

**The National Assembly for Wales**  
**EDUCATION AND LIFE-LONG LEARNING**  
**COMMITTEE**

**INFORMATION AND COMMUNICATION**  
**TECHNOLOGY IN EDUCATION**

**Expert Adviser Report**  
**by**  
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November 2000

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## **Executive Summary**

### Introduction

The PRE 16 Education, Schools and Early Learning Committee decided in July 1999 to undertake as a priority a review of the process of procuring Information and Communication Technology (ICT) for schools in Wales by the Local Education Authorities (LEAs). It became clear early on in this review that there was a need to look at the whole issue of ICT in education in Wales from its procurement to its use in the classroom.

The Committee nominated two of its members, Huw Lewis A.M and Jonathan Morgan A.M, to lead on this review. They undertook visits to Scotland, Ireland and England to ascertain how they were approaching the issue of integrating ICT into their education systems. In order to assist them in this task the Committee appointed Neil Harries as its expert adviser. This report is a distillation of all the information gleaned through visits, interviews with education professionals in Wales and other countries, research into the approaches taken by a number of other countries and Neil Harries own

personal professional experience as senior educationalist in Wales for over 30 years. It has been considered and discussed in detail with both Huw Lewis and Jonathan Morgan and reflects their vision for ICT in Education in Wales.

This report is the basis of a Conference of a broad range of invited people in Wales who will be involved in turning the words on the pages of this report into reality for teachers and pupils in schools in Wales. In writing the report it also became clear that the implications of any strategic approach to ICT in Education had implications for all sectors of education in Wales and also for its economic future. This is why the invitation list was broadened to include representatives of those sectors.

The views expressed at the conference will be considered and this report will be amended as necessary. The final report will be formally presented to the PRE 16 Education, Schools and Early Learning Committee at their meeting on 8th November 2000 for their consideration.

### **Why the imperative to act now?**

To position schools properly in this rapidly changing ICT situation we need clarity of vision and a determination to put systems in place that support and deliver that vision, and we need them at both national and local levels. We are engaged currently in one of the most significant processes of change in schools and this process, to be effective, must start from a coherent strategy.

Many countries throughout the world are launching initiatives in response to the challenges of the global information society and its knowledge economy - the integration of ICT into the school curricula is invariably a key element of such initiatives.

The Welsh economy requires an increasing availability of ICT skills and knowledge to underpin sustainable growth. There is the 'learning effectiveness' reason that shows ICT having a key role in the improvement of pupil achievement. There is the efficiency reason that the uses of ICT assist in overcoming problems of distance and isolation, thus assisting small rural schools. All of these reasons are valid in the context of Wales.

### **Where are we now?**

The overall position in Wales on connectivity is encouraging but investment needs to be made to achieve computer to pupil ratios that are at a level necessary to enable teachers and pupils to maximise the potential of ICT throughout the curriculum. There is a need to ensure equality of access for all and any network needs to build this in at the outset. There already exists an outline network infrastructure at national, local authority and school level, this needs to be firmed up, there are already initiatives in place, which are progressing this work. There is a need to develop closer links between the private and public sector in order to ensure that connectivity and equal access can be achieved.

The professional development of teachers has been identified internationally as the single most

important factor in enabling effective integration of ICT into schools. In order to ensure that teachers in Wales are in a position to maximise the potential of ICT for their pupils, work needs to be done with the initial teacher training institutions and with Estyn on the ICT component in courses. We have to ensure that the necessary support is in place in order that teachers can continue to develop their skills in the use and application of ICT in the teaching of their curriculum area.

There is a shortage of high quality curriculum relevant content available to teachers and pupils, much of what currently exists has been produced by commercial companies. There is a need to be more proactive in commissioning and quality controlling the content and also encouragement to teachers and schools to upload their teaching materials to the Web using school websites.

The three strands of 'connectivity, competence and content' need to be brought together into a single strategy for ICT in education in Wales.

### **Where we should be?**

The Report makes a number of recommendations about where we should be in Wales and these are summarised below. To achieve real progress and for the National Assembly to stamp its priorities on the emerging agenda, there needs to be an all Wales policy drive to locate everyone on the same route, and make the proper contribution to the development of the knowledge economy in Wales. The continued success and quality of our schools depends on our collective ability to close the gap between the mere presence of ICT in the classroom and its effective integration into the curriculum to enhance pupil performance and deliver the skills necessary for the 21<sup>st</sup> century.

### **How we should get there.**

The report outlines a national strategy for Wales and proposes a framework for achieving the initial stages over a three-year period. It looks to the future and how we can ensure that Wales keeps pace with the rapid developments in the use of ICT to enhance the delivery of education from the teachers' viewpoint and the learning experience from the pupils' viewpoint.

It recommends the establishment of an Advisory Committee for ICT which will oversee the work of an ICT Task Force and the National Grid for Learning (Wales) team in the first three years. It recommends that during these three years work should be undertaken to identify a permanent body which can be charged with the responsibility for continuing and in which the work of the Advisory Committee and the NGfL (Wales) team can be located.

### **Conclusion**

The lessons of the report dictate that we must seek to position our schools in Wales so that they may begin to take full advantage of the emerging ICT developments and initiatives, which are key to their future and the future of our children. Taking due cognisance of the policies and rapid developments in

other nations, the programme of initiatives outlined in the report and the following recommendations are considered necessary, essential and indeed urgent.

## Summary of Recommendations

The numbering in parentheses couples the recommendations to the original requirements of the Revised Policy Remit agreed by the Committee as Stage 2 of its investigations.

- Establish a **Policy Advisory Committee for ICT** with a precise 3-year development brief for ICT in Welsh schools. [1 – 6]
- Establish an **Information and Communications Technology Task Force** as an arm's length agency to carry out the 3-year development programme for ICT in schools. [1 – 6]
- Establish a **National Grid for Learning Wales team** to provide all appropriate curriculum services, planned, designed and tailored to the needs of Welsh Schools, working in both English and Welsh languages. [4,6]
- Establish an **Innovative School Initiative Fund** to assist schools to develop digital content. The NGfL Wales team should manage the fund.
- Establish the **all-Wales public services ICT 'backbone'** under the aegis of the National Assembly for Wales. [3]
- Establish a **national procurement agreement** for the purchase of ICT equipment for schools. [1]
- Ensure the existence of full **Curriculum Networks in all LEAs** within 3 years. [3]
- Ensure the existence of **School wide Networks** with a minimum of 5 'drop points' per classroom in all schools in Wales in 3 years. [3]
- Establish a **minimum standard ratio of 1 multi-media Personal Computer (PC) to every 5 pupils in 3 years.**[1 – 6]
- Initiate an **ICT equipment replacement programme** for schools from the 3<sup>rd</sup> year of the development.[1 – 6]
- Create a **franchised PC re-cycling operation** for schools [3]
- Create **ICT systems maintenance technician** posts to support the new networks on a notional ratio of 1 technician to every 15 schools in 3 years. [3]
- Expand a **review of the ICT component in Initial Teacher Training** institutions by Estyn, supplemented by seconded practicing teachers to be delivered in 1 year. [5]
- Investigate the feasibility of seconding teachers to the ITT institutions on time limited contracts **to reinforce the delivery of the ICT component in ITT institutions.**[5]
- Influence the National Opportunities Fund (NOF) planners to **initiate a staff development programme for higher order ICT skills for teachers .** [5]
- Take advantage of the **quinquennial review of the remit of the Qualifications, Curriculum and Assessment Authority for Wales (ACCAC)** to explore and, if thought appropriate, **determine long-term arrangements for the management of ICT curricular development in Wales.** [1 – 6]
- Ensure that **video-conferencing facilities** are installed in every secondary school and Further Education College in Wales to assist with the teaching of small groups and minority subjects at 16 +. [1 – 6]

# **Chapter 1 - INTRODUCTION**

## **1.1 Project Remit**

In July 1999 the PRE 16 Education, Schools and Early Learning Committee of the National Assembly for Wales decided to place the procurement of Information and Communication Technology (ICT) in Education on its agenda as an early item for discussion. As a part of the exercise it received and considered a series of submissions and presentations until the end of 1999 from a number of bodies including British Educational and Communication Technology Agency (BECTA), Association of Directors of Education, Wales (ADEW) and the Teaching Associations in Wales. The Committee then took the view that this was an area where The National Assembly for Wales could achieve a major impact, creating a situation that would represent an added value to the education of our children and would bear directly on the economic re-generation of Wales. As result of that review the Committee decided in March 2000 to widen its original remit to a consideration of the future strategy for ICT in Schools in Wales and appointed an expert adviser to assist in the policy development with the following remit: -

1. An examination of the merits of developing a National Framework Agreement to support procurement so as to achieve economies of scale;
2. An investigation as to why the BECTA kite marked managed service do not meet the needs of Welsh Local Education Authorities (LEAs) and explore with ADEW ways in which this could be improved;
3. An exploration with ADEW, the Qualifications, Curriculum and Assessment Authority for Wales (ACCAC) and other interested parties as to whether the establishment of a National ICT network based in the public sector is feasible for Wales, and the implications in time and resources of establishing such as network;
4. An examination of ways to establish greater co-operation across Wales in the development of bilingual educational software that supports the national curriculum;
5. A review of the delivery of training in ICT for teachers in Wales and the support available to them on the use of ICT in delivering the national curriculum;
6. Examining the merits of creating a National Grid for Learning (NGfL), Wales team to develop and maintain the NGfL web site in Wales in a way that meets the needs of teachers in Wales.

