects on the teaching of science and the use of computers in national schools will also have an important in-service component."

Having been involved in in-service courses for Second level teachers for many years, CESI organised a course for primary teachers at Tóndal Riomhaireachta na Scol, Colaiste an Spioraid Naoimh, Bishopstown, Cork. in 1983. Following the success of this course and in response to teachers' requests, CESI was involved in the provision of several courses throughout the country in 1984. These courses were recognised by the Department of Education. Some were organised in association with the Colleges of Education. The need for comprehensive introductory and follow-up courses cannot be over-emphasised. The demand is there: teachers are anxious to learn. Their needs must be met. As Gerard Enright said in a recent article:

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"The introduction of computers in primary school classrooms clearly needs planning and preparation and calls for a considerable investment of time and effort by the teachers concerned. Teachers should be assisted by the provision of study leave and generous arrangements for lesson preparation. Pre-service and in-service courses should include preparation for computers, introductory programming and experience with a good selection of equipment. A crucial part of any course for primary teachers is software evaluation. Commercial software must be subject to rigorous examination." Teachers will demand high pedagogical standards for classroom material." (1)

A copy of the October 1984 issue (Vol. 8 No. 1) of the CESl Journal, Riamhíreachta na Scol, is presented with this submission. It contains a report on the 1984 summer courses in which CESl was involved... from which we quote the final paragraph:

"Teacher reaction to the course was very good and most people called for further courses in this area. Indeed the great attendance at this year's course at the various centres shows that there is a very high level of interest in computers in primary schools and that teachers are keen to learn as much as they can, so that the best possible educational advantage can be derived from this development." (2)

Courses were also held in several Teacher Centres, whose role in in-service education and teacher support is recognised by the Minister in her proposal:

"To provide micro-computers and appropriate software in the principal Teacher Centres." (3)

PROJECTS

Ionad Riamhíreachta na Scol was established at Colaiste an Spioraid Naoimh, Bishopstown, by the Cork Branch of CESl in 1978. It provides computer facilities and opportunities for experience to teachers and students in the Cork area. It has provided courses at beginners and continuation level for primary and secondary teachers. During 1984, a series of workshops was organised for teachers in local primary schools. Concentrating on LOGO and word processing, these proved to be very successful and they are continuing through Spring 1985.

Members of the Steering Committee of the Primary Education Group, who work in Primary Schools and in Colleges of Education, are involved in experimental projects using computers with primary school children. These are not CESl projects and the Board will probably hear of them from their own sources. We would, however, like to express our support for such projects in this submission by mentioning the following:
1. A number of teachers at St. Patrick's National School, Drumcondra, in cooperation with staff of St. Patrick's College, have introduced computer work on an experimental basis in their classrooms. Their approach is centred on the language LOGO, in their opinion, provides the single most valuable environment available to schools at present. Their strategy has been to design supplementary procedures, which can be treated as part of LOGO, and which offer the possibility of a uniform approach to geometry, set theory, arithmetic, physics, music, creative writing, information storage and retrieval, and other areas. They have also created teaching aids designed to link computer work with traditional classroom activities and to accustom children to procedural thinking away from the computer.

2. Computers are being used in a special class in St. Patrick's National School, Drumcondra, in a variety of ways, and the children's progress is being monitored by the teacher. Applications include reinforcement by means of individualised drill and practice programs; language development, logical thinking, discussion and social training using adventure games and simulations; and the teaching and use of LOGO. It is hoped that a project on the possible use of a computer as an aid to the integration of mildly handicapped pupils in the ordinary class can be undertaken in the future.

3. Several schools in which members of the Steering Committee teach have become involved in the Department of Education Pilot Scheme 1984-85 on Microcomputers in Primary Schools. The Board will presumably receive a report on this scheme. Its findings should provide valuable guidelines for the use of equipment and provide an assessment of LOGO and other educational software materials.

