

Development of Satellite and Terrestrial Digital Broadcasting Systems and Services and Implications for Education and Training

Final Report

A Study for the DGXIII C3
Telematics Applications Programme
Education and Training Sector

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Executive Summary

Introduction

This is a study into the “Development of Satellite and Terrestrial Digital Broadcasting Systems and Services and Implications for Education and Training”. It covers issues that will need to be addressed by all organisations involved in education and training concerning the developments of satellite, terrestrial and cable digital broadcasting systems and services. The main focus of study is on the development of interactive TV learning services to the home via consumer or low cost receivers. It primarily covers developments within the European Union but also considers developments in other parts of the world.

Up until a few years ago most radio and television broadcasts made use of analogue technologies. This has now changed and there are now over 1000 TV channels accessible to homes in Europe via satellite using digital technologies. Using suitable equipment it is also possible to broadcast data via satellite directly to a computer. In addition, it is increasingly possible for digital broadcasts to be sent via cable networks and also in a digital format “over the air” - terrestrial broadcasting using an existing aerial that was used for receiving analogue broadcasts.

As Europe along with the rest of the world is moving to an era of lifelong learning a key issue for those offering learning services is to find the most effective way of reaching their target audiences. This study reviews these technology developments and explores the potential use of interactive digital TV learning services reaching people in their homes. Interactivity can enable a passive viewer to become an active learner - thus increasing the potential for more in-depth learning to take place.

Digital broadcasting technologies -state of the art

The study looked at the developments concerning data broadcasting, digital radio and in particular it focused on interactive digital TV. (Chapter 2)

Data broadcasting

It was found that data broadcasting services primarily use a satellite to broadcast multimedia data directly to a computer via a satellite dish at high speed. Although it is possible for a home user to receive such a service at a relatively low cost, uptake has mainly been by institutions and companies who subscribe to a specialist service. A few educational applications are beginning to emerge focused towards schools or medical centres.

Technically the technology is mature and a number of commercial suppliers offer various delivery services.

Digital Radio

The study found that although a number of broadcasters are broadcasting in a digital audio format across a number of countries within the EU, there are very few listeners utilising this format. This is mainly due to the high cost of digital radios. It was also noted that some limited multimedia facility could be made available with the audio signal which, some people see as having a potential usage for education and training (Chapter 2).

Digital TV

Digital TV is now in its third year in some parts of the European Union. However, in some countries it has only just become available during the later part of 1998. A few countries do not have any digital TV channels that originate from within the country.

The overall uptake of digital TV services across the European Union is still very low. The latest figures available indicate that only about 2.2% of EU TV households were accessing digital TV services in mid 1998. As Digital TV has started to take off in many European countries from mid 1998 there will certainly have been an increase by mid 1999 but it is still likely to be low.

Digital TV is now available via satellite, cable networks and digital terrestrial networks. However, access to any one of these services is not evenly spread across the European Union. Most households within Europe are able to receive digital TV broadcasts via either satellite cable or digital terrestrial delivery methods. Some households are capable of receiving more than one of these services.

All these methods of reception require a digital set-top box that converts the digital signal into a suitable format for using with an existing TV set. Or it is possible to buy a new TV which has the set-top box integrated within the system.

Early set-top boxes had no capability for interactivity except for changing channels. Later versions of set-top boxes will have increased levels of interactivity utilising a connection to a normal telephone line or a cable network as the return channel. This means that interactivity is possible in the form of: -

- “*Enhanced TV*” - the viewer selects additional information, views or responds to questionnaires whilst watching an existing TV programme.
- “*Interactive services*” - accessing information independent of a TV channel through the TV set, including access to the Internet and other online services.

Interactive services in various formats are only just beginning to emerge and consequently are only used by a very small number of users across Europe. However, market analysts predict a significant increase in interactive services via TV in Europe and the US over the next four years with 25% of households having access to them.

However, residential uptake of interactive services via computer will still be greater due to the larger number of households having all the equipment to access such online services.

The study explores in detail the technical issues relating to the development of interactive digital TV including key players and developments of other competitive technologies (Chapter 2).

State of developments in Europe and other parts of the World

The study includes a country by country status report (Chapter 3) on the state of developments of digital TV in Europe and the other parts of the World. It has been found that there are wide variations in the state of implication for receiving the

different digital broadcasting technologies - satellite, cable and digital terrestrial across the EU. The historical development of analogue reception technologies, methods of paying for the channels resulting in the number of free-to-air channels is influencing the development of digital broadcasting.

The European Union is more diverse in terms of the technologies used for digital TV than the United States. However, Japan seems to be following a similar pattern to the EU but is lagging behind in digital TV developments. The interactive digital TV market in the EU appears to be slightly more developed than the US, but is likely to be overtaken by the US over the next few years. With the exception of Poland generally Central and Eastern Europe is lagging behind the EU. Poland appears to have approximately 6% of households subscribing to digital TV services.

Currently, the EU may just have the edge on the United States by leading developments towards interactive digital TV learning services. But, strategies in the US will lead to continent-wide developments and could enable the US to take the lead if digital TV uptake is rapid. There is little evidence that there is much activity in Japan or Central and Eastern Europe.

Examples of digital broadcasting learning services

The study includes twelve case studies of current and planned learning services using digital broadcasting technologies (Chapter 4). They can be categorised as: -

Traditional educational channels who enhance their services by: -

- Utilising the extra capacity available by increasing the number of programmes broadcast
- And possibly, providing some sort of interactivity via a separate web site

Data broadcasting services that provide: -

- High speed access to the Internet enabling educational content to be accessed
- Delivery of specific learning resources

New Interactive TV Services that can be either: -

- Interactive services which enable the viewer to access information independent of the TV channel
- Enhanced TV services which enable the viewer to do more than passively watch a TV programme

Understanding the market for interactive digital TV services to the home

The development of the market for digital TV interactive learning services in Europe is very much dependent upon the development of the broader market for interactive services to the home. The study (Chapter 5) provides some observations and trends for the development of this broader market in terms of: -

- Online Internet based interactive services
- TV based Interactive Services

There is likely to be continuous growth in interactive TV enabled households over the next decade. This second platform for interactive services to the home is becoming a serious contender with the possibility of a quarter of European households capable of receiving interactive TV services within four or five years. However, online-enabled computer households will dominate for the foreseeable future providing another means to enable interactivity to the home. (Figure 1)

Figure 1

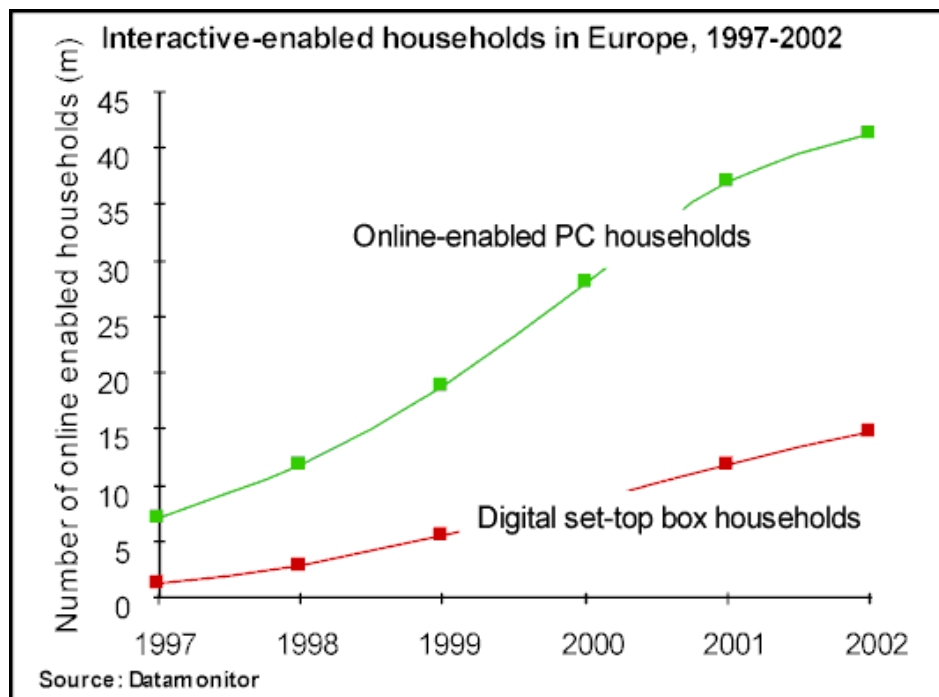
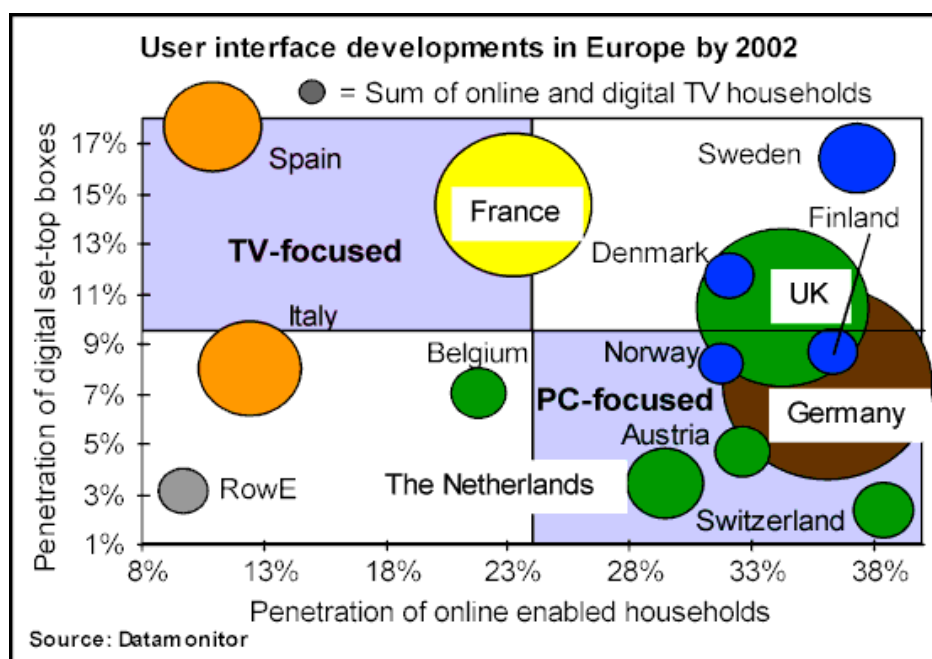


Figure 2



There will also be variations across Europe as to whether various interactive services via the TV will take off or not. In some countries access to online services using a computer will be the most appropriate means. Whereas in other countries with a lower penetration of computers to the home the TV may be more appropriate. The delivery mechanisms used - satellite, cable or digital terrestrial - will also vary across Europe (Figure 2). There is also likely to be a demand for video-on-demand services.