This report is the result of that exercise. It attempts to spell out where we are currently in Wales in terms of ICT development in schools, where we should seek to be and, finally, how we should propose to get there.

## **1.2 Historical Background**

During the 1990s ICT development in schools in Wales has been largely driven by central government in a series of "equipment provision" exercises, where specific sums of finance have been allocated, either through Grants for Educational Support and Training (GEST) or through appropriate capital budgets. These funding initiatives have either been allocated to the LEAs on a per capita basis as earmarked funding, or managed on behalf of the Welsh Office and, more recently the National Assembly for Wales, by the National Council for Educational Technology (NCET) and its successor body the British Education Communications and Technology Agency (BECTA). These initiatives have not always been perceived as forming part of any coherent pattern or overall strategy.

It is axiomatic that the present day demands on education are unprecedented. In reality they always have been, since the pressures to change that bear on teachers in the classroom are a function of the environment in which they work, which changes constantly. What distinguishes the present situation however is the nature and the accelerated pace of the pressure.

Schools now operate in a particular context, which finds itself replicated increasingly throughout the world –

- Increased demands from business for ICT literate school leavers,
- Constant demand from government for a world class school system that can compete with the rival economies in the "knowledge stakes,"
- Growing demand from parents for school programmes that promote information literacy.

Thus schools, among everything else that they are expected to achieve, are also required to respond to the fact that knowledge is now widely perceived as wealth and that the ICTs are seen as the key. Furthermore the dilemma facing the LEAs and the schools is a major one – how to reconcile the competing demands for ICT development with the financial constraints that continue to exist.

ICT in schools requires a strategy that targets major capital investment and supports that investment with on-going revenue budget allocations, targeted staff development programmes, and a rapid growth in content readily available for successful implementation. The image of the three-legged stool is an appropriate one – the balance between the three aspects of the programme is key to progress, we need attention paid to –

### ***'Connectivity, Competence and Content'***

We also need them to be tackled simultaneously in order to ensure development, and we in Wales need them to be tackled in the context of the needs of the fourth "C" – "Cymru". To achieve progress we must take full advantage of the experiences of those who are ahead of us in the game. In the USA for instance they now freely admit that they made mistakes in the early rush to connect schools and are now moving forward on a more coherent policy that gives a more balanced weight to staff development and the creation of digital learning content.

ICT in schools is too often categorised in extremes – it is often cited as some kind of ‘magic bullet’ whose mere presence in the classroom will immediately produce tangible improvements in educational outcomes. The truth is that it is a tool – arguably the most powerful tool yet offered to teachers - but its power lies in how and when it is used. To position the schools properly in this rapidly changing ICT situation we need clarity of vision and a determination to put systems in place that support and deliver that vision, and we need that at both national and local levels. We are engaged currently in one of the most significant processes of change in schools and this process, to be effective, must start from a coherent strategy.

### **1.3 Context**

While the current exercise is effectively located within education - a discrete context that relates largely to the provision of ICT to schools - it would be unwise to ignore the wider implications of ICT for Wales. Any schools’ ICT policy in Wales should, by definition, be a key sub-set of a much larger agenda. Indeed any failure to address that agenda would be to ignore the example of the benefits that have accrued in other parts of the world where the development of ICT in schools has been seen as a key component within a wider strategy driven by the emerging imperatives of the ‘knowledge economy’. These issues are underlined by the National Assembly in its Economic Development Strategy paper discussed by the Economic Development Committee on 13<sup>th</sup> September 2000.

It would be to ignore essential lessons from the USA, Ireland, Finland, New Zealand, Singapore etc., where the education agenda has been a key function of a national strategy aimed at the economic regeneration of the area. These are countries where the development of ICT skills in schools has been correctly perceived as a key driver in the economic regeneration of the country. Those countries have properly made the connection between the development of ICT skills at schools and the increased attractiveness of an area for inward investment of a type that feels confident that it can draw on local talents and will not be obliged to import them.

We are in reality talking about the economic implications for Wales of the need for a rapid increase in the development of software engineers at Bachelor and Masters degree level – still a comparatively low priority in Universities; we are talking about the rapid development of an infra-structure of skilled staff to maintain the local ICT systems as they are built, not only in schools but in other public services and the private sector; we are talking about the potential for the creation of locally based companies to respond to the emerging needs of schools, colleges and other services in terms of software development, web-site design and development; we are talking about the creation and development of curricular based CDs, CD ROMs and DVDs for school use.

We ignore all these implications at our peril. The signs are that we still have some way to go in clarifying that agenda. Evidence of boundary protection is still apparent in Wales. The capability of the National Assembly to run with issues that transcend departmental boundaries will be tested in the next few months as will its ability to work with the private sector within Wales. Similarly the local authorities will need to adapt to new ways of working.

It is my considered view that the wider context of the potential ICT development programme for schools in Wales cannot be delivered without constructive private sector involvement. To achieve the next stages of development we need to think and, where necessary, act differently.

#### **1.4 Why action is necessary now.**

To set the scene it is helpful to remember a single statistic that encapsulates the accelerated impact of the technologies that we are about in this study - it took 38 years before there were 50 million TV users worldwide - it took barely 4 years before there were 50 million Internet users worldwide.

The International Data Corporation (IDC) publishes an annual ranking of countries in terms of their state of preparedness for the 'information age'. The USA is ranked, not surprisingly in first place. What is perhaps more significant is to note the countries that rank in the top ten – they include Sweden [2], Denmark [3], Norway [4], Finland [5] and New Zealand [9]. It is significant because all these relatively small countries have developed early national strategies for the integration of ICT into education.

Many countries throughout the world are launching initiatives in response to the challenges of the global information society and its knowledge economy – the integration of the Information and Communications Technologies into school curricula is invariably a key element of such initiatives. Major national ICT plans, with appropriate provision for schools, have been implemented by Sweden in 1994, by Finland in 1995, in the USA in 1996, by Ireland and Korea in 1997 and by Japan [in conjunction with the private sector] and by New Zealand in 1998. In 1998 Ireland was ranked by the IDC in the third division [at position 23]. Ireland is now described as the Celtic Tiger Economy. What has changed? Among the key influences on this rapid progression is the fact that in Ireland national planning has changed. All of these governments are driven by certain key imperatives: -

- More and more people are employed in information sectors in services, in higher and middle level skill occupations, and fewer in manufacturing and lower skill posts. Increasingly our workforces are made up of knowledge workers. [Someone has tried to exemplify this as the emergence of 'Mentefacture' as opposed to 'Manufacture' ...].
- Developing the 'competitive edge', whether it be for the individual, the enterprise, the region or the country, depends increasingly on how knowledge is used and how expertise is deployed. A premium is now placed on accessing and using information rapidly and strategically.

There are a number of powerful arguments for the integration of ICTs into the school curriculum. There is the social reason of avoiding the division into the 'haves and have nots' by ensuring equality of access for all to the new technologies, and thus counteracting the problems associated with access from home, which is dependent on other factors. This is coupled with the opportunity to offer pupils with Special Needs additional assistance and facilities for learning. There are strong economic and vocational reasons since knowledge of, and familiarity with the new technologies will be a fundamental aspect of employability in the developing knowledge economy. The Welsh economy requires an increasing

availability of ICT skills and knowledge to underpin sustainable growth. There is the 'learning effectiveness' reason that shows ICT having a key role in the improvement of pupil achievement. There is the efficiency reason that the use of ICT assists in overcoming problems of distance and isolation, thus assisting the small rural schools. All of these reasons are valid in the context of Wales.

There are also substantial pedagogical reasons for the integration of ICT into the classroom. ICT can improve the quality of the educational experience of the pupil by providing rich, exciting and motivating learning experiences. It can assist the teacher by providing accurate, up to date and well-presented teaching material 'on-line'. There is increasing reference in research to the high motivation of pupils using ICT for learning. Indeed the evidence is already beginning to emerge in the USA that demonstrates that ICT use in schools is beneficial to pupils and their learning. There is also the opportunity that ICT presents to encourage creativity, imagination and self-expression.

The relatively limited impact of video and TV on educational outcomes is sometimes quoted as evidence that the potential of ICT in the classroom is being over-stated. This misses an essential point - video and TV are about ways of presentation, whereas ICT is about the distribution of knowledge. The print based society [and by implication educational process] has been founded on the premise that selected resources were available to special groups in special places at special times in order to use them – and they had the potential to 'wear out' or be damaged - a classic example of such circumstances is the classroom. ICT is part of a different culture where all resources can be available to anyone at any time and in any place without any risk of 'wear out' or damage – an inherently egalitarian concept. Print is in essence an inhibitor and defines the characteristics of the present schooling arrangements – what are the possible implications of the removal of that inhibiting factor for the future? In brief the comparison is not valid because it fails to compare like with like.