4. The Computer Centre at Mary Immaculate College, Limerick, provides courses on computers and their educational uses for student teachers and for teachers on a regular basis. Local teachers visit the Centre to examine and test hardware and software products which are of interest to them. Advice, references and access to equipment and materials are available to students doing research work in this field. The Centre has recently become involved in an experimental project on the use of LOGO, in association with a number of Limerick primary schools, at the request of the College's Curriculum Development Unit. Some teachers and their classes are working in the College, while others have computers in their schools. The project is guided and monitored by College staff and by the class teachers.
CONCLUSION

We hope that CESI, with its national structure and network of local Branches, provides considerable support to teachers and schools. We regard it as a forum for the exchange of ideas, for the sharing of experiences and for co-operation. Experienced members make themselves available for courses, conferences and seminars; they meet with individual teachers and with researchers and they assist colleagues who begin to use computers in school. As we end this submission with a set of six recommendations, we are aware that we may have strayed from the specific question asked of us (to provide information on projects), but we hope that our comments may be considered under the term of reference of the Review and that they will be of some assistance to the Primary Review Committee and to the Curriculum and Examinations Board in their deliberations.

1. That the main consideration in the introduction of computers at primary level be to ensure that pupils are prepared for the impact of computers on their lives and brought to some awareness of the beneficial uses of modern technology.

2. That adequate facilities be provided for teacher education in the use of computers and in their potential at primary level, that high standards be maintained and that courses be co-ordinated.

3. That the findings of pilot schemes such as that initiated by the Department in November 1984 be published to facilitate informed debate and to assist in the formulation of a national policy on computers in education.

4. That high standards of educational and technical suitability be brought to bear on software provision so that quality materials can be recommended to schools.

5. That a comprehensive backup service be established as computers are used in primary schools so that teachers can have access to materials for experimental and research purposes and to expert advice and assistance.

6. That realistic financial provision be made for the introduction and use of computers in primary schools and that, even in times of economic restraint, such be regarded as an essential investment in education for the sake of the future development and progress of our country.
REFERENCES


2. Enright, G.M., The 1984 Summer Courses for Primary Teachers, ibid.


Twelve major European companies, together with other groupings, hundreds of small and medium-sized undertakings, universities and research centres, have set to work in the context of a European programme of pre-competitive research in the field of Information Technologies, namely ESPRIT.

It is felt that Information Technology is the key to Europe's future. It is the world's fastest growing industry. A practically endless stream of new applications, generated by microelectronics innovation lies before us. The Information Technology sector has sustained a remarkable growth during the recession, while other industries were laying off workers. It is claimed that at the present real increase is 8% per annum. Information Technology is likely to become a $3,000M world industry by 1990. It is a revolution that promises new exciting opportunities for the citizens of Europe. First of all a boost for jobs for young and old: demand for new skills for school leavers; a revitalisation of worn-industries; work without the hassle of commuting to congested city centres; a level of automation that will do away with the
tedious jobs in factories and offices.

Today nearly two out of every three Europeans are directly affected by Information Technology in their work. In the next few years, that proportion will be even higher as service and information industries play an increasingly dominant role in the European economy. Today, the need for Information Technology products has created a situation where Europe imports on a vast scale from countries such as the United States and Japan, and in so doing has created an $8 billion balance of payments deficit—a tenth the size of Europe's oil bill.

At present, Europe represents one third of the market, but supplies only 10% of world production. The European Commission is convinced that the Community can reverse this trend and that it must be done soon. If it does not then Europe will lose out in more than just the Information Technology industrial sector which employs 5% of the population. Information Technology is acting as a dynamo industry revitalising old industries. For example, the introduction of robotics is vital to help the European car industry compete at home and abroad.

What this means for Europe is either continuing industrial decline
with lower levels of prosperity in the next few years for the average citizen, or a quantum leap forward to marry scientific invention to industrial production with the promise of vast economic gains. European Information Technology firms now apparently want to put their weight and efforts into building a Europe-wide Information Technology industry as strong as their competitors. This could create about one million extra jobs in this sector alone. Another million could be added in Information Technology service industries. The stimulating effect on other parts of the economy, which have up to now been slow in applying and absorbing Information Technology products, should generate additional millions of jobs.