Implications for Education and Training

The study looked at what implications this has for education and training (Chapter 6) in terms of: -

- what evidence exists to suggest a demand for interactive TV learning services
- the nature of education and training provision and how it is funded

It provides an: -

- analysis of service providers involved or likely to be involved in offering digital broadcasting learning services
- assessment of the impact digital broadcasting systems are likely to have on education and training, in terms of traditional and innovative services
- analysis of the different ways of paying for such services
- analysis of service providers involved or likely to be involved in offering digital broadcasting learning services

Where there is an awareness of interactive services via TV, there is some evidence to show that there is interest in educational services and some indication that households would be prepared to pay for such services.

Conclusions

Data broadcasting

1. The further development of learning services utilising data broadcasting technologies is primarily dependent on content providers identifying this technology as an appropriate means of delivering the service they wish to offer. Therefore commercial technology suppliers need to make learning service suppliers more aware of their offerings.

Digital Audio

2. This study was unable to identify any potentially unique digital audio application that could be utilised by education and training.
3. However, as with all technologies, the development of digital audio broadcasting should be monitored in case any technical breakthrough offers new opportunities for the delivery of education and training.

Digital TV

Interactive TV Services

4. Generally, there is currently little demand from home consumers for interactive services via TV so a demand will need to be created before consumers will buy the appropriate equipment needed.
5. However, where public awareness has been raised, there is some interest in interactive services and even a willingness to pay for such services.

Development of Interactive TV learning services

6. The uptake of interactive TV learning services across the EU will be very uneven. Prospects for the development of such services is high in only three countries and prospects will be low in another six countries as indicated in the table below (Figure 3).

Figure 3 Prospects for development of interactive digital TV learning services with EU Countries
(shaded area indicates the level of prospect)

Country	Prospects		
	High	Medium	Low
Austria			x
Belgium			x
Denmark			x
Finland		x	
France		x	
Germany		x	
Greece			x
Ireland		x	
Italy	x		
Luxembourg			x
Netherlands		x	
Portugal			x
Spain		x	
Sweden	x		
United Kingdom	x		

7. However, this may not necessarily put some European countries at a disadvantage to others because other competitive technologies may be more appropriate and have a more dominant role.
8. Most of these interactive TV learning services are likely to be in an informal or “edutainment” format.
9. Early developers of interactive TV learning services are likely be public service educational broadcasters and commercial operators who may wish to gain a competitive advantage over their rivals like sports channels.
10. However, there does appear to be a demand for language learning, which may encourage the uptake of interactive digital TV.
11. Interactive TV may offer some innovative approaches to tackling the problems of basic skills in an informal and entertaining way.
12. Separate “TV channel independent” interactive services utilising the return channel are starting to emerge in the form of: -

- a) learning resources related to the national curriculum for school children and
 - b) Online encyclopaedias involving new alliances with traditional publishers.
13. Until a critical mass of households are “interactive TV enabled”, traditional education and training providers will be reluctant to consider offering interactive learning services.
 14. Broadcasters will continue to be the prime gatekeepers of interactive TV services to the home. As they have done with television they will control what the user has access to as well as the quality of the services on offer and the development of these services. Compared to the World Wide Web this may act as a barrier for traditional education and training providers to offer interactive TV learning services.
 15. Therefore it seems unlikely that interactive TV learning services will be dominated by traditional education and training providers. However, they may find new market opportunities for offering their learning services through local cable networks once they are able to offer broadband accessibility.
 16. In some parts of Europe there is a strong affinity for a regional or national identity linked closely with culture and education. If these areas have access to their own digital TV channel there could be opportunities for developing interactive TV learning services closely with local traditional educational and training providers, as is happening in Wales. However, they must be part of an education and training strategy funded from mainstream public sector funding.

Internet-based learning services to the home

17. Most education and training providers will find it easier to utilise the Internet for interactive learning services than for using interactive digital TV.
18. There will also be new opportunities for accessing good quality full screen video and audio with further improvements to increasing speed of access via ADSL technologies, which would increase usage.
19. However, these technologies could still be used to access the Internet through a TV set.
20. Low cost set-top boxes linked to a TV for accessing only online services could provide an alternative means of accessing such services without the need for a computer. This may meet a socially important need to offer online learning services to people who cannot afford to buy a home computer.

Digital TV Technology issues

21. The technologies to support interactive TV services are developing fast. Incompatibility issues relating to hardware and software are beginning to be addressed by the industry, which is aware that these issues need to be solved.
22. Therefore, over the next few years the industry is likely to resolve problems like different conditional access systems and different interactive software, through a mixture of mutual co-operation and competition.
23. As most households would generally only subscribe to one type of digital TV service with its bouquet of channels and interactive services, these incompatibility issues are not really a problem to them.
24. But it can create additional costs for broadcasts that make their services available on a number of different platforms. This would be due to the cost of adapting the interactive software for the different platforms.

Other Competitive Technologies

25. As the Internet is now relatively easily accessible from the home it will continue to develop as the main technology for utilisation by remote learning services.
26. As ADSL technologies develop it will be increasingly possible to distribute full screen video with interactivity via the telephone to a computer or to a TV.
27. There are also developments towards personal TV where the viewer is able to decide what programmes they want view and when they want to view them. They could access them from a remote server or they could be stored in a high-capacity storage device in the home.

Decisions for organisations supplying learning services

28. Organisations wishing to offer interactive learning services to the home will need to make decisions on what is the most appropriate and cost-effective delivery mechanism for their purpose. It could be broadcast or it could be accessible online. Knowledge and know-how in this area is only starting to emerge.

Process of Innovation transfer

29. As has been stated in a previous report to the EC¹ it is very important to understand the process of innovation transfer. This helps to determine what recommendations should be made for the development of interactive digital TV learning services across the European Union.
30. An innovation can involve the development of products, tools and devices. Or it can involve a process with the development of new ideas, approaches or techniques.
31. The products tools and devices are already available and being further refined in the case of interactive digital TV. But the new ideas and approaches in the context of interactive digital TV learning Services are at a very immature stage and limited to isolated pockets of development across the EU.
32. Therefore, to ensure the even diffusion and transfer across the EU of new ideas and approaches for the utilisation of interactive digital TV learning Services, human networking of those involved in broadcasting, education and the IT is critical.
33. This would also enable equality of opportunities for such services to develop and would be an important ingredient in securing and increasing competitiveness across the EU where there are clearly cultural and linguistic barriers within broadcasting and education. This is compared to the United States where a common language certainly can encourage the rapid diffusion of ideas and approaches nation-wide.

Need for Intervention

34. The development of interactive digital TV learning services could be left entirely to market forces. This would eventually result in the development of some sort of sustainable services but unevenly and slowly spread across the EU because of lack of knowledge and know-how.
35. The other approach could be to actively stimulate interest, knowledge and know-how through the bringing together of education, broadcasting and the IT sectors. This could result in some early solutions to large-scale training needs across regions or countries and enable EU organisations with expertise in this area to gain a competitive advantage over rivals from other parts of the World.

¹ "Developing Telematic-based Learning Services - the Role of SME Networks" A Study for the DGXIII C3 Telematics Applications Programme Education and Training Sector 1995

Recommendations

These following recommendations describe ways in which the European Commission may intervene to stimulate developments in utilising new digital broadcasting technologies for education and training without distorting existing market developments.

A market for digital broadcasting technologies is already developing with a number of suppliers already offering products and services for data broadcasting and digital TV. In particular, digital TV with fledgling interactive services is emerging within a consumer market. Other competitive technologies are also emerging rapidly, which could provide alternative solutions. As previously stated the education and training business has little control over these technology and market developments.

However educationalists and broadcasters need to be aware of the continuing technical developments and constantly review their potential utilisation. Manufacturers and suppliers of digital broadcasting technologies need to be aware of the potential education and training market for such services and actively exploit it.

Within this context the European Commission's primary roles should be raising awareness, disseminating good practice and stimulating a body of research which will ensure that the interactive TV learning services are utilising sound pedagogical practices and are sustainable within the mainstream funding mechanisms which are available. This will help education and training providers make decisions as to whether they should be utilising these technologies for their particular learning offerings.

The recommendations are therefore:

1. As a first stage this report could be made available to policy and decision-makers in broadcasting, education and training and the IT industry.
2. But, in order to further raise awareness, disseminate knowledge of technological developments and encourage co-operation, a series of workshops should be funded in order to bring together key players from across Europe to share knowledge and know-how.
3. With some assistance from the industry and from the EC a web-site should be established in order to collate technological, pedagogical, managerial and costing issues relating to using digital broadcasting and other technologies for learning.
4. This should be linked to an information service consisting of a helpline where organisations will be able to get further assistance and where knowledge and know-how can be disseminated via presentations and articles to the education and training world.
5. This should lead to the establishment of a European-wide forum in order to bring together all key players who are active or interested in using digital broadcasting technologies to develop interactive TV learning services. In particular it should be a vehicle to encourage strategic alliances between public-private partnerships and to reduce the cultural differences that currently exist between broadcasters and those in the telecommunications industry. It should take into account the convergence of the technologies and should consider the impact of new developments in online technologies. Although the Forum may initially have a particular technological focus,

this should always be in the context of the appropriate use of the technologies for enhancing learning.

6. It is proposed that the Forum will identify specific areas of research where a greater understanding of the learning process through interactive TV is still needed. Involving the key players in this decision process will ensure that the research that is carried out will be of value to them and will also be state of the art research not already covered by the industry.
7. Areas of research may be:
 - i. Gaining better understanding of the various approaches for utilising interactive TV learning services where there is a need for a high impact with a mass audience.
 - ii. Further market research into the types of interactive TV learning services that home users really want and their effectiveness over traditional education and training systems.
 - iii. To create a body of research into good design practice of user interfaces, for interactive learning services, from a pedagogical perspective.
 - iv. As the market starts to develop, to conduct research, which gains a better understanding of the costs of utilising interactive TV, compared to other online services for learning purposes.
 - v. A feasibility study into the potential usage of very low-cost devices linked to an ordinary TV set and an existing telephone line utilising ADSL technology to access local learning resources via an Intranet. This must include the ability of people with computers to also access the same resources.
 - vi. Exploring the potential of local or regional educational institutions utilising local digital cable networks for interactive TV learning services.
 - vii. Exploring the potential of utilising interactive TV for tackling national or regional skills shortages and basic skills deficiencies in an informal and entertaining way.
8. Other activities undertaken by the Forum should be:
 - i. Monitoring developments towards interoperability of set-top boxes and identifying whether there are any factors concerning the development of interactive TV learning services.
 - ii. Addressing standardisation issues with particular reference to adopting a standard encoding system or enabling learning resources and interactive components to be easily moved onto a number of different platforms and delivery systems.