A substantial amount of evidence is now emerging that reports on the enthusiasm and engagement of pupils using ICT, on the enhanced quality of pupils' thinking and increased levels of cooperation between pupils – these are positive outcomes that need to be considered seriously. A number of research reports in the USA are beginning to home in on actual improvement in performance in tests in numeracy and literacy. In short, evidence is now emerging that the Internet can help transform traditional school-based learning, but only if the medium is used to support models of teaching and learning that are based on good teaching practices.

There are also the broader reasons for integration of ICT into the classroom. The use of on-line PCs in the classroom can accelerate positive outcomes such as the increased emphasis on information handling and problem solving. ICT makes schools more collaborative environments for both teachers and pupils, more importantly this collaboration can extend easily to other schools in other areas and indeed in other countries. The content issue is increasingly being characterised as Digital Learning - the educational approach that integrates technology, connectivity, content and people. This in turn both supports and promotes the essential skills that pupils will need in education, life and work in tomorrow's world. It uses digital content, which is not just computer-based, but includes video on demand, software, CD-ROMs, DVDs, web sites, e-mail facility, integrated learning packages, computer simulations, streamed discussions, data files, data-bases and audio.

Digital Learning content can be:-

- Randomly accessed both from school and from home. The traditional limitations of time, location, delivery etc no longer preclude pupils from accessing high-quality information, which can be transmitted, stored, received, shared, organised and stored in a variety of ways, and accessed through a variety of devices.
- Relevant, up-to-date, accurate and authentic. Curriculum materials can be augmented easily with current, live, real information that is often maintained by the people who are directly involved. When they are connected to real-world information teachers and learners can become active in local and global issues.
- Explored on many levels. The material can be examined according to interest, needs and abilities of the teacher or learner.
- Interactive and engaging. While the traditional forms of information furnish information, digital content can stimulate and involve pupils through its 'real world' presence.
- Instantaneous. With optimal bandwidth information becomes immediately available according to teacher and pupil needs.
- Creative. Learners become active participants in the learning process and the potential of digital content allows the pupil to manipulate the materials that are being used.
- Collaborative. Pupils and teachers can engage with others who are in other schools or other countries. Learning can become an increasingly interactive experience as teachers and pupils access material, communicate with other schools and countries and even consult on-line with experts where necessary.

### **1.5 Fundamental principles for the development of ICT in Schools.**

Any strategy developed for ICT in education in Wales must be based on certain clear principles: -

- The principle that all pupils should have equal right to knowledge about and familiarity with ICT through the education system. This pre-supposes that pupils must have access to technology, that the PC in the classroom must be an integral part of the tuition system for all, that teaching methods will be adapted to facilitate this and that pupils will be afforded sufficient access.
- The principle that continuous individual competence development – life long learning – is a pre-requisite of future society. Schools must provide the individual pupil with the capacity to develop competences throughout life. The focus in life-long learning is on the ability to find, interpret and evaluate information on an individual basis. Learning must be available increasingly in a broader and more flexible manner than is contained within school and college walls and in the syllabuses dealt with in the first quarter of our lives. We need to face up to the fact that education is no longer just for the young and our strategies and institutions must be prepared for that development.

Consequently we should aspire to create a context in schools where: -

- All pupils must have equitable access to ICT;
- All pupils will leave school with the technology skills needed in today's world and tomorrow's workplace;
- All teachers will be properly equipped to use technology as a tool to achieve high academic standards;
- The needs of both Welsh and English languages are properly met;
- All parents and communities must be kept informed of key decisions in ICT;
- The nation must invest in ICT research and development, and the development of educational software for our schools.

## **1.6 A vision for digital learning**

"any time, any place, any path, any pace"

## **1.7 Skills for the 21<sup>st</sup> century**

The US Department of Labour estimates that of the 54 jobs expected to experience the most significant growth between now and 2005, only 8 of them do not involve technological skills. Moreover it is estimated that 60% of the jobs available at the beginning of the next century are currently held by only 20% of the workforce.

It follows that we need to understand in Wales that we are now actively involved in moving to a different context. We are directly involved with the development of the skills mix that must emerge in Wales to move us up the economic ladder. Various taxonomies are emerging that spell out the skills needed in the 21<sup>st</sup> Century. There is often a 'knee-jerk' reaction in these circumstances that veers towards the Luddite view of progress.

Nonetheless the evidence is clear that the skills mix is changing and while we may not accept the specific suggestions of the International Society for Technology in Education (ISTE) based in the USA, it would be perverse and extremely unwise to suggest that we will simply carry on as we are at present. A close examination of the last 40 years in the UK should be enough to dispel that particular myth. Equally it would be entirely inappropriate to start indulging in 'automatic behaviour' based on the premise that 'everything will work out in time'. Let us at this early stage begin to examine robustly the options being considered, since on them the decisions will have to be made for the next generation. The ISTE postulates the following and, if we are determined to reject them, we have a duty at least to attempt to replace them: -

- The ability to be proficient in the use of technology

- The ability to communicate information and ideas using a variety of media and formats
- The ability to access, exchange, compile, organize, analyse and synthesize information
- The ability to draw conclusions and make generalisations based on information gathered
- The ability to know content and be able to locate additional information as needed
- The ability to evaluate information and sources
- The ability to construct, produce and publish models, content and other creative works
- The ability to become self-directed learners
- The ability to collaborate and cooperate in team efforts
- The ability to solve problems and make informed decisions
- The ability to interact with others in ethical and appropriate ways.

If these are the type of skills needed for the 21<sup>st</sup> century the issue is how we are equipped in Wales to meet them and move ahead of the field. The Assembly seeks an edge for our economy and for our pupils, our pupils seek an edge for themselves, and we have to prepare ourselves quickly in schools in order to achieve it.

## **Chapter 2 - WHERE**

### **ARE WE NOW?**

#### **2.1 Connectivity, competence and content.**

The report is based on the three "Cs" taken together since essentially they must be perceived as three strands of the same strategy. That option is not necessarily made easier by the fact that in Wales a number of different agencies are actively involved in the three strands with, on occasion, quite separate and distinct agendas.

#### **Connectivity**

is largely within the purview of the Local Education Authorities [LEAs] and the schools, working within guidelines laid down by National Assembly Training and Education Directorate [NATED] via GEST arrangements and Central Managed Funding arrangements.

#### **Competence**

issues in ICT and teaching are variously managed by the University Sector in terms of Initial Teacher Training [ITT], a mixture of the LEA Advisory Services and the New Opportunities Fund [NOF] in terms of INSET.

#### **Content**

development on the web is developed in a variety of locations, most notably commercial publishers,

public agencies such as the BBC and, increasingly, individual schools.

The variety of key players makes it extremely difficult at present to think in terms of an overall strategy in Wales without central government taking a leading role, at least in the next few years. There is in Wales a strong expression of will for this central strategy to emerge and there is also evidence that it will find willing partners. Failure to use this opportunity will see a continuation of a series of disparate and largely uncoordinated initiatives without any coherent policy base. All three aspects require attention and in order to achieve a visible sense of policy direction, some degree of direction to provide shape and structure is inevitable and indeed essential. More to the point that national strategy is now expected and awaited.

## **2.2 Connectivity.**

Currently the situation across Wales is imperfect, but encouraging. The aim of the National Assembly is to create a 'connected' society. It is possible to make a shorthand assessment of the current situation based on a working model where the National Assembly takes responsibility for a network to the LEA and the LEA ensures the network to its schools. Working on such a model there are already arrangements in place in the majority of the LEAs that would form key components of such a system.

However the ratio of PCs to pupils varies both between LEAs and, within them, between primary and secondary sectors. Furthermore the ratios fall, when the criteria limit the PCs involved to machines of 486 and Pentium standard. Thus in terms of creating a network from central government to the individual classroom we are involved in a four-fold activity – connecting the Central Government to the LEAs, secondly connecting the LEAs to the schools, thirdly the creation of school wide networks and fourthly having the PCs at the end of the system for the pupils to use 'on line'. It is helpful here to separate the four aspects and consider them individually.

### **2.2.1 Wales network.**

Firstly let us consider the connection between the proposed Public Services 'backbone' for Wales and the LEA networks. Wales is not equally served by the availability of systems across the Principality. In some parts of the South and North Wales corridors there is a choice of options available, in other parts LEAs are limited to a single provider option and in Mid Wales there are the added major difficulties associated with rurality. This affects the LEA's ability to establish working connections. From the schools' perspective the provision of the all-Wales 'backbone' for ICT is essential – it may require different solutions for different areas, and consequently, differential expenditure, but it must be based on the premises that all are given equal access, irrespective of location – the rights of the two teacher primary school in Mid Wales are the same as a large urban primary on the coast. The reason why this central initiative is crucial is that schools in Wales [or for that matter the UK] do not enjoy the privilege of free telecommunications line use that exists in other more favoured parts of the world. In developing the backbone protocols must also be put in place to facilitate access to curriculum materials from home by teacher and learners.