The EEC aims to regain a share of the market comparable to what the European market offers, which is 30% of the world market; that is three times more than at present. To do this the aim is to mesh with national support schemes strengthening national industries and go above and beyond this to build a strategic, pre-competitive technology for Europe's future. Potentially Europe has all the major requirements going for it. The European Community (EEC) has created a common market of 270 million consumers. It has major Information Technology companies with innovative traditions, together with a new breed of smaller companies and entrepreneurs who are forging new
business markets. Above all there is a skilled work force and Europe's primacy in scientific innovation.

The ESPRIT programme aims at producing a major strategic impact by linking a significant proportion of key European engineers and scientists in Research and Development (R & D) collaboration for a pre-competitive industrial technology. By engaging both companies and national programmes most efficiently and eliminating duplication of effort, R & D can be spearheaded towards the most vital goals.

At its peak ESPRIT aims to unite two to three thousand of the best brains in Europe in a 10-year partnership of the EEC Community and industry. A pilot scheme was launched in 1983 costing $23 million and the main programme runs from 1984-94.

The goals of ESPRIT are:

- A new level of man-machine interfaces so that the user will feel more at home and he can communicate in more 'natural' ways. Machines will have to understand natural language, whether spoken or handwritten.

- A greater degree of interactivity that will allow the machine greater leeway or delegation to solve problems. Thus a system should become more "intelligent" and begin to fill
out the details itself. It may find ambiguities and contradictions in the desires of the user and begin a dialogue with him to resolve them. The system will need to understand more about the background to a problem so that it can both explain its conclusion and also what it is to do further if the result is unsatisfactory to the user.

Integration of various services and functions will require interconnected local and wide area networks and all possible forms of distributed processing.

New levels of reliability will be required to obviate, for example, a system malfunction closing down a factory. Reliability becomes an even larger problem as greater numbers of less and less sophisticated users are involved.

Coupled with this is the need for greater security of sensitive data.

All these factors require progress in software as well as in the systems. Increased processing power can only be achieved through advances in components (microelectronics) and system architecture (the combination of hardware and software systems). The greatest economic impact of Information Technology will be at the office and in the factory.
APPENDIX R

THE CANADIAN EDUCATIONAL MICROCOMPUTER
(an overview)

The general configuration for the proposed system consists of either Standard Student Micros or Advanced Student Micros connected together on a network to a File server. Both micros have the option of a mouse or track-ball as pointing devices, along with a removable bilingual keyboard including a number keypad and ten definable function keys. All parts of the system support the transmission and generation of voice and monotonic music plus the use of the Telidon PDI protocol for graphics.

In an effort to reduce the problems which occur with the duplication of commercial software, each machine is supplied with its serial number contained in ROM thus allowing companies to code their software so that it will only work on prespecified units.

THE OPERATING SYSTEM

The system is controlled by a modified Unix-like operating system called ONX by Quantum Systems in Ottawa. It is menu driven...
access to the menu structure through pointing devices. The software
to drive these interfaces is provided for elementary, secondary, and
teacher-administrator levels.

THE NETWORK

The network is based on Arc-net by Datapoint with a transmission
speed of 2.5 mega bits/sec. It supports 254 workstations. Control
of the network is through a 7400 fileserver with 256K of RAM, two
RS232 serial ports, one Centronics printer port, a 1 megabyte
floppy drive, and a 5 megabyte hard drive. The latter is in the
Winchester ST506 format and supports tape drives or removable
medium to increase its storage capacity. The connection of the
individual micros to the network will be through vacuum-cleaner
hose-like cabling modules containing both A.C. power, and network
data signals.

THE STANDARD STUDENT MICRO

This machine is based on an Intel IAPX80186 16-bit processor which
is currently not used by other micros. It is supplied with 128K of
memory, and is expandable to 256K. The display is software selectable
up to 640H x 240V monochromatic or 320H x 240V colour.
THE ADVANCED STUDENT MICRO

This machine is based on the National Semiconductor NSC 16032, and has a computing power approximately equivalent to a VAX 750. It is supplied with 256K of memory, and is expandable to 1024K. The display format is software selectable up to 600H x 800V monochromatic.