Contents

EXECUTIVE SUMMARY	I
CHAPTER 1 INTRODUCTION.....	15
1.1 PURPOSE OF THE STUDY	15
1.2 OVERVIEW OF DEVELOPMENTS OF DIGITAL BROADCASTING SERVICES	15
1.3 IMPLICATIONS FOR EDUCATION AND TRAINING PROVIDERS	16
CHAPTER 2 DIGITAL SATELLITE, TERRESTRIAL AND CABLE BROADCASTING TECHNOLOGIES – THE STATE OF THE ART	19
2.1 DATA BROADCASTING	19
2.2 DIGITAL RADIO.....	19
2.3 DIGITAL TV	20
2.4 OTHER COMPETITIVE TECHNOLOGIES	34
2.5 KEY PLAYERS	35
CHAPTER 3 COUNTRY BY COUNTRY STATUS REPORT OF THE STATE OF DEVELOPMENTS IN EUROPE AND OTHER PARTS OF THE WORLD	39
3.1 DEVELOPMENTS IN EUROPE	39
3.2 OUTSIDE EUROPE.....	60
3.2 COMPARISONS BETWEEN EUROPE AND THE REST OF THE WORLD.....	66
CHAPTER 4 CASE STUDIES OF DIGITAL BROADCASTING LEARNING SERVICES	67
4.1 TRADITIONAL EDUCATIONAL CHANNELS WHICH ENHANCE THEIR SERVICES.....	67
4.2 DATA BROADCASTING SERVICES.....	70
4.3 NEW INTERACTIVE TV SERVICES	72
CHAPTER 5 UNDERSTANDING THE DEVELOPMENT OF THE MARKET FOR INTERACTIVE SERVICES TO THE HOME	79
5.1 SOME TRENDS AND OBSERVATIONS.....	79
CHAPTER 6 IMPLICATIONS FOR EDUCATION AND TRAINING	89
6.1 INTRODUCTION.....	89
6.2 DEMAND FOR INTERACTIVE LEARNING SERVICES	89
6.3 NATURE OF EDUCATION AND TRAINING PROVISION.....	90
6.4 AN ANALYSIS OF SERVICE PROVIDERS INVOLVED OR LIKELY TO BE INVOLVED IN OFFERING DIGITAL BROADCASTING LEARNING SERVICES	92
6.5 ASSESSMENT OF THE IMPACT THAT DIGITAL BROADCASTING SYSTEMS ARE LIKELY TO HAVE ON EDUCATION AND TRAINING, IN TERMS OF TRADITIONAL AND INNOVATIVE SERVICES	96
6.6 AN ANALYSIS OF THE DIFFERENT WAYS OF PAYING FOR EDUCATION AND TRAINING DIGITAL BROADCASTING SERVICES	98
CHAPTER 7 OVERALL CONCLUSIONS AND RECOMMENDATIONS.....	101
7.1 CONCLUSIONS.....	101
7.2 RECOMMENDATIONS.....	104
APPENDIX A DATABASE OF ORGANISATIONS ACTIVE OR PLANNING TO BE INVOLVED IN OFFERING LEARNING SERVICES THROUGH DIGITAL BROADCASTING	107
APPENDIX B DATABASE OF EUROPEAN ORGANISATIONS INVOLVED IN DIGITAL BROADCASTING SERVICES THAT ARE RELEVANT TO THE PROVISION OF INTERACTIVE LEARNING SERVICES.....	109

APPENDIX C SURVEY OF FUTURE INTERACTIVE TV LEARNING SERVICES SCENARIOS.....	115
APPENDIX D CONSENSUS REACHING WORKSHOP	127

Chapter 1

Introduction

1.1 Purpose of the study

This study looks at the development of satellite, terrestrial and cable digital broadcasting systems and services and the implications that this has for education and training. It focuses on developments within Europe but also considers developments in other parts of the world.

A major focus of this study is on the potential for interactive learning services to the home via digital television (TV) using consumer or low-cost receivers. However, it is also possible using the same or similar equipment to receive interactive learning services to the office or a learning institution. This study does not deal with digital broadcasting technologies that require more expensive equipment to be available in institutions and companies. Therefore, the types of services that are available to the home or the office via consumer devices are likely to be of the same types.

Issues that are addressed by this study include:

- Technologies
- Services
- Key Players
- Implications for Learning
- Accessibility
- Regional differences
- Barriers to development
- Regional versus European developments
- Competitive and Future Developments

1.2 Overview of Developments of Digital Broadcasting Services

Up until a few years ago most radio and television broadcasts made use of analogue technologies. This has now changed and there are now over 1000 TV channels accessible to homes in Europe via satellite using digital technologies. Using suitable equipment it is also possible to broadcast data via satellite directly to a computer in the home. In addition, it is increasingly possible for digital broadcasts to be sent via cable networks and also in a digital format “over the air” - terrestrial broadcasting using an existing aerial that was used for receiving analogue broadcasts.

In order to receive digital broadcasts, the home user has to have a suitable device - known as a set-top box - for receiving and converting the digital signal into a suitable format for using with an existing TV set. This is in addition to the equipment needed to receive the signal - whether it is via satellite, cable or terrestrial means.

Receiving a digital broadcast means that the quality of sound and picture is improved. It also means that the broadcaster can transmit more programmes over the same amount of bandwidth than it can do for analogue broadcasts. For the broadcaster this means it is cheaper to broadcast each channel and more channels can be offered to the consumer giving them a wider variety of choice. This has been a major advantage for

the commercial broadcasters who charge a subscription for a bouquet of channels and can also charge extra for additional premium channels on a pay-per-view basis. With extra channels available they can also stagger the start of films enabling people to have some choice as to what time they wish to watch a film.

The most rapid developments of digital broadcasting have been via satellite. However, in some countries - the United Kingdom and Sweden in particular - terrestrial digital broadcasting has started. The driving forces for these developments have tended to be national governments who:

- are keen to encourage competition amongst broadcasters
- want to stimulate the development of the Information Society
- are able to gain extra revenue from selling off bandwidth.

The more rapid the conversion from analogue to digital, the more bandwidth is available for digital services.

At the end of 1997 no more than 50% of European homes passed by cable (but not necessarily connected) had been digitised.² However, competition is now also driving the cable companies to offer digital services. For older cable networks this involves considerable expense for upgrading - but this also means that they can both offer telephony and also meet demand for high-speed access to the Internet.

Digital broadcasting is in effect the broadcasting of data in a variety of multiple media formats - video, sound, text and graphics - in a similar way that a computer receives data when it is connected to an online service. For households with digital cable networks it is possible to request information from the broadcaster via the cable network's "return channel". This is also possible for satellite and terrestrial broadcasting by using a normal telephone line connected to the set-top box containing an internal modem. Thus it is then possible to offer so-called interactive services, changing the TV from a passive viewing device to an active device which can receive information requested by the viewer.

1.3 Implications for Education and Training Providers

As Europe along with the rest of the world is moving into an era of lifelong learning a key issue for those offering learning services is to find the most effective way of reaching their target audiences. It is also in the interest of many governments to make learning more widely available and accessible to their citizens. Access to knowledge and learning is now seen as a means of enabling a region to remain competitive in what is now becoming a global economy. The reskilling and upskilling of large numbers of people is now being considered as being critically important in particular for those who may not have had any education or training since leaving school.

The traditional providers of education and training are failing to satisfy all these needs particularly when there is an increasing demand for access to learning at any time and any place. Flexible and distance learning methods are being seen as one way of meeting some of these needs, particularly with the use of new technologies. The use of the Internet with the World Wide Web is starting to become a useful way of

² "Development of DTV in Europe Reference Report/ 1998" Draft IDATE December 1998

providing learning services including the opportunities for interactivity. TV and radio broadcasting has for many years been a very appropriate means of providing knowledge and specific learning experiences ranging from university level to primary school level, from basic skills to vocational courses for small businesses. However, the availability of such specific programmes does vary across Europe. In addition, increasingly “specific learning” programmes have been broadcast during unsocial hours requiring the viewer to record the programme and view at their “convenience”.

Digital broadcasting technologies have the potential to offer new ways of providing learning experiences to the home as well as the office. More digital channels can be broadcast than was possible with analogue channels. Potentially the programmes could be cheaper to produce and broadcast. Interactive services of various types are possible. Interactivity is seen to be of particular importance in the process of learning. The combination of these two factors means that learning through a TV set could be made more accessible and interesting and has the potential to reach most households in Europe who are already used to watching a TV.

Interactive digital broadcasting learning services do have the potential of reaching millions of people in their own home or office whenever they have a need for such services - and possibly in a cost-effective way. However, there are still a large number of issues that need to be addressed before such services could become widely available. This report explores the possibilities of what might become a reality in the near future. It also explores the implications of developments of other competitive technologies that are beginning to emerge to offer high-speed delivery of information to the home. In addition it looks at current ways that data broadcasting can also provide multimedia learning resources.

Chapter 2

Digital Satellite, Terrestrial and Cable Broadcasting Technologies – the State of the Art

It is possible to divide digital broadcasting technology into three types according to how it is utilised:

- Data Broadcasting
- Digital Radio
- Digital TV

They are all delivered in the same way as digital data as distinct from an analogue signal. They can also be broadcast via satellite, cable and terrestrial means. However, the method of receiving this signal will vary.

2.1 Data Broadcasting

Generally, data broadcasting involves the delivery of multimedia content directly to a computer. This involves installing a specific data card into the computer for receiving the data and converting it into a format that can be utilised by the computer. As most commercial data broadcasting services deliver via satellite this data card will need to be connected to a satellite dish. Requests for specific data are via the “return path”, currently involving a modem connected to a computer generally via a normal telephone line. However, a new generation of two-way satellite links using 90-cm dishes is planned to be available towards the end of 1999. It will also be possible for higher-speed return channel links to be available via cable modems if connected to cable networks.

Various European satellite operators including Astra, Eutelsat and Hispasat have implemented satellite data broadcasting networks (DBNs). The wide area coverage of a single satellite footprint and the possible bit rates of more than 30 Mbit/sec per transponder could enable a typical CD-ROM to be transmitted to a whole continent in under three minutes. With more than 16 million PCs bought in Europe in 1996, and more than 30 million households having direct access to satellite transmissions, the potential for utilising this technology is huge. A number of commercial services are now available across Europe. However, they have tended not to focus towards the home market at present. This report does include a number of examples of educational use to schools (See Chapter 4)

2.2 Digital Radio

There are a number of broadcasters broadcasting in a digital radio format in various countries of Europe including the UK and Germany. However, currently the main obstacle to this development is the high cost of radio receivers (about 700 euro). It is also possible to plug in a data card into a computer to receive digital radio. Digital radio not only offers high quality sound particularly when on the move but it can also offer some limited multimedia.