### ***2.2.2 LEA network.***

When we look at the situation within the LEAs, as the report stated earlier, while it is imperfect, it is distinctly encouraging. Indeed Wales is farther down the line in ICT development than Ireland was at the point when it chose to initiate its schools' ICT development programme. While that is not a cause for complacency it is nonetheless encouraging. The vast majority of the LEAs in Wales have Local Area Networks [LANs] in place; therefore they have some form of ICT permanent link to their schools. 12 of these are already developed for both Administrative and Curriculum use; therefore the next stage of the chain is fully in place in over half the LEAs. Another 6 LEAs have LANs for Administrative purposes, where it would not be too difficult to overlay the Curriculum link, indeed 2 of them will move in that direction within the coming year. The remaining 4 LEAs represent different problems and different stages of development. The priority attached to ICT in schools varies between the LEAs. In one LEA they intend to make it their priority for this year, in another case the situation is heavily influenced by financial constraints. All 4 say that they have some form of Internet access to an Internet Service Provider [ISP] for their schools.

Mid Wales has had major difficulties in finding solutions to the problems faced in connecting its schools to the host LEAs, and through it to the Internet; indeed it is to be commended on its perseverance and ingenuity in difficult circumstances. The efforts made by the LEAs involved have essentially avoided the possible emergence of a 'two-tier system', which would have been devastating for those children affected.

Clearly there are still gaps in the second link of the chain but they are surmountable. However caution is needed in dealing sensitively with the situation since it risks mis-interpretation if those LEAs who have given ICT development in schools a low priority were suddenly seen to be 'bailed out' by the National Assembly. It could be widely perceived as rewarding LEAs who have done very little at the expense of the LEAs who have been diligent and prudent in their use of available resources.

### ***2.2.3 School based networks.***

The existence of school wide networks with 'drop points' in individual classrooms varies enormously. In one LEA [and soon two others] there are networks in all schools giving Internet access from a minimum of one 'drop point' in each classroom, in others it varies widely and the matter is further complicated by the fact that some schools are installing over and above LEA provision and the LEA is not always necessarily aware of the current situation.

Indeed it is strongly suggested now that the single Internet 'drop point' per classroom represents the minimum that should be considered. Interestingly early 'equipment provision' initiatives in secondary schools tended towards the provision of PC suites in schools. Currently secondary schools are increasingly moving away from PC suites towards distributed access of 'drop point' across the school. They are effectively moving the Internet information access to the point of teaching and learning delivery – this must be born in mind in future arrangements. The National Assembly must give priority

to the urgent establishment of school networks in order to put the final link in the chain.

### ***2.2.4 PCs in the Classroom.***

When we examine the number of PCs in schools and their ratio to pupils, we have a limited amount of information at present since there are two key variables - the age and power of the machines in use and the number of machines that have been bought or leased by the school over and above the LEA purchasing arrangements. This field is being currently researched and information is now to hand. Current information suggests a variation between LEAs of 1:10 to 1:30 in the Primary Sector and 1:8 to 1:20 in the secondary sector. Clearly these ratios include very old machines and we need to establish baseline ratios of machines, capable of fast on-line use that will be achievable over a maximum of 3 years.

We need also to consider the facilities needed for whole class teaching using on-line material from PCs. Currently a PC can only be used by 1 or 2 pupils at a time. In order for the material on the PC to be used by the teacher in a whole class teaching and learning context, there is a need for a 'data projector' working either with a plain screen or an 'electronic white board'. At present data projectors and electronic white boards are very scarce indeed in schools in Wales, however they will quickly become a major part of classroom equipment and need to be considered as increasingly essential to delivery of teaching and learning in the classroom.

### **2.3 Competence.**

The professional development of teachers has been identified internationally as the single most important factor in enabling effective integration of ICT into schools. Three aspects of this training are identified: -

- ICT skills and awareness training
- Professional skills development in the ICTs
- Pedagogical skills development.

These criteria must be set in the UK context. The current arrangements for competence training in the ICT field are based on the assumption that within the next 3 years all teachers leaving Initial Teacher Training (ITT) institutions will have learnt these skills as an integral part of their course and that it will be a matter for the LEAs and schools to maintain and enhance those skills through appropriate INSET provided by the LEA Advisory Services and commercial providers. In the meantime the New Opportunities Fund (NOF) training is designed to bring those teachers already in post up to the necessary standards, when [in theory at least] its job will be done. It is a matter of concern since ICT training and skills development is essentially a changing and developing field and any national training strategy that is predicated on a finite activity contains the seeds of its own shortcomings and possible failure.

It will not come as a surprise that there is not unanimity of view concerning the quality of the current ICT training as a component of ITT arrangements in Universities and Colleges. This may be due in no small measure to a general ignorance of what actually happens. This concern about the quality of the ICT component in ITT, however, is not limited to the UK but is reflected in reports from different parts of the world, notably USA and New Zealand. In contrast there is the oft-used argument that the present ITT courses are an attempt ‘to squeeze the quart into the pint pot’.

The NOF training is widely perceived to be very basic. ‘One shot’ training sessions will raise awareness, motivate and excite, but longer, more comprehensive training strategies, including coaching and modelling are critical to sustainable success.

In reality the key issue here is that the development of ICT skills is largely a ‘bottom up’ initiative and the ‘cutting edge’ ICT skills and the leaders in the field are mostly currently in classrooms and Local Education Authority ICT Centres. We are in Wales, and indeed in the United Kingdom, effectively in a situation where the ITT institutions may not be in the lead in terms of ICT skills and may even be significantly behind the schools.

The education sector in Wales has already been through various stages of ICT development, moving from the use of floppy disks to CD-ROM technology and now we are seeking to exploit the potential of the Internet. How successful this stage will be and how much it will break the mould of teaching styles will depend essentially on teachers. The term widely used in the USA to describe the use of Internet in certain curriculum areas is to refer to the teacher’s role as ‘guide on the side’. We are moving from a situation where teaching is partly about a strategy for disbursing scarce knowledge, towards finding ways of enabling people to use, with purpose and effect, their unlimited access to the resources now available. It does not reduce or indeed detract from the role of the teacher, it simply changes parts of the skills base required.

This experience stands in sharp contrast with the views of those who have talked about ICT making the pedagogical process ‘teacher proof’. On the contrary all the evidence underlines the fact that while the widespread use of ICT as an integral part of teaching is ‘learner-centred’, it is also clearly ‘teacher-intensive’. We see constant reference to the uses of ICT strengthening the teacher’s repertoire of skills and opening up a wider array of learning resources for pupils to access. We have to ensure that these higher order skills are made readily available to the teacher in the programme of professional development. Significant changes in the possibilities available to education now exist in the fact that multi-media systems add other options for working, teaching and learning – the traditional ways of working are expanding rapidly – the existence of digital libraries, multi-media and PCs that effectively augment the skills of both teacher and pupil change the limits of education practice, and have clear implications for staff development.

## **2.4 Content.**

In the current situation in Wales, in common with the UK, the curriculum content providers are largely

commercial companies [in fact many are from the USA which raises a 'culture' issue] and the major broadcasters such as BBC, ITV and S4C. ACCAC has a limited commissioning role in terms of digital content. There is also a critical shortage of Digital Learning content in the Welsh Language. There is, as yet, in Wales relatively little curriculum material being uploaded from schools to the World Wide Web [WWW] in either Welsh or English. Schools already make use of Websites in teaching as a means of getting at 'primary source material'. The statement has already been made that the Internet-linked PC on the desk represents an accurate, up-to-date open book containing information that, in some cases, may not be available elsewhere.

There have been major changes in teaching styles over the years and they have been absorbed eventually. Even now at an early stage in ICT development schools, teachers and pupils are accessing, using and evaluating information and knowledge that they are obtaining from original sources around the world. Thus, while we have relatively few dedicated curriculum sites in UK, we already offer our teachers and pupil's access to the world. Web sites used for teaching and learning in the USA are categorised into four rough categories: -

- Curriculum sites
- Information sites – 'primary sources'
- Conference and discussion sites
- Distance learning sites.

Here we need to learn lessons from other countries. The availability of on line services from the classroom has encouraged teachers in other countries to upload their own teaching materials to the Web using school websites. Thus in one single move you create the effective Virtual Teachers' Centre for Wales. Since, while nothing can prevent a teacher putting curriculum material on the Web, the existence of a quality assurance system through a curriculum portal based in Wales can filter in the best materials and save valuable teachers' time! They put them into a classified, categorised format that makes it easy for teachers to look at what other teachers are doing that is deemed to be of good quality. When this starts to happen in Wales, as it has in the USA, then we allow our teachers to tap into a rich new vein of materials relevant to their needs in the teaching and learning process.

## **2.5 Conclusion.**

The different strands assist us in identifying the nature of the problem. However the fact that they are largely under different masters, serves to emphasise the difficulties involved. Perhaps we should draw attention to the Ireland strategy here and consider the possible benefits of a single agency in Wales with the power to create a strategy that draws in the 3 'C's in to a single policy with three distinct strands, set in a Wales context. This is surely preferable to the current fragmentation?