LANGUAGES

The system operates under the computer language "C", which increases its speed and will also support the Waterloo interpretive languages. In addition, Waterloo is developing compiler-based languages for it. A version of LOGO will also be available. The CEM project is designed to go beyond what schools are currently doing with computers. While existing machines are mainly used for home and business and could effectively be used in the classroom, with the new machines they claim to be leaping a generation or two to a more advanced machine.

Funding provisions were $4-$5 million in 1984-85 and $10-$15 million in the years 1985-87. Over the next five to six years there is expected to be approximately 300,000 microcomputers in Ontario.
schools, that is one to every 5 or six students. Money for software was allocated as follows:

- $1.3 million to develop the operating system, and language software in 1984.
- $5.4 million to translate existing software packages in 1985.
- $10 million in 1986 to develop new software.
APPENDIX S

ALL-CANADIAN EDUCATIONAL MICROCOMPUTER

(Functional specifications)

A study was performed by two Ottawa companies for the Canadian Advanced Technology Association was funded by the Ontario Ministry of Education. It commenced in July 1981 and the final report was submitted in October 1981. Its terms of reference were:

"to develop functional specifications which will enable the effective utilisation of microelectronic technology to support educational processes at all levels in Ontario and elsewhere."

ASSUMPTIONS

- The functional specifications of a family of Canadian Microcomputers for use in education were identified.
- The specifications would continue to evolve in tandem with both developments in educational technology and computer communications technologies in their broadest respective senses.
- The rate of introduction of microcomputers into the Ontario educational system will continue to be dependent upon:
  - congruence with teacher’s goals
  - availability of quality computerised learning
materials
- trained professional staff
- product competitiveness
- Ministry of Education policies and availability of a provincial strategy

- The trend in usage was towards stand-alone applications of microcomputers but with application to local (classroom, school), regional, provincial networks for middle and upper grades and administrative applications.

- Applied educational research indicated promising applications of microcomputers with young children in the primary division.

- Ontario educational policies continued to emphasise the development of the individual.

- Teachers will apply the technology and some will produce courseware. Thus teachers will:
  - demonstrate the use of microcomputers and networks
  - use local, regional, provincial and national communications networks
  - anticipate uses for, and incorporate, microtechnology into the classroom
  - use computers as record keeping devices
FUNCTIONAL SPECIFICATIONS

Microcomputers had four major educational uses in Ontario (1981): these were -
- computer literacy
- computers as a tool
- CAI/CAL
- communications

It was envisaged that the MICROCOMPUTER MUST SUPPORT LEARNING IN BOTH COGNITIVE AND AFFECTIVE DOMAINS: Examples are given as follows:-

- Build on previous conceptual models
- Allow choice and change of cognitive styles
- Challenge the imagination
- Be enjoyable to use
- Eliminate fear of technology and permit and encourage social skills.

FAMILY OF SYSTEMS CONCEPT

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The specification identify a FAMILY of microcomputers. With this in mind, students must have the opportunity to grow in the range of sophistication of their use of computer applications as they progress from the primary grades to high school. They must make use of familiar and "friendly" systems as they move through the grade system. For those reasons, the CEM family must be required not only to connect readily with other but to run with compatible software and courseware.

APPLICATION

The application of microcomputers was discussed according to six critical interfaces:—

- STUDENT/COMPUTER INTERFACE: objectives identified and illustrated according to grade level and subject area, including guidance, characteristics of computers identified and special needs of minority groups reconciled.

- STUDENT/TEACHER INTERFACE: typical objectives including evaluation identified and the analogy with the language laboratory noted.
STUDENT/STUDENT INTERFACE: need for peer group communication noted, e.g. in decision making exercise: requirement for analog input devices.

TEACHER/COMPUTER INTERFACE: typical uses:
- record keeping
- report generation
- lesson development computer library
- CAI/CAL
- authoring . etc

the need for security of access was stressed.

STUDENT/TEACHER INTERFACE: school-based (local) network could allow interclassroom connection for demonstration of, for example, electronic mail systems, simulation exercises.