This study did investigate the potential for utilising digital radio for education and training purposes but it was difficult to see any unique opportunities which were not

already becoming available via digital TV or via the Internet. The multimedia component of digital radio is very limited due to the limited bandwidth. Better multimedia content is already accessible via the Internet. There is the potential for broadcasting learning resources in the form of data to a local community via a local radio station, but this could be done without digital radio. Digital radio is in fact just the broadcasting of data.

The transmission of data through local terrestrial transmitters in a similar way that local radio is broadcast does offer some interesting opportunities for education and training and should be investigated further once digital radio starts to take off. Predictions are that this will not be until 2003 when digital radio receivers start to be installed in cars, thus bringing down the cost of the receivers and encouraging more listeners. In turn this will encourage more radio stations to broadcast in a digital format and will enable a better assessment of what bandwidth could be utilised for localised terrestrial data broadcasting.

Due to its limited opportunities for education and training the study did not investigate digital radio any further. However, it is noted that many radio stations also broadcast using streaming audio via the web and this is increasing world-wide access to many local radio stations previously unheard of outside their local areas. Low cost access to learning programmes via the web does offer a lot of potential.

2.3 Digital TV

Digital TV is seen as offering the biggest potential for education and training purposes as most European households already have a television and digital TV broadcasting is already widespread across Europe particularly via satellite. It is also starting to be broadcast via cable and also via terrestrial means. However, the latest figures available indicate that only about 2.2%³ of EU TV households were accessing digital TV services in mid 1998.

Set-top Box

For all delivery mechanisms a digital set-top box has to be connected between a normal TV and the incoming signal. The set-top box serves a number of purposes:

- It converts the digital signal into a format that can be viewed on the TV.
- It usually provides the means by which only registered users can access the digital broadcasts - this is known as conditional access.
- It also contains the software to enable the utilisation of interactive services.
- The box may also have an internal modem that can be connected to a telephone line, both for the “return path” for interactive services and for sending user statistics back to the service operator.
- There is also currently limited memory in the box for holding updated versions of the electronic programme guide and other data that might be downloaded into the box. Later generations of set-top boxes are likely to have considerably more memory.

³ Information provided by Gilles Fontaine, IDATE, 25 May 1999

According to a Datamonitor⁴ report, the installed base of digital set-top boxes in Europe will grow rapidly from 1997 to 2003, enabling consumers to receive interactive services via their television sets, not just their PCs. The report predicts that in 2003 there will be 29 million digital set-top boxes in Europe enabled with a modem for interactive services. Modems are fast becoming standard in digital set-top boxes in Europe, already extending the reach of interactive services beyond the PC user base. The number of set-top boxes enabled with a modem for interactive services will increase from 1 million in 1997 to 29 million in 2003, in Europe. The majority of the installed base of set-top box modems will be PSTN ones, used by satellite and terrestrial operators. First-generation digital cable set-top boxes are also using PSTN modems, although in the long term many cable operators will change to use cable modems to make use of upgraded networks. It is predicted that not all of the homes with modems in their set-top boxes will enable them by plugging them into a telephone socket. However, this may change if set-top boxes are configured to work only if they are connected to a telephone line.

There is no standard specification for a set-top box as this is determined by the service broadcaster, who may sell, rent or give away the set-top box when a household subscribes to a particular service. Set-top boxes for receiving “free-to-air” satellite broadcasts can also be purchased independently, but they can cost twice the amount than those provided by the service broadcaster, as they would not be subsidised.

There are many different types of set-top boxes available across Europe. They vary according to two particular features:

- Conditional access system
- Application Programme Interface software (API)

Conditional access

Conditional access is the method by which the service broadcaster can control access to the bouquet of channels that are subscribed to by the viewer. When a viewer subscribes to a service they are usually provided with a smartcard that is inserted into the set-top box. It is also a useful way of controlling which regions of Europe are allowed access to particular programmes, allowing fees for intellectual property rights to be more finely tuned, thus perhaps reducing costs. The table (Figure 2.1) below lists the different types of systems available.

⁴ “Set-top box markets in Europe and the US: profit opportunities in digital TV”, Datamonitor Report January 1999 - taken from press release “Digital television will bring interactive services to television across Europe”, 11 January 1999

Figure 2.1 Conditional access systems in Europe

Systems	Designers
Viaccess	France Télécom
Mediaguard	Seca
nd	Beta-Research-Irdeto
Nagravision	Kudelski
Videoguard	News Data System
Digicipher II	General Instrument
Conax CAS3	Conax Telenor

Source IDATE⁵

It is debatable as to whether the number of different conditional access systems causes problems or not. For the minority of households with more expensive steerable satellite dishes and receivers who wish to subscribe to more than one bouquet of offerings, across a range of satellites, different conditional access systems can cause difficulties. But for majority of households it is not a problem, as they will tend to only subscribe to one bouquet of offerings delivered via satellite, cable or digital terrestrial. If they decided to subscribe to more than one bouquet of offerings via different delivery systems they would still need a different type of set-top box.

Where more than one bouquet of offerings is available via the same platform, e.g. satellite, simulcrypt agreements have usually been reached allowing set-top boxes with different methods of conditional access to receive both bouquets of offerings. However, there is one notable exception - Canal Satellite and TPS in France - where no agreement has been reached for various commercial reasons. In countries where a number of bouquets of offerings are available, the operators have also tended to broadcast from the same satellite making it unnecessary to require a steerable dish.

Simulcrypt allows different decoders with different conditional access methods to decode different bouquets of channels from different service providers if the appropriate smartcard is present. However, this adds complexity to the service provider's equipment, as they will have to send more than one type of decoding signal. But it does allow the use of existing receivers without modification.

Another method is multicrypt transmissions that allow two different encryption systems to co-exist in the same receiver. The signal is sent sequentially through different conditional access modules that are in the set-top box. If the appropriate smartcard is present the viewer will be able to receive that bouquet of programmes. However, set-top boxes that are capable of using a number of different conditional access systems tend to be more expensive.

For the mass market most set-top boxes are generally rented or free to households who subscribe to a specific service operator but they are sometimes only capable of using the conditional access system of the service provider. This is a "trade off" for getting a cheaper but a proprietary set-top box. However, it does have an important impact of increasing the overall number of subscribers to digital services that could eventually reduce costs for both the subscriber and the service operator.

⁵ "Development of digital TV in Europe: Reference report/ 1998", IDATE Draft December 1998

There have been early fears that proprietary set-top boxes with their own conditional access would cause restricted access to digital TV offerings. However these fears do not appear to have materialised⁶. Market forces are likely to drive service operators to sort out any interoperability problems as they are more likely to have to bear the cost of replacing future generations of set-top boxes at no cost to the household. Future generations of set-top boxes will provide the more advanced interactive services that will become available.

Broadcasters also have the option of transmitting their channels on more than one platform depending on their target audience. Public service broadcasters will tend to offer their channels on a number of different delivery systems. For example, BBC Knowledge is available via satellite and terrestrial digital. Commercial operators would have to make a commercial decision as to whether they would offer an educational service on a number of different platforms.

It should also be noted that the vast majority of learning services are regional or national, but rarely, Trans-European in nature. The exception is specialised professional services that would be of high value thus the cost of buying any additional receiving equipment would be very small compared to the overall cost of the learning service. Therefore, any organisation wishing to offer a digital TV learning service for the mass market in the future needs use service operators who reach the majority of households they wish to target even though it may involve a number of different platforms. The costs of conditional access are already being born by each service operator.

Application Programme Interface

The application programme interface (API) is essentially the software operating system for the set-top box - in particular it controls the types of interactivity that are possible. A number of different systems are available in Europe as detailed in the table (Figure 2.2) below:

Figure 2.2 API systems in Europe

Systems	Designers
Open TV	Thomson Multimédia
Mediahighway	Seca
Sun Chorus	Sun Microsystem
Power TV	Scientific Atlanta
DTV Navigator	Network Computer Inc.

Source IDATE⁷

Two APIs currently dominate the European market: Mediahighway, developed by Canal+, and OpenTV. These are proprietary systems that are not interoperable with each other or the Internet. Mediahighway has rolled out on the back of Canal+'s dominant digital pay-television services in France, Spain, Italy, Belgium, the Netherlands and Scandinavia. In contrast, OpenTV⁸ has been adopted by British Sky Broadcasting and Open in the United Kingdom; Television Par Satellite, France

⁶ "Development of digital TV in Europe, Reference report/ 1998" P69 Draft December 1998 IDATE

⁷ "Development of digital TV in Europe: Reference report/ 1998", IDATE Draft December 1998

⁸ OpenTv Web site: <http://www.opentv.com>

Telecom Cable and Lyonnaise Cable in France; Telia in Sweden; TeleDanmark Kabel in Denmark; ViaDigital/Telefonica in Spain; Stream in Italy; and Multichoice in Greece, South Africa and the Middle East.

These designs of set-top box are being joined by new entrants including PowerTV from Scientific Atlanta and Navigator from NCI which are making modest progress in the cable sector. Microsoft also has aspirations to have its Windows CE operating system incorporated within a range of set-top boxes. There is also the MHEG5 design that is being developed under the auspices of MHEG - the Multimedia and Hypermedia Experts Group. Some broadcasters appear to be interested in using MHEG5 but most of the industry appears to want to move towards a Java- based standard.

The various APIs for set-top boxes are generally not an issue for a particular home user, as each tends to subscribe to only one service. However, the current set-top box installed base across Europe is fragmented between the different APIs - and these have differing levels of interoperability. Potential interactive television content providers are likely to be deterred from producing services if they have to develop them for a number of different software platforms even within one national market.

This is a very important issue for those planning to develop interactive learning services. They will be keen to offer their services through as many platforms as their target audience will use. This would result in additional costs and as new generations of set-up boxes become available there may also be additional costs for repurposing older courseware.

However, it is believed that the industry is aware of this particular problem and is starting to address it. It is likely that the differing APIs will migrate towards interoperability in line with the path set out by the Digital Video Broadcasting Group⁹ (DVB) Multimedia Home Platform (MHP) standard, which appears to be moving towards a Java-based standard. This will include Internet standards, making different APIs compatible with each other and the Internet. Software interoperability will lead to increased development of interactive services on digital television platforms.

Recommendation

The development towards interoperability needs to be monitored carefully. If there are signs that lack of interoperability is acting as a deterrent to the development of interactive services, then some sort of intervention may be needed by the European Commission.

Digital Satellite

For those households receiving digital satellite broadcasts, a satellite dish is also required. This could be a fixed dish pointing to the appropriate satellite transmitting the digital broadcasts they want to receive. Alternatively, it could be a steerable dish - however, some satellite broadcasters claim that if the dish is not permanently pointing to their satellite, software upgrades to the set-top box may not be possible. The satellite towards which the dish needs to point varies from country to country. For example in Italy the two commercial digital satellite broadcasters Stream and Telepiù

⁹ DVB web site: <http://www.dvb.org>

plus the public service operator RAI all use Eutelsat's Hot Bird II satellite. As a contrast, in the United Kingdom Sky Digital and the BBC use one of the Astra satellites.