## **Chapter 3 - WHERE WE SHOULD BE!**

The experiences of ICT innovation in schools in the last 10 years have resulted in increasingly robust

models evolving to show how Information and Communications Technologies integrate into the classroom. It is generally accepted that the process of integrating ICT in the classroom goes through a number of stages. The stages are not distinct or even discrete, but they give an essential sense of 'shape' to an assessment of progress. They are: -

- Adoption - Investigation and Experimentation. Schools go through an initial stage of experimenting in which a few teachers begin using technology to support traditional teaching and become ICT advocates. They start to use technology to enrich the curriculum, in effect they are using ICT to automate their existing practices.
- Adaptation. As teachers become increasingly comfortable with ICT and its potential for teaching, they expand the scope of activities that utilise ICT. LEAs and schools re-adjust teaching methods to take advantage of the expansive resources that ICT makes available to improve teaching and pupil performance and begin to achieve concrete educational objectives.
- Appropriation. Teachers view technology as the relevant tool for teaching and learning and design the learning experiences to harness the capabilities.
- Invention. Teachers grow in confidence and new work styles and organisational models of teaching emerge. ICT becomes an essential tool for teachers and pupils. It allows flexibility to create new forms of collaborative and enquiry based learning and, at the same time, improves pupil performance.

There is general view in the USA that they are around stage three of the process. These various stages all currently exist within Wales, with the major focus being probably on the border between stages two and three. While that is indeed encouraging it is salutary to remember that the move from stage three to four is the biggest shift in emphasis and makes the greatest demands on the system. High levels of achievement are exemplified by the later phases of the model that exist in Wales, in some cases in individual classrooms, in others in individual schools and in some individual LEAs. Currently progress is still fragmented. To achieve real progress and for the National Assembly to stamp its priorities on the emerging agenda, there needs to be an all Wales policy drive to locate everyone on the same route, and make the proper contribution to the development of the knowledge economy in Wales. We have progress in isolated places, we remain short on national policy guidance.

While we are still considering the essential tools, other countries are moving forward with the creation of 'Virtual Schools' which can be accessed by pupils directly both from school or from home, or indeed from other countries. The schools were created in parts of the USA from 1994 onwards to "implement the educational promise of technology". They serve to provide both 'top-up' and 'catch-up' teaching and learning experiences for pupils who need to be stretched or retrieve lost ground. They also offer accredited High School Diploma courses on line. Their participants now span the globe and their working day 'begins with Singapore and ends with Alaska'. A powerful image indeed and an indication of the shape of some of the future... These virtual high schools already exist in Florida, Massachusetts and Maryland in the USA and it is no doubt only a matter of time before the UK moves in a similar direction.

This is a timely indication that the world is not standing still while we catch up. While we in Wales are

still discussing the essential tools for progress, a US Senate Commission on 'Web-based education' is in the last 6 months of a two-year study of the future of ICT in US schools. They are considering and taking widely based evidence on issues such as technology trends and costs, teaching styles, access and equity, teacher support and training, regulatory issues, intellectual property protection, accreditation and certification in a distributed learning environment, new style learning institutions, standards and assessment etc. At the same time the National State Governors Association [NGA] in its annual meeting in August 1999 devoted the entire programme to a consideration of the need for clear ICT policies for American schools. Singapore's new 'Master-plan for ICT in Education' has been through the government's legislature. Evidently the situation elsewhere is not standing still.

In the words of one writer 'The biggest challenge is getting everyone to stop seeing ICT as 'one more thing that they must add on', an adjunct to rather than a part of the learning process. Technology is successful when it is used to make teaching and learning more constructive, more interactive – basically when it gives students broader horizons'. In short the continued success and quality of our schools depends on our collective ability to close the gap between the mere presence of ICT in the classroom and its effective integration into the curriculum to enhance pupil performance and deliver the skills necessary for the 21<sup>st</sup> Century.

### **3.1 Connectivity.**

An all Wales backbone needs to be established and managed by the National Assembly. This backbone, whose format is yet to be decided, will enable an all-Wales education intranet, whereby teachers in one part of Wales to access and use material developed in other parts of the country at no line cost. The network is key to enabling teachers and pupils to help each other and access the big providers. This aspect of the work will be managed as a part of the all-Wales ICT strategy under the aegis of the National Assembly for Wales. Given the nature of the geography of Wales, it is unlikely that any single technology could work in a satisfactory manner, therefore there is likely to be a plurality of modes in operation.

Each LEA needs full connectivity to its schools within three years. This will enable the national network to be rolled out into the schools. The format of connectivity is to be decided by the LEAs in terms of local needs and possibilities. It is not the purpose of the report to be prescriptive in terms of systems, but to emphasise the need for LEAs to have a system in place that enables classroom connectivity.

Schools, working with the LEAs must establish internal networks that offer, initially, a minimum of one Internet 'drop point' in every classroom or in a configuration that the school prefers. That minimum standard should grow to a notional 5 'drop points' per classroom by the end of a three-year period, arranged in whatever configuration the school deems appropriate. The USA has taken its classroom connectivity from 14% in 1996 to 72% in 2000. It aims for 100% in 2001. When one considers remoteness of some communities in the USA that is a major achievement.

Ratios of 1 multi-media standard PC to 5 pupils in schools and Colleges are the goals that Wales should

aim to achieve within 3 years. These goals are now being mentioned by the Prime Minister for the secondary sector. An All-Wales Purchasing Framework should be considered because of the huge disparity that exists between different LEAs based on their relative size and consequent buying power. The choice between leasing and purchase options should be considered under the terms of an agreement worked out in negotiation with the Welsh Local Government Association (WLGA) and ADEW. The negotiation should take account of the fact that the technology changes fast, which strongly suggests that leasing might be the preferred option. The aim should be to establish a purchasing arrangement that will set prices at an all Wales level and thus obtain significant economies of scale for all LEAs. This arrangement should be available to other public service bodies in Wales such as colleges, libraries etc. The agreement will assist the LEAs in taking advantage of the possibilities made available and in effecting the actual procurement. The procurement exercise should be set in a national framework specifying technical standards. It should also be born in mind that there will be a need as a part of the arrangements to start scheduling a PC replacement programme for schools within 5 years or we will re-enter the same cycle of short-termism yet again.

The USA ratio of multi-media PCs to pupils has gone from 1:24 in 1996 to 1:6 in 2000. New Zealand aims for 1:5 in 2001 against figures in 1997 of 1:19 in primary and 1:10 in secondary schools. Norway is already at a 1:5 ratio. Singapore will achieve a ratio of 1:2 in 2002, with the corollary development that 30% of the curriculum will be taught through PCs. We need to ensure that the ICT requirements of the pupils with Special Needs are addressed, both in mainstream schools and in Special Schools.

The provision of systems maintenance staff needs to be built into the operation immediately. The systems maintenance staffing ratios need to be given attention at an early stage in the strategy. The current commercial model of 1 support officer to 80 desktop PCs is often quoted, but is probably unrealistic. A model of 1 support officer to 15 schools is offered as a possible strategy, However it is acknowledged that we operate in a context of pupil:computer ratios and not school:computer ratios, and that the same principle should apply to support:computer ratios..The format of an appropriate expression of this ratio needs further consideration. However two key issues need to be guaranteed in any ration established as a part of the strategy - firstly that the need for support is recognised and secondly that there is equity in the proposal. Any operation must be backed by a full-time central help desk service in each LEA.

The issue of systems maintenance has been consistently ignored in previous revenue budget proposals. Providing capital grants without recognising the maintenance implications of those allocations simply builds up a financial time bomb that ticks away under both the LEA and the school. We should learn from the well-documented experiences in early ICT development in the USA not to repeat their errors. This proposal also has implications for CCETs and Objective 1 funding that the report will return to later. In economic development terms this proposal underlines the career opportunities that are emerging in the ICT systems support field, since the need for system maintenance staff is not restricted to education but has clear implications for other sectors such as health and private business. .

A National Grid for Learning Wales [NGfLW] should be established as soon as possible, based on the model of the NGfL Scotland and drawing on successful models elsewhere. It is now widely agreed in

Wales that the needs of teachers and learners in Wales and, in particular the Curriculum Cymreig, cannot be met responsively by an operation that is based in England.

All strategies must acknowledge that the borders between the schools sector and the distance-learning field are diminishing.

Schools should be prepared to make discrete parts of the campus available for evening ICT use by the Youth Services, Adult Education, local Small & Medium Enterprises, the public etc as a trade off for the substantial investment in the schools' ICT facility. This will also have the potential to bring schools ICT investment within range of Objective 1 funding streams.

### **3.2 Competence.**

An assessment of the ICT component of ITT courses in Wales is key to the future. The review begun by Estyn should be extended, with currently practicing teachers with acknowledged expertise seconded into the teams involved. Part of that review should centre on the extent to which the institutions are themselves using the technology in the day-to-day business of preparing our future teachers.

It is appropriate at this point to seek to isolate some of the subtle changes that are taking place in the classroom as a result of the progress of ICT. They can be polarised as a comparison between traditional and emerging learning environments, with the strong caveat that this polarisation is designed to make a point and is not meant to imply any rupture in the system but rather to a steady progression along a continuum.