With a student/teacher-remote Network, CEM acts as a terminal for "larger" computers in order to use remote CAI/CAL systems and databases, e.g. Student Guidance Information System, access to videotext and teletext system, e.g. Telidon; CEM can interact "intelligently" with other computers, e.g. communication with remote computers including possibly, those located at the Ontario Communications Authority.
ADDITIONAL REQUIREMENTS

- wide range of applications in order to attain Ministry objectives
- fool-proof operating systems for unsophisticated users
- ability to incorporate technological enhancements
- special input devices e.g. language character sets
- non-tangle cords for use with young children:
- colour and special shape generation-
- video disc compatibility;
- storage and print devices
- sound
- use over a wide use of temperature variations
- multi-language capability (BASIC, FORTRAN, PASCAL etc)
- teleprocessing interface
- simple animation
- random number generator
- real time clock
- standard operating system
- TELEDON videotext/graphics editor
- adequate and comprehensible documentation
- teacher self-teaching programs
- reliable and debugged system
- safety requirements

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APPENDIX T

COMPUTER EDUCATION SOCIETY of IRELAND

(Cumann Riomhaires na hEireann um Oideachas)

OFFICERS AND EXECUTIVE COMMITTEES

1974/75

Chairman : James P. Roche, Crawford Municipal Institute, Cork
Vice-Chairman : C.C.H. Dawkins, Portora Royal School, Enniskillen, Co. Fermanagh, N.I.
Secretary/Treasurer : SR Lourda Keane, Laurel Hill Convent F.C.J., Limerick.
Committee:
Fr Cyril Byrne, St Mary’s College, Rathmines, Dublin 6
Fr Charles Gardiner, St. Paul’s College, Sybil Hill, Raheny, Dublin 5
John Kelly, Vocational School, Wicklow
Brother Michael McInerney, Christian Brothers, Sutton, Co Dublin.
Matthew Murphy, Vocational School, Wicklow

HONORARY MEMBERS

Professor A.C. Bajpai, University of Technology, Loughborough, England
Dr John Hislop, University of Technology, Loughborough.

Dr Gwen Evans, University of Technology, Loughborough.

Mr. George Deacy, Computer Centre, University College, Galway.

TRUSTEES

Sean Ó Laoghaire, Department of Education, Hawkins House, Dublin 2.

Rev. P. Steen, St Patrick's College, Drumcondra, Dublin 9.

1975/76

Chairman: John Kelly, Vocational School, Wicklow.

Vice-Chairman: C.C.H. Dawkins, Portora Royal School, Enniskillen.

Secretary: Diarmuid Mc Carthy, Vocational School, Crumlin, Dublin 12.

Treasurer: Sr Lourda Keane, Laurel Hill Convent, F.C.J., Limerick.

COMMITTEE

Fr. Cyril Byrne, St Mary's College, Rathmines, Dublin 6.


Pat O'Leary, Coláiste Cholm, Swords, Co. Dublin.

Elizabeth Oldham, School of Education, Trinity College, Dublin 2.


Sr. Bernadette Kelly, Loreto Convent, Mullingar, Co. Westmeath.

1976/77

Chairman: John Kelly, Vocational School, Wicklow.

Vice-Chairman: Pat O'Leary, C.B.S., Swords, Co. Dublin.
Sec/Treasurer: Diarmuid Mc Carthy, Vocational School, Crumlin, Dublin 12.

COMMITTEE

Fr. Cyril Byrne, St Mary's College, Rathmines, Dublin 6
Bro. Michael Mc Inerney, C.B.S., Sutton, Co. Dublin
Elizabeth Oldham, School of Education, Trinity College, Dublin 2
Sr. Lourda Keane, Laurel Hill Convent F.C.J., Limerick
Michael Moynihan, Colaiste an Spioraid Naoimh, Bishopstown, Cork
Fr. Emmanuel Curtis, Cistercian College, Roscrea, Co. Tipperary.

1977/78

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Fr. Emmanuel Curtis, Cistercian College, Roscrea, Co. Tipperary.
James Walsh, C.B.S., Naas, Co. Kildare
Elizabeth Oldham, School of Education, Trinity College, Dublin 2
Maurice Brosnan, Vocational School, Wexford.
1978/79
Chairman: Michael Moynihan, Coláiste an Spioraid Naoimh, Bishopstown, Cork.
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Hugh Dobbs, Newtown School, Waterford
Fr. Emmanuel Curtis, Cistercian College, Roscrea, Co. Tipperary
James Walsh, C.B.S., Naas, Co. Kildare
Maurice Brosnan, Vocational School, Wexford
Mary Delaney, Presentation Secondary School, Kilkenny
Elizabeth Oldham, School of Education, Trinity College, Dublin 2.