Digital Cable

Digital TV broadcasts via cable are only possible if the house is in a area that can be connected to a cable network which is broadcasting in a digital format. The cable operator would usually provide the set-top box and would also make a simple connection to the cable network.

Most of the newer cable systems installed in Europe during the 1990s do transmit digital signals - for example, most cable networks established in the United Kingdom and Italy. However, some older cable systems available across most other parts of Europe may only currently be capable of transmitting analogue signals. Note that recently it has become possible to upgrade older cable systems to receive digital signals through a technique known as Hybrid Fibre Coax (HFC) as is happening in parts of Belgium and The Netherlands - but it must be noted that the main reason for upgrading the cable network from analogue to digital is to provide the home user with telephony and high-speed access to the Internet.

With the support of the European Cable Communications Association (ECCA),¹⁰ a number of cable operators from across Europe have developed the Eurobox Platform.¹¹ This concept is based on a common set-top box and a common API and Conditional access method. The box specification is used as a reference model by the cable industry and manufacturers. Viaccess has been selected as the conditional access system, whereas Open TV is the selected API, Application Programme Interface. The Eurobox Platform has been successfully implemented in France, Sweden and Denmark and is due to be implemented in the Netherlands during 1999. However, some cable operators, notably in the UK, do not appear to be following this platform in its entirety.

Digital Terrestrial

It is only possible to receive terrestrial digital signals to the home in the United Kingdom and Sweden at present - although other countries in Europe, notably Denmark and Spain, will soon start transmitting signals. These systems use an existing aerial, which has to be connected to the set-top box. The set-top box may be also connected to a telephone line to provide a return channel for interactive services.

In the USA the transition from analogue to digital TV is linked with the move from Standard Definition TV (SDTV) to High Definition TV (HDTV). This started in late 1998, with SDTV and HDTV being broadcast simultaneously. It is planned that all major cities will have terrestrial digital broadcasting by 2000 and by 2006 all stations are scheduled to be running all-digital services.

Field trials have also started in Japan and Singapore has started experiments this year.

¹⁰ ECCA Web Site: <http://www.ecca.be>

¹¹ Web site for further details: <http://www.ecca.be/eurobox/eurobox.htm>

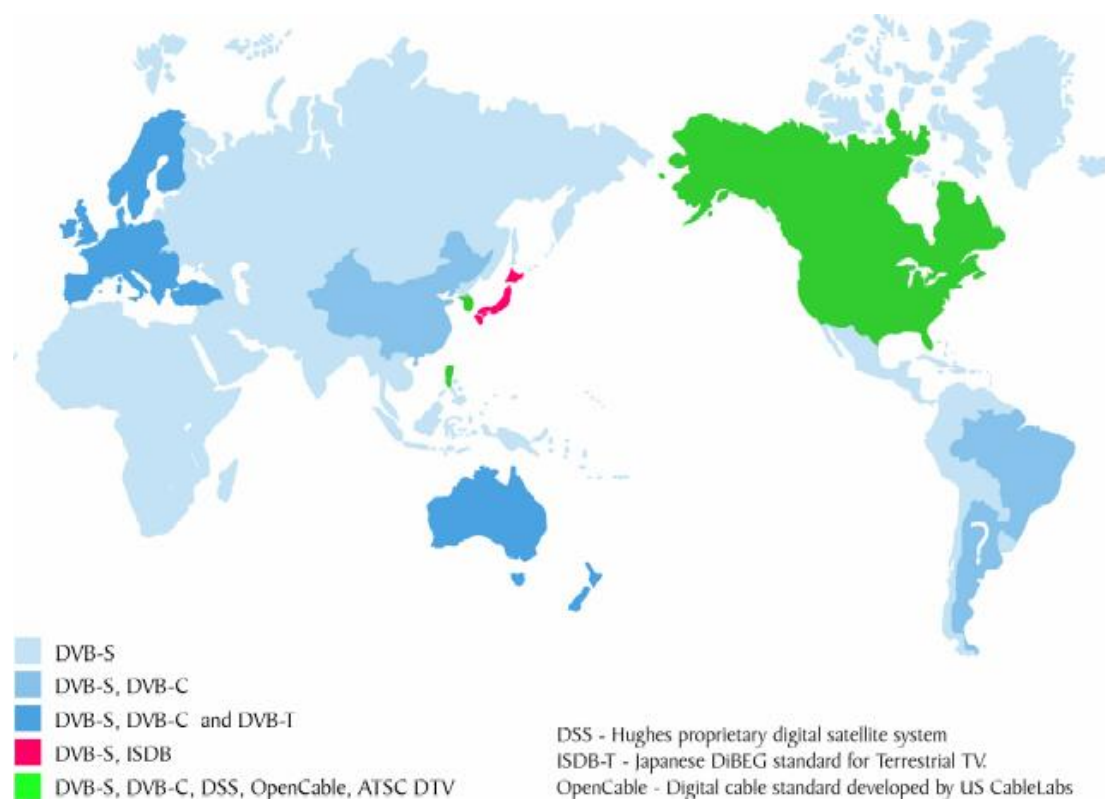
Standardisation issues

Digital Broadcasting offers the potential for having more channels using SDTV - multi-channel Standard Definition TV - and/or for improving the resolution of pictures through HDTV - High Definition TV, using for pictures the global MPEG-2 digital compression standard. Unfortunately there is currently no global sound coding systems standard, resulting in a number of different digital television standards emerging from Europe, Japan and North America

Europe plus several other areas of the world have chosen to adopt the DVB - Digital Video Broadcasting - standard. This is available in a number of compatible versions: including DVB-S - for satellite transmission, the de facto global standard; DVB-C - its cable equivalent; and DVB-T - Europe's chosen digital terrestrial broadcasting system with services which started in the later part of 1998. The digital SMATV (Satellite Master Antenna TV) version - DVB-CS - has been adapted from DVB-C and DVB-S to serve community antenna installations such as for blocks of flats. Singapore has been conducting experiments with DVB-T and Australia has plans to adopt this standard.

The data-broadcasting version of the standard - DVB-Data - allows a wide variety of different, fully interoperable data services to be implemented. DVB-S satellite transmission of data is much faster than traditional telecommunication methods.

Figure 2.3 World-wide adoption of DTV standards, September 1998¹²



¹² Source: 'World DTV Adoption' [online], September 1998, available at

http://www.dvb.org/dvb_framer.htm

Please note that Argentina has meanwhile adopted ATSC as standard for digital terrestrial TV.

Standards used in other parts of the world include:

- DSS - the proprietary digital satellite standard developed by Hughes, used by their DirecTV service in the United States and Japan.
- ISDB - the variant of the DVB-T system developed by the Japanese Digital Broadcasting Experts Group (DiBEG). It differs in one key respect only, the use of an intermediate (software-driven) data segmentation system, whereby services such as radio, SDTV, HDTV and Mobile TV can be flexibly allocated pieces of the overall service bandwidth. The Japanese ISDB system is anticipated to launch in Japan no earlier than 2003.
 - CableLabs - also known as OpenCable - the digital cable system developed in the US by the CableLabs project.
 - ATSC - also known as DTV - the US Digital Terrestrial Broadcasting System, developed by the so-called "Grand Alliance".

Although both the ATSC DTV and the DVB-T systems use MPEG-2, they are different in a number of respects.¹³

There is no interoperability between the CableLabs and ATSC and DSS standards, in other words MPEG-2 streams must be decoded and re-coded for jumps from one of these systems into another. Europe therefore has the key advantage of the interoperability that is featured as standard on all DVB systems for any delivery medium.¹⁴

Integrated TV Sets

An alternative to the separate set-top box is currently an expensive integrated TV set that incorporates the set-top box. This integrated TV will also be a high definition TV (HDTV) in a 16:9 format - "pillar-box" - making it possible to view pictures in a wider format which is more natural for the eye, when that format is broadcast. However not all HDTV sets sold in Europe have integrated set-top boxes, because the 16:9 format has been broadcast in some countries over an analogue signal. However, in the USA HDTV sets were not introduced until the end of 1998 and do have integrated set-top boxes.

A number of manufacturers are now offering or preparing to launch Integrated Digital TV (IDTV) in the US or European markets, including Mitsubishi, Philips, Panasonic and Sony. So far, sales have been measured in thousands, while sales of digital set-top boxes last year reached over 8 million units.

¹³ RF Modulation: ATSC uses the single carrier 8-VSB modulation technology where DVB-T uses the multiple-carrier COFDM system. MobileTV using the 8-VSB system is impossible, and set-top antenna reception highly problematic. DVB-T is not only capable of both applications, but supports HDTV just as well as the US standard does.

Audio: The surround-sound audio system used by ATSC is the proprietary Dolby AC3 system, which offers no performance advantages over the DVB MPEG Layer II Audio system, which has the advantage of being an open standard.

Service Information: The ATSC system also makes use of a unique Service Information system, making interoperability between ATSC and DVB-T as infeasible as interoperability between ATSC and US cable and satellite standards.

¹⁴ European Public Policy for Digital Television, University of Hull, December 1998

However, there appear to be a mismatch in the consumer replacement rates for a TV, which typically is 10-15 years, compared to a set-top box, which is likely to have a 3-5 year time span as it is based on computer technology. This appears to be backed up by a report from Strategy Analytics which forecasts that by 2005, only 6% of US households will own an IDTV set compared to 63% with digital set-top boxes. In Europe, IDTV will hardly gain a foothold.¹⁵ The report considers that regular upgrades in technology and services, such as new software, devices and modems, mean that buyers of IDTV sets may be left with expensive but obsolete products. They consider a more prudent option is to buy a set-top box that can be replaced at minimal cost when upgraded services arrive. Service providers need to build audiences quickly, without waiting for consumers to replace their old TV sets, and are therefore likely to encourage sales of set-top boxes.

Development of Interactive TV

Television is considered¹⁶ central to most people's domestic life and to their cultural, social, political and consumer awareness for billions of people throughout the world. "Television is everyday life."¹⁷ But it has been primarily a medium that is passively viewed when the broadcaster wishes to make the programmes available. However, the videotape recorder has enabled viewers to record programmes and watch them when they wish to do so.

There have been many attempts over the years to develop interactive television.¹⁸ There were some attempts of interactivity during the 1970s with systems such as QUBE but they appeared to fail to offer a sufficient return on capital.¹⁹ The development of videotext or teletext services enabled viewers to have some form of interaction by choosing what information they wish to see. Although it is claimed by Teletext in the UK that 50% of TV viewers are also teletext users, some people have been put off by the poorer graphics, compared to what is on offer through the web. The development of digital teletext with its better quality graphics may redress this imbalance.