#### Traditional learning environments

Teacher centred instruction

Single-path progression

Single medium stimulus

Isolated work

Information delivery

Isolated, artificial context

#### Emerging learning environments

teacher guided learning

multi-path progression

multi-media stimulus

collaborative, co-operative work

information guidance and exchange

authentic, real-world context

The New Zealand Education Review Office [NZERO] has devoted a considerable amount of time to a review of the use of ICT in its schools and how it affects the way that teachers teach and has drawn certain conclusions based on their analysis. They note a strengthening of the links between school and the outside world, which are made more effective by a shift in the teacher's role towards guide and

facilitator, indeed they even speculate about the possibility that the teacher role might begin to develop specialisms. They believe that teacher staff development should be a part of a coordinated strategy with the acquisition of equipment. They express legitimate concern about the inequalities of access for pupils due to the differential growth of the use of PCs in the home, and demand a minimum level of access to all students.

Both ITT centres and NOF should be encouraged to recognise that the new technologies call for a broader and highly demanding repertoire of skills, teaching knowledge and competence. The skills we begin to perceive are of a different order. We are now asking teachers to increase the integration of ICT into the curriculum, to use technology for classroom management, to identify and use Key Stage specific multi-media materials and ultimately to create new technology supported teaching and learning activities. These are challenging skills where development of, and advice and help to the teachers is key to real progress. Teaching using interactive media involves higher order skill than those currently provided for under the NOF training initiative. Planners should be encouraged to consider the feasibility of a 3 year programme of staff development related to the emerging higher level skills as they are identified. What is required is a scheme that makes the most effective use of available funding, offers flexibility through a range of approaches, allows focussed activity and acknowledges the time allocation problem for practice in schools. This staff development programme is viewed as urgent.

### **3.3 Content.**

Digital learning does not change the fundamental purposes of education. As the report stated earlier, even with widespread use of ICT the education process remains 'teacher intensive' but with a developing role for the teacher. The changing global economy and its imperatives does require a corresponding adaptation of our teaching environment. We need to encourage our teachers to have the confidence to upload their teaching materials on to the WWW via school web sites. We therefore also need to have expertise available to assist them in that process. This will, alongside the commercially generated materials, provide a 'critical mass' for future curriculum development initiatives, which will exceed the present range of available materials and software by some distance.

We need to find ways of assisting teachers, who show initiative in using ICT in teaching and learning, to be able to develop their materials to the professional level. Here we should pay close attention to the successes achieved by the Scottish Centre for Educational Technology(SCET) operation that seeks to bring teachers together with technical staff to design the new software needed, and to enhance the quality of the material that teachers can create.

We need to initiate and generate a local education software support that will be able to assist teachers, with specific reference to the potential of DVD development with its capacity to carry more than one soundtrack to actively assist with the bi-lingual nature of education in Wales. We need to find ways to put the technical support alongside the teacher who is leading the way in ICT classroom material development. This is the key that unlocks the content issue. We must bear in mind that in a sense we are trying to compress all the work that the textbook companies have traditionally put into developing full-

blown curriculum materials into a shortened time-frame. While we seek to incorporate the ingenuity and creativity of our teachers we must ensure that we place alongside them the technical expertise that they need.

There is a case in the rapid development of content using ICT for the companies involved to seek greater involvement with teachers. There is also a need for them to move more rapidly to the use of digital formats.

We also need to begin considering the implications of 'Assessment on-line', it will soon only be a matter of time and confidence that governs the increasing use of ICT in the assessment and examination process.

### **3.4 Conclusion.**

There is much to be done in a relatively short time frame to put our schools, our teachers and our pupils in the position to take advantage of the new technologies in a way that other countries are already doing successfully. There is a big agenda to achieve in a small time-frame and we are extremely unlikely to achieve it in the context of our present style of development.

## **Chapter 4 HOW WE SHOULD GET THERE**

### **4.1 Policy.**

The National Assembly should create a time limited Advisory Committee for ICT Development in Wales with a 3-year time-limited brief. The group will draw strengths from the experiences of the Board of Management in SCET, the National Policy Advisory and Development Committee in Ireland and the Chief Executive Officers (CEO) Forum for Education and Technology in the USA. The Committee should assume the policy brief of advising the Assembly Ministers and the Assembly Education Committee on the overall policy covering the three strands outlined earlier. Its membership should be from 9 to 12 and reflect the interests of central government, local government, schools and the private sector as the key stakeholders in the field. It should oversee the arm's length agency, the Information and Communication Technology Task Force (ICCTF) and the NGfLW team during the three-year period then ensure a smooth handover to a successor organisation. The Advisory Committee should establish an evaluatory contract to set criteria and judge outcomes at the end of the three-year period.

We should acknowledge our Welsh heritage and consider registering the domain name 'taliesin.gov.uk' as the site for the project development.

See Appendix 1

### **4.2 Information and Communication Technology Task Force (ICCTF).**

It is in my view extremely unlikely that this ambitious ICT initiative can be delivered without the active involvement of the private sector. Such involvement has been crucial to the successes achieved in a number of other countries, notably the USA, Ireland and New Zealand. Involvement of their staff in the Task Force by secondment should be presented as a key aspect of staff development for their managers. There are obvious difficulties to be resolved in terms of procurement arrangements, but here we are entering new ways of operating because, quite simply, we have to in order to achieve what we perceive as fundamental to the needs of our children. It is essential that the difficulties attached to procurement issues are not treated as a vehicle to block progress. It is worth reminding ourselves that governments in other countries seem to have achieved satisfactory partnership arrangements without too many difficulties and found willing partners, prepared to assist with schools.

We need an urgent injection of equipment into our schools and that injection may come from a variety of sources – capital grant, private sector input, sponsorship schemes both national and local, and quality recycling schemes. Re-cycling has been tried in a half-hearted way in the past, but highly successful operations are now being run in California and New Zealand. This will increase as the machines update more frequently and machines become available from government and private sector that have a substantial shelf life as far as schools are concerned. Examples include **Smart Valley Inc.** [SVI] in California, who make multimedia PCs available to schools for \$100 and **Computer Access New Zealand Trust** [CANZ] who recycle 486/Pentium standard machines through an accreditation exercise at \$NZ450 per machine. We are currently in a climate where PCs are replaced more frequently, and therefore, with limited overhaul, still have a potentially reasonable shelf life for a school. CANZ recommends that their branded re-cycled machines are used in schools for general applications such as word-processing, spread-sheeting, web-browsing and e-mail. This ensures that the more expensive machines are used more appropriately to deliver the latest applications of interactive software, etc.

We should therefore create an ‘arm’s length agency’ for 3 years to work with the private sector, develop and manage initiatives, create or franchise a quality PC recycling operation, develop Objective 1 options and negotiate on behalf of the Advisory Committee [using NCTE/SCET models]. It should be known as the ICT Task Force [ICTTF]. Detailed proposals for the role and staffing of the ICCTF appear in Appendix 2.

### **4.3 National Grid for Learning Wales [NGfLW].**

The National Assembly should establish a permanent NGfL team for Wales [NGfLW]. It would be based on the successful SCET model known as NGfL Scotland with variations to take account of the fact that we work with two languages in Wales. It will also draw on the experiences of the Scoilnet development in Ireland, the GEM Project in the USA and the ICT Ideas Bank in New Zealand. The NGfLW would operate as a managed ‘portal’ arrangement.

We should also use the benefits of the new technologies and develop the NGfLW as a ‘virtual’ organisation that allows the possibility of key staff based in North Wales being appointed without needing to move their homes [this could be vital for Welsh speaking input to the team]. NGfLW team

might possibly be located on appropriate University campuses in North and South Wales. It is feasible that it could also manage the proposed Estyn Web facility [thus saving duplication of expertise and freeing up much-needed capital] and undertake work on behalf of the Assembly that is currently handled by BECTA. Its chief executive should be automatically accorded the Welsh representation on BECTA, if the Assembly deems it appropriate to continue membership of BECTA.

The large volume of work will need careful prioritisation, possibly linking to national themes such as numeracy. The NGfLW team will work in close co-ordination with the LEAs and schools, and to provide a quality assurance role. There is already much good content available, and the NGfLW team will need to take care that it identifies gaps in the digital content available and targets those initially, thus avoiding any risk of expensive duplication. This precise targeting will build a comprehensive range of digital content for our schools over time, ensuring also that the Special Needs agenda receives due attention. Their role will include both production and commissioning of digital content developments.

Detailed duties appear in Appendix 3.

#### **4.4 Competence.**

There should be a clear learning outcome from the competence training designed for our future teaching force. Any assessment of the competencies needed in ICT for teachers should have as their starting point the curriculum, the technologies available, the nature of learning and the potential changes in that process. Teachers should be empowered to identify ways in which ICT can be used to encourage engagement and participation in learning. Crucial to such an outcome will be a significant increase in the ways that the ITT institutions provide appropriate role models by using the technologies in their college courses. Training for new teachers will ring hollow if future teachers are simply given lectures about the ICT available and the staff involved are not using it. The new technologies require 'action learning' to be effective.