1979/80
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Vice-Chairman: John Kelly, Computer Science Dept., U.C.D., Belfield, Dublin 4.
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Philip Cuthbert, Our Lady's School, Rathnew, Co. Wicklow.
Mary Delaney, Presentation School, Kilkenny
Hugh Dobbs, Newtown School, Waterford.
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1980/81
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Treasurer: Maurice Brosnan, Vocational School, Wexford.
Assistant Secretary: Nóra Ní Neachtain, Mount Anville Secondary School,
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Philip Cuthbert, Our Lady's School, Rathnew, Co. Wicklow.

Mary Delaney, Presentation School, Kilkenny

Hugh Dobbs, Newtown School, Waterford.

Fr. Augustine Hughes, Gormanston College, Co Meath

Sr Lourda Keane, Laurel Hill Convent F.C.J., Limerick.

Brendan Mackey, Vocational School, Wexford.

Diarmuid McCarthy, College of Marketing & Design, Parnell Square, Dublin 1

Michael Mc Inerney, Computer Science Dept, Trinity College, Dublin 2

Paddy Moran, Coláiste Muire, Tuar Mhic Eadaigh, Co Mayo.

Elizabeth Oldham, School of Education, Trinity College, Dublin 2.

Susanna O'Leary, St. Patrick's Comprehensive School, Shannon, Co Clare.

Fr. Eamonn Prendeville, St Brendan's College, Killarney, Co Kerry.

Fr. Liam Sharkey, St Peter's, Athlone

1981/82

Chairman: Brendan Mackey, Vocational School, Wexford.

Vice-Chairman: John Kelly, Computer Science
Dept., U.C.D., Belfield, Dublin 4
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Treasurer: Maurice Brosnan, Vocational School, Wexford.
Assistant Secretary: Núra Ni Neachtain, Mount Anville Secondary School, Goatstown, Dublin 14

COMMITTEE

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Hugh Dobbs, Newtown School, Waterford.
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Diarmaid Mc Carthy, College of Marketing & Design, Parnell Square, Dublin 1.
Paddy Moran, Coláiste Muire, Tuar Mhic Éadaigh, Co Mayo.
Michael Moynihan, Coláiste an Spioraid Naoimh, Bishopstown, Cork.
Bro. Maurice P. Murphy, Patrician College, Ballyfin, Co Laois.
Fr. Liam O'Connell, S.J., Crescent Comprehensive School, Limerick.
Elizabeth Oldham, School of Education, Trinity College, Dublin 2.
Susanna O'Leary, St. Patrick's Comprehensive School, Shannon, Co Clare.
Fr. Liam Sharkey, Ardmore, Croghan, Boyle, Co Roscommon.

1982/83
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Vice-Chairman: John Kelly, Computer Science Dept., U.C.D., Belfield, Dublin 4.

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Treasurer: Maurice Brosnan, Vocational School, Wexford.

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Dr. Joseph Chester, Limerick Technical College, Moylish Park, Limerick.

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Michael Moynihan, Colaiste an Spioraid Naoimh, Bishopstown, Cork.
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ICS REPRESENTATIVE ON CESI EXECUTIVE
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I.C.S REPRESENTATIVE ON CESI EXECUTIVE

Sean Connolly

1984/85

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1985-1986

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Michael Brady, Holy Faith Convent, The Coombe, Dublin 8
Sean Connolly, ICS Representative
Dermot Duffy, C.B.S., Sexton St., Limerick
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Síle Fitzpatrick, Stanhope St PS, Dublin 7.

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Seán Ó Sé, St. Patrick's B.N.S., Drumcondra, Dublin 9.

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James Walsh, C.B.S., Naas, Co. Kildare
APPENDIX U

COMPUTER EDUCATION
SOCIETY OF IRELAND.