During the early to mid 1990s, the term "interactive TV" has been used to describe feedback from the viewers during live TV programmes notably those of an educational nature. These have tended to be pilot projects partially funded by the European Space Agency or the European Commission. Interactivity has been in the form of email, telephone calls or video link-ups via ISDN to presenters in the studio. It is commonly believed that Europeans have tended to see learning as primarily an interactive process. This is in contrast to viewers of educational programmes in the

¹⁵ "Set-top boxes and dumb monitors -- The impact of IDTV on the TV receiver industry", Strategy Analytics - taken from press release "Set-top boxes will dominate the home", 8 March 1999

¹⁶ Stewart, James. "Interactive television at home: Television meets the Internet - A new innovation environment for interactive television", Research Centre for Social Sciences, University of Edinburgh, United Kingdom, August 1998.

¹⁷ Silverstone, R. (1994). "Television is everyday life", London, Routledge.

¹⁸ Carey, J. (1996). "An Ethnographic Study of Interactive Television. ITV 96, Edinburgh unpublished and Carey, J. (1996). "Winky Dink to Stargazer: Five Decades of Interactive Television", I-TV'98: The Superhighway through the home?, University of Edinburgh. Both cited Stewart, James (1998).

¹⁹ Stewart, James, "Interactive television at home: Television meets the Internet - A new innovation environment for interactive television", Research Centre for Social Sciences, University of Edinburgh, United Kingdom, August 1998.

USA, and to viewers of distance learning programmes from open universities, who have found the “talking head” approach of a lecturer quite acceptable.

Unfortunately, those offering live interactive learning programmes have yet to show that they can produce sustainable services, particularly for home users. The number of interactions that are possible during a live TV programme is no more than, and perhaps less than, what can be offered during a face to face learning situation. However, the techniques utilised do offer the remote learner the potential ability to interact with the experts. Despite there being many experiments in this area a formula still has to be found as to what is the most appropriate learning experience for utilising these techniques in a sustainable way. The use of cheaper bandwidth through digital broadcasting is claimed to offer new possibilities but the case still has to be proven.

The mid 1990s have seen many expensive proprietary interactive television projects which it is claimed²⁰ “were set up, or at least publicised, by technology and network companies anxious to realise long standing science fiction dreams, bolster share prices and generate new revenue streams”. Although many of these projects failed, they gave birth to huge numbers of other spin-off business opportunities that are only now starting to become commercially available. For example, video-on-demand services through existing telephone lines to the home have been proven to be uneconomic due to the lack of demand for the limited number of videos that could be offered. But it has been realised that the same underlying technology - xDSL - could be used to provide users with higher speed access to the Internet - an area where there is a pent-up demand. In fact this development could run in parallel and is very likely to compete with the next stage in the development of interactive TV.

Internet access via TV set

The late 1990s have seen developments towards accessing the web via the TV set, either using a set-top box or using a dedicated terminal. Although currently using an analogue set-top box, NTL²¹ in the UK provide access to the Internet and other interactive services. NTL are currently testing the technology and market before they move to a digital platform.

A number of manufacturers have developed and are planning to market a device that provides access to the Internet directly via an ordinary television set. Connection is usually through a SCART socket on the TV set and also to an existing telephone line. The main thrust has initially been through WebTV²² from Microsoft - still at a pilot stage in Europe but widely used in the US -with over 800,000 subscribers. But also from those that can provide a terminal, like the NetBox in France and Slipstream²³ in the UK.

The NetBox has been specially developed to offer Internet access via an ordinary TV set. It is based on software and hardware architecture developed by NetGem²⁴ - a privately-owned company founded in 1996 in Courbevoie, near Paris. It is claimed that the NetBox can be easily adapted to the needs of major telecoms operators,

²⁰ Stewart, James, (August 1998)

²¹ NTL Press Release “NTL launches UK’s first Interactive TV service” 30 March 1999

²² WebTV web site: <http://www.webtv.net/>

²³ Web Site for Slipstream: <http://www.msu.co.uk>

²⁴ NetGem Web Site: <http://www.netgem.com>

retailers, banks and media groups in Europe. In partnership with these corporations, the NetBox is currently being marketed across 15 countries in Europe, in conjunction with Alcatel²⁵ and France Telecom.

Slipstream has been developed by MSU (UK) Ltd²⁶ - based in Milton Keynes, UK. MSU develops consumer electronic products and reference platforms for itself and other companies. The SlipStreamTM Internet access technology enables anyone with a television and regular telephone line to access the Internet and send and receive email. When it is used with MSU's customised, proprietary browser, the device allows users to access and interact with foreign web sites in their native language. The company appears to have reached a deal with a Chinese manufacturer and distributor for production and sales to China and the rest of the world. Although personal computer penetration into Chinese households is low, it appears that China has an installed base of 320 million television sets, and that new television sales average 30 million units per year. Furthermore, an adequate Chinese telephone infrastructure is now in place in all 33 major cities and in most rural areas.²⁷

It remains to be seen how successful these devices will actually be in the European consumer market. A key issue is the quality of the fonts and graphics that can be displayed on an ordinary TV set, which will be of a lower resolution than a computer monitor. (There is much experience from teletext and videotex to build on.) The price of the device will also be critical, as it will need to be significantly lower than a home PC, a device that continues to drop in price. It is possible that these "Internet TV" devices will find a niche market - but a socially important one - for people that cannot afford to buy a home PC, on the basis that such people should be provided access to the opportunities of the Information Society, including learning opportunities.

If these devices are connected up to the telephone line using ADSL, it might be possible to access good quality streaming audio and video consisting of learning materials. If the device has enough memory it should be possible to cache the streaming video and replay it repeatedly. This could lead to opportunities for language learning or basic skills. Another possibility is that the device could be used for accessing resources from a local school or a community learning centre or even a local library via an Intranet. This may overcome some potential problems related to the maximum distance that ADSL can be used over an existing telephone line.

Recommendation

There is a need for a feasibility study into the potential usage of very low-cost devices linked to an ordinary TV set and an existing telephone line utilising ADSL technology to access local learning resources via an Intranet. This study must also consider the ability of people with PCs to access the same resources.

²⁵ Press Release "Alcatel and Netgem partner to provide Internet services on television sets", Paris, 25 March 1999 - found at http://www.alcatel.com/press/current/1999/03_25a.htm

²⁶ The Web site of MSU (UK) Ltd is <http://www.msu.co.uk>

²⁷ Press Release: MSU Corporation "MSU Corporation, an Internet Technology Company, Signs Manufacturing and Distribution contract in China - Agreement Marks MSU's Entry Into Chinese Market", Milton Keynes, England, 6 April, 1999

However, it should be noted, following the recent trial in the UK, it appears that Microsoft may not launch a WebTV service in Europe in the same way as it has done in the US. Although under the title of Microsoft TV it is likely they will primarily focus on client and server software packages working with service and content providers

Digital TV interactivity

With the development of digital TV, interactivity is now being understood to mean enabling millions of TV viewers to interact with programmes and services. The focus of this study is on this form of interactivity. Interactivity can be divided into two types:

- Enhanced TV
- Interactive Services

The method of accessing interactive services is through the remote controller or a remote keyboard sending an infrared signal to the set-top box. The set-top box then requests that information is displayed on the TV if it is already stored in the set-top box or from regularly updated data re-broadcast on a carousel basis, or the set-top box may request specific information via the “return” channel through an existing telephone line. This information may come back via the broadcast link or via the telephone line depending on what service is requested. Alternatively, with cable networks the request for data is sent via the cable system which itself is a two-way broadband system if the cable system is an advanced one.

“*Enhanced TV*” means that the viewer can do more than passively watch a TV programme. For example, they could be:

- watching a travel programme and click on an information icon which provides more detail in the form of text and graphics about the location of the activities
- watching a football programme and being able to view the match from a number of different camera angles with a split screen
- competing with studio competitors in a quiz show and having the results displayed at the end of the programme
- placing an order or requesting further information about a product whilst watching an advertisement
- accessing a directory of words or phrases during a language learning programme.

“*Interactive services*” involve accessing information independent of a TV channel. For example, it could mean:

- the electronic programme guide (EPG) which is used to select channels through a menu system and also regularly updated to ensure the programme timing is up to date - with additional information about the programmes

- selecting information from an enhanced teletext²⁸ type service which will display a screen in the form of high-quality graphics, various fonts, pictures, sound and video clips
- answering multiple choice questions and being informed whether the answers are correct or not
- accessing an electronic encyclopaedia requesting information about a particular topic.
- using an online banking service
- sending and receiving electronic mail
- on-line shopping
- booking airline tickets or other services
- accessing the World Wide Web
- video-on-demand services
- interactive games.

Many of these services are also becoming available via the web. In fact interactivity through the TV and through the web are bumping alongside each other on an imaginary racecourse. But the finish to the race is not clear and the convergence of the technologies over time may mean they become integrated together before they reach the finishing line.

However, a key point needs to be made when comparing web-based developments with those of interactive TV. The web has evolved with end users having a lot of control over the content and what they want to select. They can also easily publish material themselves. Interactive services via the TV will develop in a more traditional manner, just like TV programming, where end users have not been involved in the innovation process and have not been able to express their interest in interactive services or systems through purchasing and use in the home.²⁹ The impact of this on new interactive services has yet to be realised and will be a key factor on whether they will be able to compete with web-based services.

While many companies are racing to join the digital TV market, the potential of the technology is too new for standards to be in place for such elements as conditional access and EPG systems. This presents a dilemma for a manufacturer or designer who wants to be in the market, but is wary of starting out with what will become proprietary technologies or processes.³⁰

According to a report from Strategy Analytics³¹ new technologies will let broadcasters offer interactive services which will bring consumers from their PCs back to their TV sets. It says the rapid developments in hard disk drive storage technologies will allow broadcasters to build new revenue streams from value-added interactive services.

²⁸The term “teletext” is often used as a generic name for videotex but there is also a Teletext company involved in the developments of enhanced teletext. Their web site is <http://www.teletext.co.uk>

²⁹ Stewart, James (August 1998)

³⁰ Information from NTL Web Site <http://www.ntl.co.uk/guides/digitaltv/interactive.htm#feedback>

³¹ “Developments in technology set to bring TV audiences back”, report from Strategy Analytics at <http://www.strategy-analytics.com/cis/epm.html>

The report identifies such US-based start-up firms as TiVo³² and Replay Networks³³ as having pioneered these developments, which are now being supported by leading service providers and electronics manufacturers such as DirecTV and Philips. New advanced set-top boxes should start to appear on the market later in 1999, says the report, which also predicts that a high-capacity hard disk will become a regular feature in next-generation set-top boxes, allowing temporary or permanent storage of massive amounts of data, including high-quality video. Broadcasters will offer such services as “virtual VCRs”, video-on-demand, and fast access to interactive information.