We must review the time allocated to ICT and the quality of the ICT component in initial teacher training courses. It is recognised that ESTYN has already begun some work in this field, but there is a need for that to be extended rapidly, incorporating serving teachers into the experience. There are various guesses about the amount of time currently devoted to ICT in ITT courses in Wales, and there needs to be a view taken by the Advisory Committee about how much should be allocated to the needs of the new teachers. We need to know how 'integrated' the integration of ICT is in Initial Teacher Training (ITT) and how pervasive ICT is in its delivery of the various courses. Allied to this is a need to support the ICT skills of the NQTs when they begin to work in our schools and that has clear implications for the role of LEA advisory staff. To be effective competence training needs to be focused to priorities and accept the need for a range of approaches.

Consideration should be given to entering into secondment arrangements for teachers with ICT expertise into ITT institutions to work on the skills necessary for a maximum of 2 years secondment. To ensure that training in ICT is at the 'cutting edge' we should facilitate funding secondment arrangement on a

fixed term basis for two year only to allow the best teachers using ICT skills to be the trainers – currently they are the acknowledged experts and we need to use that enthusiasm and skill to the advantage of all. Equally the secondment arrangement guarantees that these skills are not lost to the classroom.

The Advisory Committee should commission the preparation and delivery distance-learning materials for teachers to be able to develop their skills on-line at school or at home. NGfLW can build a portfolio of ICT courses, course-based, distance learning options etc. and include them in the CD ROM offered to teachers each year. It should explore the potential of the Professional Development Schools [PD Schools] operation in New Zealand, where some 30 designated schools act as regional staff development centres. This replicates the Irish model for ICT curriculum development, where clusters of schools work on specific ICT related curriculum development projects.

#### **4.5 Content.**

NGfLW must seek to build on the successes of the 5 ADEW projects and extend the range of activities that seek to develop educational software that relates to the needs of Wales instead of having to import. This development will be assisted by the **Innovative Schools Initiative fund**, which will support LEAs and schools that are at the forefront in innovative development in ICT. This can be improved by putting NGfLW technical staff alongside teachers who are developing good materials in a multimedia context. The model has worked well in Scotland where a designated fund has been established for some years. As a result, SCET has been able to subsidise its main activity by successful marketing of software products developed with local schools.

The ISI Fund, which will need clear well-focused criteria for selection might be established by some re-allocation of the ACCAC budget. It is critical that the operation of the fund avoids a complicated bidding system, which deters many teachers from seeking support and would continue to do so. The schools can work in clusters with the LEAs acting as co-ordinators, thus reinforcing the value attributed to cooperation and collaboration. This will have the virtue of producing resources that: -

- Are proven in a Wales context,
- Are developed by qualified, practising teachers working with technical support,
- Demonstrate best practice in the use of ICT in the support of teaching and learning,
- Provide models that can be adapted by other teachers to suite the needs of their pupils,
- Inspire teachers to be creative and innovative users of ICT in a learning environment,
- Are quality assessed by colleagues and other professionally competent staff.

In the current financial context where there is a large volume of work to be considered, there will be clear need for the prioritisation of activity.

#### **4.6 Long term future.**

The initiatives being proposed, while they are set in a 3-year context, are not just a short-term programme, but they represent a strategy designed to enable the education sector to be properly assisted and prepared for new ICT initiatives, as they develop and become available.

There is therefore a need to establish a locus for this operation for the long term. In Scotland SCET operated independently for many years. However consideration has been on-going in terms of its eventual policy location. In July 2000 SCET was merged with the policy responsibility of the Scottish Central Curriculum Council [SCCC] under the new title Teaching & Learning Scotland [TLS]. This has been seen in Scotland as a strong merger of two dynamic partners that locates ICT firmly alongside the curriculum policy base for Scotland. It is essential that the Advisory Committee is a time-limited operation to ensure that the appropriate energies are concentrated and delivered to the project in the short term.

In Ireland a parallel debate is now under way and the outcome is likely to be similar to Scotland when the present 3-year initiative ends in 2001. There is currently no obvious partner in Wales for the long-term location of ICT strategy in schools, since ACCAC is perceived as a different style of operation from SCCC in Scotland. However there are powerful reasons why the policy for ICT development in schools should sit alongside the curriculum policy base to ensure maximum benefit to schools, teachers and pupils. Therefore it is proposed that the three-year period of the Advisory Committee be used to allow a review of the remit and operation of ACCAC in terms of revision, if thought appropriate. This proposal sits well with the current arrangements since the quinquennial review of ACCAC is scheduled for 2003. when the Education Committee will be required to approve the remit of ACCAC for the next 5-year period. If this can be achieved then it is feasible to explore the possibility of a merger at the end of the 3-year period into a suitably modified vehicle.

#### **4.7 Video-conferencing.**

We should seek to put at least one dedicated Video-conferencing facility into each secondary school and FE college in Wales in order to facilitate the potential for joint teaching for small 'A' level/ 'AS' level/ GNVQ teaching groups, particularly in the minority subjects at 16+. This will obviously assist rural areas; it will also assist other schools where class size is seen as a problem. Using the available technologies properly represents a better alternative at 16+ than the major costs and upheaval of 16+ re-organisation with its attendant problems. The higher education sector could also make its expertise available to 16+ education in this way. ICT has the potential for providing more coherence between schools, Further Education and Higher Education. This arrangement should be negotiated through the Community Consortia for Education and Training (CCETs) with the prior policy agreement of the Council for Education & Training Wales (CETW).

#### **4.8 Systems maintenance and software development.**

The Assembly should seek the immediate development of courses at Further Education Colleges for school based ICT Systems Maintenance Technicians, using the local CCETs for delivery of this

initiative. This is an area of identifiable skills shortage within Wales and thus potentially eligible for Objective 1 funding support. This role may be of key importance in other emerging ICT agendas such as the maintenance needs of ICT systems in the National Health Service and other public and private sector bodies.

The Assembly should ask Higher Education Funding Council for Wales (HEFC[W]) to consider urgently the need to increase the number of places for software engineers at graduate and post-graduate levels as a priority. Ireland plans to increase its output of software engineers from the universities from 2000 in 1997 to 4500 in 2001. This is an identifiable skills shortfall within Wales and again possibly suitable for consideration under Objective 1 support. At present there is no consistency across the universities in Wales in the importance attached to the indigenous development of software engineers.

We should consider the potential value of the European Computer Driving Licence [ECDL]

#### **4.9 Funding.**

There are a number of recommendations in this report that have financial implications, the information needed to cost these is held within the National Assembly Education Department. In order to assist the Committee in its deliberations it is recommended that the Education Minister be invited to prepare a supporting paper outlining the financial implications of the recommendations made in this report.

#### **4.10 Private sector development.**

As the report has already stated, the initiative will need a strong private sector involvement working with the Assembly to succeed. That involvement should be at a variety of different levels – both at national policy and at local operational level. In other countries great store has been placed by local businesses assisting schools with the procurement of equipment but usually with some key incentives. We have experience of the superstore initiatives in the UK to obtain computers for schools – the incentive was for the children to persuade the parents to change their store allegiance and its repetition seems to suggest that it has not been without success. What has not been explored is the possibility of offering tax incentives to businesses to contribute to national initiatives or to provide approved equipment for local schools. This should be given consideration within well-defined limits and conditions. In the California ICT development programme the input from local business was key to the initiative.

We must, through the agency explore some of the initiatives that have been successfully developed in other countries such as: -

- The TELIA [British Telecom's equivalent in Sweden] sponsorship scheme for schools ICT developments in Sweden. TELIA sponsors projects involving use of audio and video communication between schools, communication with data bases containing interactive multimedia tools and the production of new interactive computer based teaching aids.
- The EIRCOM (British Telecom's equivalent in Ireland) support so readily made available to Irish

schools, when they put £10 million of PC equipment and networking into Irish Schools.

- The decision by Bill Gates of Microsoft to sponsor a number of major schools ICT developments across the USA with the \$3 million profits from his book ‘The Road Ahead’
- The Telecom New Zealand offer to all schools in New Zealand of the Telecom Learning Line – a separate line installed free to all schools with no line rentals. It was taken up by 89% of schools in the country.
- The effectiveness of Smart Valley Incorporated – the arm’s length Public/Private sector operation in California that drove the Silicon Valley initiatives that lead the world.

The willing involvement of the private sector in other countries is also of note. The businesses in these countries perceive active operational and financial support for the ICT development in schools not as philanthropy but as enlightened self-interest. We must not be too proud to follow where others have led successfully. The ICT initiative in Wales is not about empires and boundaries it is about new thinking and new ways of working in support of our schools, our teachers and our pupils. The window of opportunity is with us now, but will not be open forever.

## **Chapter 5 - CONCLUSIONS**

The resolution of the PRE 16 Education Committee to widen the remit of its enquiry was a brave decision. Current evidence indicates that Wales is now treading the same path as the nations that are now perceived to be leading the way in terms of the development of ICT in schools. The wider implications of such a policy are key to the locus sought by the Assembly in terms of placing Wales in the ‘knowledge economy’. As we draw on the experiences of the nations that lead the ICT developments in schools, certain facts, fundamental to success, are common to the experiences of all: -

- Warnings about the dangers of uncoordinated and unsupported implementation of new technologies into learning environments,
- The need for teachers using the new technologies to be adequately trained,
- The need for implementation of ICT developments into schools to be well coordinated and properly funded.