JULY 1975

Co. DUBLIN COURSE & CONFERENCE, SUMMER 1975

The course has three components:
1) A series of lectures on various aspects of Computer Education in Schools.
2) A course on BASIC for Beginners.
3) A course of lectures, suitable for those with some computing experience, on more advanced topics.

The first component is intended for all participants; courses 2 and 3 are concurrently scheduled alternatives.

The following people will be available all the time;
Sister Louise Kenny, Secretary & Treasurer of the CEBIE.
Mr. John Kelly, organising the BASIC course.
Mr. Chris Devane, organising the Advanced course.
Mr. Pat O'Leary, organising the computer hardware.
Mr. Michael Moloney, Chairman of the Dublin Branch.
Miss Elizabeth O'Callaghan, Secretary of the Dublin Branch.

PROGRAMME FOR THE 1975 SUMMER COURSE AT COLLEGE OF SCIENCE, DUBLIN

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<tr>
<td>09.30 Facilities or view</td>
<td>10.15 CMI &amp; CDS</td>
<td>10.45 COMPUTER EDUCATION IN SCHOOLS</td>
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<tr>
<td>11.00</td>
<td>11.30 LOGO</td>
<td>11.30 BASIC Tutorial Analysis</td>
<td>TEACHING COMPUTER STUDIES</td>
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<td>12.00</td>
<td>12.30</td>
<td>12.30 All Participants to leave</td>
<td>PANEL DISCUSSION</td>
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<tr>
<td>14.00 INTRODUCTION AND DESCRIPTION OF FACILITIES</td>
<td>14.30 COMPUTERS IN SCHOOL ADMINISTRATION</td>
<td>14.30 C E S I — A.I.R.</td>
<td>End of course</td>
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<tr>
<td>14.15 BASIC コM-PREHENSIVE LANGUAGE</td>
<td>14.45 SYSTEMS</td>
<td>14.45 to be addressed by Dennis F. O'Sullivan</td>
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<td>15.00</td>
<td>15.15 AFTERNOON session</td>
<td>15.15 FREE TALK</td>
<td>Computer Laboratory</td>
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<td>17.00 Hardware and speakers available</td>
<td>17.00 HARDWARE AND SPEAKERS AVAILABLE</td>
<td>17.00 HARDWARE AND SPEAKERS AVAILABLE</td>
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A001. COMAL TUTOR [APPLE J], CP/M 2.20
(DOCUMENTED)
(by Mike Norris, Computer Centre, UCD)
An interactive reference guide to the COMAL language. Written
in COMAL, the suite of programs contains some useful programming
techniques.

A002. LEAVING CERTIFICATE PHYSICS
(APPLE J), DOS 3.3
(by Joseph O'Hegarty, St. Columba's College, Co. Downagall)
A very popular suite of programs covering aspects of electronics
and electron and nuclear physics.

A003. PHYSICS/APPLIED MATHS [APPLE J],
DOS 3.3
(by Steve Kamm et al).
A number of very useful tutorials for Leaving Cert. Physics and
Applied Maths.

A004. TRIGONOMETRIC GRAPHS [APPLE J],
DOS 3.3
(by Br. Kevin Butterly, CBS, New Ross).
For Leaving Cert. Maths, these programs use graphics to il-
ustrate the behaviour of many trigonometrical functions.

A005. IRISH SPELLING [APPLE J], DOS 3.3
(DOCUMENTED)
(by Br. Kevin Butterly, CBS, New Ross).
Suitable for upper primary and junior cycle secondary.

A006. WORD POWER [APPLE J], DOS 3.3
(DOCUMENTED)
(by Br. Kevin Butterly, CBS, New Ross).
Suitable for upper primary and junior cycle secondary.

A007. SYMMETRY [APPLE J], DOS 3.3
(DOCUMENTED)
(by Br. Kevin Butterly, CBS, New Ross).
Suitable for lower primary and junior cycle.

A008. PHYSICS TEST [APPLE J], DOS 3.3
(DOCUMENTED)
(by Br. Kevin Butterly, CBS, New Ross).
Very good selection of questions. Suitable for Inter Cert.
Students.