Strategy Analytics say the two main strengths of broadcasters in this interactive market of the future are that they:

- control video content
- own distribution channels

The top of the range ReplayTV appliance from Replay Networks consists of two 13.7Gb hard disks capable of holding up to 28 hours of digital-quality video.³⁴ Currently it retails at \$1,499³⁵ but as the cost of memory continues to decrease this price will go down.

Movement towards “Personal TV”

This could lead towards the development of “Personal TV”. Forrester Research³⁶ estimates that by 2004, 14 million Americans will be watching TV on personal video recorder (PVR) enabled sets and that by 2009, PVRs will penetrate four out of five US homes. Personal video recorders are consumer devices that use an intelligent interface and an internal hard drive to digitally record programming in anticipation of viewer demand. They could also be capable of holding 100 hours or more of programmes. With features like instantaneous fast-forward and reverse, the ability to pause live broadcasts, and easy-to-create viewer profiles, PVRs will broaden viewer options by offering, at any given moment, a menu of recorded programmes based on the viewer’s preferences.

WebTV sees that personal television has three stages of evolution:

- A smart video cassette recorder which can seek out and record regular broadcasts - like TiVo and Replay TV do today.
- Virtual channels, where networks create entertainment packages that can be accessed on demand. For example, a broadcaster might decide to create a channel devoted to action movies. If a subscriber wanted that action pack, it would then be automatically downloaded to the disk in their WebTV receiver. And the channel creator could add other information, like Internet links or related merchandise offerings with the download.

³² Web site of TiVo: <http://www.teleworld.com/index.html>

³³ Web site of Replay Networks: <http://www.replaynetworks.com/index.html>

³⁴ Article “VCR-PC hybrid adds up to interactive TV” by Robert Lemos, ZDNN, 17 December 1998

³⁵ Replay Networks press release “Replay Networks, Inc, Launches New Era in Television Personal TV Leader Ships Award-Winning ReplayTV”, 26 April 1999

³⁶ Forrester Research press release “Personal Video Recorders will bring Fundamental changes to Television Networks”, 24 March 1999

- TV on demand,. By about 2005, the run-of-the-mill disk drive will hold as much as one terabyte or a thousand gigabytes. That means you will have the ability to record a thousand hours of digital video. When you have that capability, doesn't it make sense to record the entire broadcast schedule on Sunday night? Then when you sit down to watch TV television, it is no longer an experience of seeing what's on right now, but of choosing what you want to watch right now.

The development of devices that enable a person to customise TV viewing to a person's interest could fundamentally change the way the TV industry has operated over the last 50 years. Forrester expects viewership of TV advertisements to drop nearly 50% over the next decade, forcing advertisers to accommodate to this new environment. This could result in recognised brand names moving away from traditional advertising to increasingly sponsoring thematic channels - including learning channels. Or they could also move to an information mode of advertising where it becomes critical to be "captured" during key word searching through PVRs. This mode would not be dissimilar to web-based advertisements.

2.4 Other competitive technologies

The main competitive technology to interactive TV services is the Internet, and the World Wide Web in particular. A vast amount of information is readily accessible on the web to those that have a computer at home. Although it may not be particularly well structured, search engines and carefully indexed entry points known as portals are starting to make it easier to find specific information. Good quality audio is already available and reasonable quality video can also be accessed on demand. Currently there are limitations on the number of users that can access streaming video and the quality of the video but technical solutions to these problems are becoming available.

ISDN is already available to provide slightly higher speed access to the Internet than available over analogue telephone lines, but it is the developments with ADSL (Asynchronous Digital Subscriber Line) - and related technologies - providing high-speed access over an existing telephone line that will have a significant impact. These technologies will enable full-screen good-quality video and audio to be accessed via the Internet. This will make the Internet a very serious competitor to interactive TV.

Datamonitor expects that in the long term, video- and audio-intensive applications - which are likely to be selected and controlled through a Web interface - will rise considerably. At present, video/audio streaming accounts for 2% of Internet traffic. By 2003 Datamonitor predicts that this will have trebled to 6%.³⁷

Frost & Sullivan have also found that sales of video servers, which distribute video clips over the Internet, nearly doubled in 1998, reaching approximately \$532 million. The rate of growth for such services, according to Frost & Sullivan, will reach 7.4% over the next six years - essentially making video-on-demand a serious competitor to the video cassette rental industry. They also see barriers to entry and to dominance, in particular: bandwidth capabilities, consumers not willing to invest in equipment that

³⁷ "The Future of the Internet", Datamonitor Report March 1999 - taken from Press Release "Online population set to top 250 million in the next five years", 1 March 1999.

can adequately receive such clips, and expensive streaming technology. Current suppliers of this are Microsoft (Windows Media) and Real Networks (Real Player).³⁸

Despite the potential barriers other new players are emerging to deliver video over the Internet. US based Tranz-Send³⁹ has developed a system for delivering DVD-quality films, TV programmes and software as compressed files that can only be used according to the terms stipulated by the copyright owner. The Tranz-Send technology uses software to distribute the files and uses a specialised player device to read the files on a computer or through a set-top box. It uses a proprietary system to compress files at a ratio of from 600:1 up to 1500:1 - compared to MPEG that can compress data at about 50:1. For a film like "Independence Day" it will currently take 150 minutes to download a DVD-quality video over a digital subscriber line and require about 1.4 gigabytes on a hard disk to store it. However it is claimed that the second generation of the technology, due out later in 1999 will take less than 15 minutes to download the file.⁴⁰

2.5 Key Players

The key players⁴¹ in digital broadcasting have been identified as:

- *Content providers* - individuals or organisations with a specific interest in the production and management of content.
- *Distributors* - organisations that hold a licence to broadcast and are legally liable for the content. They have a primary relationship with the consumer. Generally, these organisations will collect advertising revenues and/or subscription fees.
- *Carriers* - organisations that provide broadcasters with the means of transporting their services to the consumer.
- *Hardware suppliers* - who supply equipment residing with the consumer.
- *Software suppliers* - who supply the API (application programme interface) software in the consumers' set-top box that enables interactive services to be deployed.
- *Interactive service software developers* - who develop the interactive service software based on upon which API application is utilised in the set-top box.
- *Management solution providers* - who enable content aggregation, distribution and presentation using interrelated hardware and software solutions for total management.

Some players may take on a number of these roles. Below is a list of key players who have been identified as having roles in providing digital TV learning services.

Content providers

- **Anglia Multimedia, UK** - plan to supply secondary school National Curriculum content to various digital interactive education service providers
- **BBC Education, UK** - provide a digital educational channel BBC Knowledge

³⁸ Interactive TV, April 15, 1999, Issue 1.91

³⁹ Web Site of Tranz-Send: <http://www.tranz-send.com/>

⁴⁰ "Net Video Coming of Age?" by Christopher Jones - article in Wired News, 29 March 1999

⁴¹ Based on some categories identified in the report "Digital Broadcasting: the Competitive Challenge for Telcos and Cable Companies", by John Moroney and Thomas Blonz, Ovum, September 1997

- **Consorzio Nettuno, Italy** - broadcast education channel on RAI but not interactive (See Chapter 4 for more details)
- **Dorling Kindersley, UK** - and educational publishers plan to supply some of their existing paper-based content to digital interactive education service providers
- **Espresso, UK** - supply a data broadcasting learning service for primary schools (See Chapter 4 for more details)
- **Granada Learning, UK** - have an interest in providing an interactive digital educational service
- **Knet, Sweden** - have launched a learning service which will include a digital educational channel (See Chapter 4 for more details)
- **RAI, Italy** - broadcast a digital educational channel (See Chapter 4 for more details)
- **IQTV (SWR), Germany** - plan to launch an interactive digital learning channel (See Chapter 4 for more details)
- **ITL (Stream), Italy** - digital commercial service provider offering an interactive learning service and channel (See Chapter 4 for more details)
- **UR, Swedish Educational Broadcasting Company, Sweden** - broadcast an educational channel (See Chapter 4 for more details)

Distributors

- **BBC, United Kingdom** - public service broadcaster
- **RAI, Italy** - public service broadcaster
- **SWR, Germany** - public service broadcaster
- **Stream, Italy** - digital commercial service provider offering an interactive learning service and channel
- **SVT, Sweden** - public service broadcaster
- **TPS, France** - digital commercial service provider

Carriers

The satellite carriers are:

- **Astra, Luxembourg** - provider of digital satellite services
- **Eutelsat, France** - provider of digital satellite services
- **Hispasat, Spain** - provider of digital satellite services

The terrestrial digital TV carriers are:

- **OnDigital, UK** - provider of digital terrestrial services
- **Teracom, Sweden** - responsible for implementation and control of digital terrestrial services

Cable companies are:

- **NTL, UK** - planning to launch digital educational TV services
- **Cable & Wireless Communications, UK** - planning to launch digital educational TV services
- **Telewest, UK** - planning to launch digital educational TV services

Hardware suppliers

The main digital set-top box and satellite dish manufacturers in Europe are:

- **Amstrad, UK**
- **Galaxis, Germany**
- **Grundig, Germany**
- **Nokia, Norway**
- **Pace, UK**
- **Panasonic, Germany**
- **Pioneer, Japan**
- **Philips, The Netherlands**
- **Sagem, France**
- **Sony, Japan**
- **Thomson, France**
- **Toshiba, Japan**

Software suppliers

- **Mediahighway, France** - supplier of conditional access and application programme interface (API) software
- **OpenTV, France** - supplier of application programme interface (API) software
- **Microsoft, UK** - supplier of client and server software with TVPak.

Interactive service software developers

- **NPTV, France** - software developer of interactive services primarily for Canal plus
- **Two Way TV, UK** - has developed interactive TV software for its analogue cable channel

Management solution providers

- **Fantastic Corporation, Switzerland** - provides proprietary hardware and software solutions for interactive TV services via any delivery channel

Brokers or Agents

- **IQ-TV, Germany** - developing the concept of an interactive learning channel and will act as a broker to co-ordinate programmes through IQ-TV
- **Wales Digital College, Wales** - being established as a trust to develop the Wales digital education channel and interactive services. Will act as a broker for Welsh colleges (See Chapter 4 for more details)
- **EuroPACE 2000, Belgium** - European Association mainly with universities as members

Contact details can be found in Appendix A and B

Chapter 3

Country by country status report of the state of developments in Europe and other parts of the world

This chapter aims to provide an overview of the state of development of digital communications technologies that may be of relevance to education and training. It includes both digital broadcasting technologies and other competitive technologies. It includes both organisations that are running learning services and organisations that are planning services.