We would ignore any of these at our peril.

The case made is a legitimate one – ICT alone is not the answer, but matched with education methods that are appropriate and good digital content that add value, thus the technologies are a key tool in the process of improving standards. The evidence is now out there. Any programme of reform involving ICT will call into question fundamental issues about how we teach – now and in the future. To be effective we require a driving force to provide the energy to carry the innovations through to full implementation and we require a social vision to legitimise the activity and inspire the efforts needed to bring it to fruition. It is to be hoped that the recommendations provide the strategy and the structure for those key factors.

This programme must be seen as a key component of a larger policy drive towards a new shape to the Welsh economy. The National Assembly for Wales has taken the view that the case for the rapid development of ICT in our schools represents an area where they correctly perceive that they have the capability of enhancing our schools, assisting our children and creating added-value to the emerging Welsh 'knowledge economy'. I am sure that the Assembly will be pleased to be judged on the outcomes of that strategy in due course.

**NEIL HARRIES,**

Expert Adviser to the PRE 16 Education, Schools and Early Learning Committee.

November 2000

Summary of actions with timescales

	By April 2002	By April 2005	By 2010
<b>Connectivity</b>	<ul style="list-style-type: none"> <li>● All Wales Purchasing Framework for the purchase of ICT equipment for schools;</li> <li>● National Grid for Learning, Wales team to be established to provide all appropriate curriculum services, planned, designed and tailored to the needs of Welsh schools working in both English and Welsh languages;</li> <li>● Schools working with LEAs must establish internal networks that offer a minimum of one Internet 'drop-point' in every classroom or in a configuration that the school prefers.</li> <li>● The provision of</li> </ul>	<ul style="list-style-type: none"> <li>● An all Wales ICT backbone needed to be established and managed by the National Assembly. - this backbone would enable an all-Wales education intranet;</li> <li>● Each LEA to have full connectivity to its schools;</li> <li>● Ensure the existence of School wide Networks with a notional 5 'drop points'. per classroom arranged in whatever</li> </ul>	

systems maintenance staff needs to be built into the operation immediately.

- configuration the school deems appropriate;
- Establish a minimum standard ratio of 1 multi-media Personal Computer (PC) to every 5 pupils;
  - The staffing ratio of systems maintenance needs to be established on an equitable basis;
  - Each LEA to have a full-time central 'Help Desk'.

**Competence**

- ESTYN should extend its current review of the ICT component of ITT courses in Wales;
  - Consider urgently the feasibility of a three year programme of staff development related to emerging higher level skills as they are identified;
  - Consider the European Computer Driving Licence (ECDL).
- Initiative of seconding teachers with ICT expertise into ITT institutions to assist in the delivery of courses;
  - Review of how INSET training is delivered and accreditation of ICT INSET training;
  - ICTTF to commission the preparation and delivery of

		<p>distance learning materials for teachers;</p> <ul style="list-style-type: none"> <li>● NGfLW to build portfolio of ICT courses etc for teachers</li> </ul>	
<b>Content</b>	<ul style="list-style-type: none"> <li>● Establish a local education software support to assist teachers in using ICT and in developing their materials to a professional level.</li> </ul>	<ul style="list-style-type: none"> <li>● NGfLW to have established and launched 'Innovative Schools Initiative Fund by <b>April 2003</b>;</li> <li>● First CD-ROM for teachers produced by NGfLW by <b>April 2003</b>;</li> </ul>	
<b>Policy</b>	<ul style="list-style-type: none"> <li>● Establish an Advisory Committee for ICT Development in Wales with a three year brief;</li> <li>● Establish the ICT Task Force (ICTTF) - an 'at arms' length' agency to work with private sector, manage the initiative and negotiate on behalf of the Advisory Committee;</li> <li>●</li> </ul>	<ul style="list-style-type: none"> <li>● Plan the transition of NGfLW and Agency into final structure through a review of ACCAC's remit and structure;</li> <li>● ICTTF to establish local learning partnerships between schools and advisory services and higher education as</li> </ul>	<p>The permanent locus for ICT in education to take forward policy development and curriculum issues to take it forward from April 2005;</p>

		equal partners by <b>April 2003</b> ;	
<b>Video Conferencing</b>		<ul style="list-style-type: none"> <li>● at least one dedicated video conferencing facility into each secondary school and FE college;</li> </ul>	
<b>Systems Maintenance and Software Development</b>	<ul style="list-style-type: none"> <li>○ Development of courses at FE colleges for school based ICT systems maintenance Technicians;</li> <li>○ Invite HEFC to consider urgent growth in the development of software engineers at graduate and post graduate levels;</li> </ul>	<ul style="list-style-type: none"> <li>● Continued expansion and development of courses;</li> <li>● Target to increase output of software engineers from Welsh universities to xx by end 2005</li> </ul>	
<b>Private Sector</b>	<ul style="list-style-type: none"> <li>● Agency to explore the lessons that can be learnt from successful private/public partnerships</li> </ul>	<ul style="list-style-type: none"> <li>● Put into practice the lessons learnt and establishment pilot partnerships expanding on this annually</li> </ul>	Flourishing public/private partnerships through the schools sector

## Appendices

### Appendix 1 - Role and Function of the Advisory Committee on ICT for Schools: -

- To advise the Assembly Secretary on the development of the role of Information & Communications Technologies [ICT] in the Welsh Education System.
- To advise the Assembly Secretary on the ICT development needs in education in Wales.
- To investigate future policy direction under the ICT 2000 programme and to make recommendations on how best to utilise advances in technology for the benefit of education in Wales
- To liaise with the appropriate bodies in the formulation of ICT policy advice for education in Wales for the Assembly Secretary.
- To consult appropriately and formulate the policy for the ICCTF and NGfLW.
- To decide on the future involvement or non-involvement of Wales in BECTA.

### Appendix 2 -Information and Communication Technology Task Force (ICCTF)

The ICCTF should: -

- establish local learning partnerships between schools, advisory services and higher education as equal partners. The ICTTF should: -
- negotiate the ICT equipment procurement options for Wales in consultation with the WLGA and ADEW, then assist the LEAs in effecting the procurement
- liaise with the private sector on initiatives of value to both parties,
- develop Objective 1 funding bids
- create a PC recycling operation for schools.

### Appendix 3 - National Grid for Learning (Wales) (NGfLW)

NGfLW should provide and manage: -

- ICT related curriculum content, quality tested and categorised by curriculum area and key stage.
- Provide quality assurance function
- Produce an annual CD ROM for schools of recommended programmes and curricular web sites. This will be for ease of access by teachers and will replicate successful schemes in California, Canada and Scotland.
- General curriculum support materials.
- Develop an on-line library of training materials covering the spectrum of INSET for ICT.
- Education documents [NATED, Estyn, WJEC, ACCAC, CCETs etc].
- Seek to take a lead in the emerging EC Celtic languages agenda, where, using DVD format, the independent linguistic interests of Wales, Ireland, Scotland and Brittany have common interest and are fundable under the minority languages programme of the European Commission.
- Manage the Innovative Schools Initiative Fund

- Administer the NOF funding in Wales.
- Assist the ITT institutions with their staff development programmes
- Provide technical support to schools and LEAs on equipment issues in the form of advice sheets [the current BECTa sheets could be used for this].
- Manage the Assembly's projects.
- Seek sponsorship and contracts in the wider ICT field that will enable it to subsidise its services to LEAs and schools.

Its staffing complement should include the following specialisms: -

- Curriculum (and ICT applications therein) and educational structures;
- Computers and Infrastructure;
- Web development and design, service provision;
- Collection and editing of resources in both English and Welsh;
- Cataloguing and metadata in English and Welsh (preferably in a web-based environment).

The NGfLW should manage the Innovative Schools Initiative Fund that can be used to fund the work of individual schools in ICT related curriculum materials that are considered worthy of assistance. It will be known as the Innovative Schools Initiative. It should make grants in return for publishing rights and be authorised to work rapidly without establishing a bureaucratic bidding procedure that inhibits progress. It is surprising what can be achieved with the adroit use of small sums such as £1000 to £5000. In the USA there is a tradition of bidding for such grants from the private sector that acts as the 'seed-corn' of school based curriculum development.

The NGfLW should be given the brief of consolidating the work of the 5 LEA consortia that were established in 1999 to lead on different ICT related initiatives in Wales. They should be empowered to create more consortia in specific projects that are deemed to be of value to schools. These consortia could be clusters of schools located together or spread across the country. They can work together using the available technology to develop teaching and learning materials in discrete, defined curriculum areas. These could be disseminated via the NGfLW portal arrangement. In Ireland they are funding nearly 80 ICT based curriculum projects in clusters of schools across the nation. The acorns from which oak trees grow...

#### **Appendix 4 - Organisation and Structure Chart**

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## Appendix 4 - Organisation and Structure Chart

## Appendix 5 - References.

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