A009. LINE AND CIRCLE [APPLE J], DOS 3.3
(DOCUMENTED)
(by Br. Kevin Butterly, CBS, New Ross).
Suitable right up to Leaving Cert. Maths. Very good for explain-
ing lines and circles.

A010. INTER CERT. SELECTION [APPLE J],
DOS 3.3
(DOCUMENTED)
(by Br. Kevin Butterly, CBS, New Ross).
This is a composite disc, made up of all Br. Butterly's programs
on discs A003 to A009.

A011. SAMPLES 1 [APPLE J], CP/M 2.20
(DOCUMENTED)
(by Michael Murchan, Coláiste an Spioraid Naomh, Cork)
Three discs for exercise programs in COMAL, for the beginner-
covering all the introduction aspects of the language. Each disc
contains 47 exercise programs.

A012. SAMPLES 2 [APPLE J], CP/M 2.20
(DOCUMENTED)
(by Michael Murchan, Coláiste an Spioraid Naomh, Cork).
See A011.

A013. SAMPLES 3 [APPLE J], CP/M 2.20
(DOCUMENTED)
(by Michael Murchan, Coláiste an Spioraid Naomh, Cork).
See A011.

A014. COMAL EXAMPLES [APPLE J], CP/M 2.20
(by Damien McCarron, College of Marketing, Dublin 11)
Examples of programming in COMAL, with several programs
covering the main topics of programming.

A015. COMAL NOTES [APPLE J], DOS 3.3
(by Damien McCarron, College of Marketing, Dublin 11).
Extensive notes on COMAL, in the form of Apple Writer 1.1 text.

A016. COMAL 80 TUTOR A [APPLE J],
CP/M 2.20 (DOCUMENTED).
(by Mike Norris, Computer Centre, UCD).
Revision of COMAL TUTOR, covering COMAL-80 Version 2.1
and including turtle graphics. You must send a disk with CP/M
AL80 on it to get a copy.

A017. COMAL 80 TUTOR B [APPLE J], CP/M
2.20 (DOCUMENTED)
(by Mike Norris, Computer Centre, UCD).
The contains some of the COMAL 80 TUTOR suite, and goes
with disc A. A labelled. Both disks are needed to run the TUTOR
A018. RADIOACTIVITY [APPLE J], DOS 3.3
(by Joseph O'Hegarty, St. Columba's College, Co. Downagall).
A suite of programs on radioactivity, with a quiz at one of the
options, by the author of the popular LC Physics.

A019. LETTER BOX/CLOCK [APPLE J], DOS 3.3
(by Br. Kevin Butterly, CBS, New Ross).
Letter Box is a vocabulary learning game, suitable for 10 to 14 year
olds. Clock allows one to set the time and practices an analogue
clock.

A020. PARABOLA/DERIVATION [APPLE J],
DOS 3.3
(by Br. Kevin Butterly, CBS, New Ross).
Suitable for Leaving Cert. Maths students.

A021. PRIMARY DISC 1 [APPLE J], DOS 3.3
(by Michael Smith, RIC, Cork).
A selection of programs for Primary/Junior Cycle students.

A022. HOOK'S/BOYLE'S/CHARLES LAWS
(APPLE J), DOS 3.3
(by Br. Kevin Butterly, CBS, New Ross).
These programs are useful aids in the plotting of graphs from
the results of the three set experiments.

A023. PRIMARY/JUNIOR SEC MISCELANY
(APPLE J), DOS 3.3
(by Michael Murchan, Coláiste an Spioraid Naomh, Cork)
A selection of public domain educational software for Primary
and Junior Cycle students.

A024. INTERMEDIATE PHYSICS SIMULATIONS
OF R.H. GOOD

B001. PCHCURVE (BBC MODEL B, 40 OR 80
TRACK)
(by D.J. MacCurtis, Computer Centre, UCD)
An extension to the popular program (LEAVING CERT LITHIOMETRY),
making full use of colour graphics windows etc.

B002. UTILITIES (BBC MODELS A OR B,
40 OR 80 TRACK)
(by Mike Norris, Computer Centre, UCD).
Some useful programs for BBC programmers and users.
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