3.1 *Developments in Europe*

Another European Commission funded study into the “Development of digital TV in Europe: 1998”, managed by IDATE⁴² provides an in depth country by country status report of the state of development of digital TV. This IDATE study has identified the existing European Union TV market as a "fragmented economy" with "strong national peculiarities". EU countries differ in regard to: -

- Analogue TV reception modes
- Methods of financing the TV sector
- Richness of the analogue TV offering

This has a distinctive impact on the development of digital broadcasting technologies. More detail is given in the IDATE Reports of the types of reception platforms used and the state of the market in each country.

Figure 3.1 Existence of Digital Services (beginning of 1999)

Country	Satellite	Cable	Terrestrial
Austria	x	x	
Belgium	*	x	
Denmark	x	x	
Finland	x		
France	x	x	
Germany	x	x	
Greece			
Ireland	x		
Italy	x	x	
Luxembourg	*		
Netherlands	x		
Portugal	x		
Spain	x	x	
Sweden	x	x	x
United Kingdom	x		x

Updated version of table provided by IDATE

In general, the situation can be summarised in the following table. Note that for digital satellite services, a country is included if either digital satellite services are broadcast

⁴² “Development of digital TV in Europe: Reference report 1998”, IDATE Draft December 1998

from that country or there is an agreement to broadcast over that country from another country. For example, in Luxembourg and Belgium there are no broadcasts but satellite services can be received from neighbouring countries.

This study has attempted to categorise each EU country according to the prospects for the development of interactive TV services, based on the limited information publicly available.

The qualitative analysis has taken the following factors into consideration before deciding the prospect levels for each EU country: -

- The current development of the market for digital TV within the country
- Evidence of interactive learning services developments
- Likely diffusion of the innovation within the country
- Penetration of computers users with access to the Internet (See Chapter 4 for more details)
- The likely deployment of ADSL technologies
- Existing use of TV for distance learning courses

Figure 3.2 Prospects for development of interactive digital TV learning services with EU Countries
(shaded area indicates the level of prospect)

Country	Prospects		
	High	Medium	Low
Austria			x
Belgium			x
Denmark			x
Finland		x	
France		x	
Germany		x	
Greece			x
Ireland		x	
Italy	x		
Luxembourg			x
Netherlands		x	
Portugal			x
Spain		x	
Sweden	x		
United Kingdom	x		

The following country by country overview tries to capture the situation as it stood in spring 1999. However, the situation is changing very rapidly as organisations start to roll out new communication services, sometimes integrated with other offerings, which raise new possibilities for education and training. Where possible, reference is also made to small-scale pilot projects if they have the potential for scaling up into sustainable services.

The countries of Europe are treated in alphabetical order.

Austria

There do not appear to be any plans by any organisations in Austria to offer digital interactive learning broadcasting services. The dominant public service broadcaster ORF (Austrian Broadcasting Corporation) is not currently offering any interactive digital broadcasting services; however, they do have what they claim to be a very successful internet news channel.⁴³ Despite this, they currently do not have any plans for interactive education and training services.⁴⁴ There are no Austrian-originated commercial TV broadcasters, but a large number of German satellite channels are available to households with a satellite dish. This includes digital channels offered by the merged providers DF1 and Premiere.

Of the 3.18 million households in Austria there were about 20,000 subscribers to digital services as of mid 1998. The digital strategy of the public service broadcaster ORF is to digitise the transmission of its existing programmes via satellite and to enter new (interactive) markets in areas other than television, for instance Internet access provision. ORF have launched "TW1" - a weather and satellite channel - as a free digital satellite channel across Europe and as a cable service to Austrian and Swiss households. They also have plans to offer a digital bouquet by satellite.⁴⁵

Plans for the development of digital terrestrial TV services are still being discussed at government level.

About 1.075 million homes in Austria are connected to analogue cable TV networks. However, the cable TV network providers tend to operate on a regional or local basis making it a highly fragmented market. In total, there are about 300 networks, but only about 100 of them have more than 500 subscribers. Decisions on whether to upgrade their networks to enable them to offer digital services will depend on the market strategies of individual network operators. There is one cable operator offering analogue pay-TV services - Telekabel Wien - with a subscriber base of 435,000 in the whole of Austria including 375,000 in Vienna. It is also offering access to the Internet via a cable modem offering in Vienna. Some other cable TV operators are also offering Internet access using cable modems at up to 10 Mbit/sec at a flat monthly rate of 43 euro.⁴⁶

Alcatel Austria and Post & Telekom Austria AG (PTA) are co-operating in a field trial to use ADSL technology for upgrading existing copper twisted pair infrastructure to support interactive video and high-speed internet access. However this is a small trial, only involving 100 households in Vienna and 12 households in Upper Austria.⁴⁷

The slow development of digital interactive TV services and the relatively small population seems to suggest that TV-based interactive learning services will develop very slowly within Austria. Decisions about Digital Terrestrial TV developments have yet to be taken by government, which has not acted as a stimulus for launching a separate learning channel - as has been the case in Sweden, for example. Some

⁴³ Web site: <http://www.orf.at>

⁴⁴ Information provided via email by Renate Rbl, Business Development, Austrian Broadcasting Corporation, March 1999

⁴⁵ "Development of Digital TV in Austria 1998 Report", Techno Z p3-4

⁴⁶ "Development of Digital TV in Austria 1998 Report", Techno Z pp6-7

⁴⁷ "Development of Digital TV in Austria 1998 Report", Techno Z p8

interactive learning services may eventually be on offer by satellite from Germany, in particular IQTV from SWF when it is launched.

In conclusion, it seems most likely that the Internet will provide the most effective means for offering interactive learning services particularly as higher-speed access could be available via cable modems and from ADSL technologies using existing telephone lines. European-wide solutions via satellite are also available in more remote areas.

Belgium

Analogue cable TV networks reach every household in Belgium and a wide choice of TV programmes is available. This has tended to act as a disincentive for operators to offer digital TV services, as one of the main reasons for doing so is to offer a wider choice of channels. Another factor has been the need to upgrade the analogue networks to digital using hybrid fibre coax (HFC) - for other reasons such as telephony rather than for TV. This has now resulted in some cable networks offering "foreign" digital bouquets as no national offer exists in Belgium.

High-speed access to the Internet has acted as an incentive to upgrade the cable network to digital but this seems to be done by companies mainly interested in telephony. For example the new phone company - Telenet - is offering telephone, Internet and (soon) multimedia services, but it is not able to offer broadcasting services - the associated cable operators handle these. Such a telephone/Internet service was launched in February 1999 in the Brussels and Leuven areas under the brand name of Chello.⁴⁸

Discussions concerning the development of terrestrial TV in Belgium are still at a very early stage. There are no digital TV satellite offerings originating from Belgium, although householders with an appropriate satellite dish and receiver can pick up offerings from other parts of Europe.

The small markets of the two main linguistic communities seem to make the emergence of sustainable interactive TV services rather uncertain. However, the Flemish community is trying to promote the development of a local digital thematic channel through The Narrow Casting Company (TNCC)⁴⁹ - this might stimulate some interactive services.

The University of Leuven (KUL) also has a special arrangement with a local cable company to provide Internet access to their students' homes in the area. In addition KUL is offering "Computer Campus TV" (CCTV) which enables TV programmes to be multicast to students' computers which are linked to the university network. This includes links to student residences. In the near future there are plans to multicast TV to students' homes via the commercial cable network.⁵⁰

⁴⁸ Based on information provided by email from Paul Van der Spiegel Chief Executive Officer, 12 March 1999 and off the Telenet web site at <http://www.telenet.be>

⁴⁹ "Development of Digital TV in Belgium 1998 Report", Lentic p5

⁵⁰ Information provided via a telephone conversation with Professor George van der Perre, 12 April 1999

In conclusion, some form of interactive TV services may develop through local initiatives like the Leuven one, particularly if they are able to increase the participation of learning. These could spread to some kind of low cost (but high profile in terms of reaching the home) services mounted in conjunction with local or regional educational institutions. Widespread interactive broadcasting learning services seem unlikely to emerge.

Denmark

Direct to home digital satellite TV started in Denmark in June 1998 with the launch of Canal Digital's subscription service, although there are over 400,000 households receiving analogue services from various operators. The major analogue satellite operator - VIASAT - which also operates throughout Scandinavia, does not appear to have any plans to move to digital TV. Tele Danmark also launched its digital cable TV service but as of October 1998 had only about 35000 subscribers. Decisions concerning the development of digital terrestrial TV are in the process of being made by the Danish government.⁵¹

There do not appear to be any interactive TV services operating in Denmark at present and the prospects for the development of interactive TV learning services appear to be very uncertain and probably not likely to develop at all. This is because the digital TV market is still very immature and the small population of the country is likely to make it difficult to sustain such a development. However a dominant deterring factor is the high penetration of computers in Danish households which would make it more realistic to offer interactive learning services via the Internet.

Finland

Digital satellite pay-TV service provision in Finland started in the autumn of 1997 with the launch of Canal Digital's digital satellite services - TV Finland is included in Canal Digital's service. As yet, digital cable TV has not been introduced in Finland - although at the end of 1997, 38% of households were subscribers to analogue cable TV.

Terrestrial TV plays a major role in Finland as over half of the population watch TV by this method. Therefore there are plans to make digital terrestrial TV available to 70% of the population by the year 2000. It is proposed that the digital terrestrial television will consist of 12 television services, eight of which will be totally new services. Plans include an educational and cultural channel provided by YLE, the public service broadcaster. Interactive services are also planned including teletext and Internet services which will be broadcast as integrated parts of the television signal.⁵² It is not known if these will apply to the planned education and cultural channel but this is most likely to be the way that any interactive TV learning services will develop. No doubt this will build upon the existing experience of offering educational broadcasting via YLE's TV1 channel. YLE already broadcast programmes for schools, language programmes, vocational training and an open university service that was launched in January 1996.⁵³

⁵¹ "Development of Digital TV in Denmark 1998 Report", CTI

⁵² "Development of Digital TV in Finland 1998 Report", CTI

⁵³ "The Future of Educational Television", Dr Paul Bacsich, January 1996.

In conclusion, Finland seems a promising country for the development of interactive TV learning services.

France

France has been an early adopter of digital TV services mainly via satellite. The country also has the highest number of households subscribing to such services compared to other countries within Europe. The first digital TV service was launched in 1996 by Canal Satellite, a subsidiary of Canal+. Now, with close to a million subscribers, it is twice as big as its national rival, TPS (Television Par Satellite). TPS is a joint venture between the free-to-air terrestrial broadcasters, France Télécom (the dominant telecommunications operator and one of the leading cable operators) and Lyonnaise Câble which is also a major cable operator. A third satellite operator is AB Sat - a service operated by AB Production, an independent television production company.

Canal Satellite transmits from the SES/Astra satellite and can be received using a digital set-top box with Mediaguard conditional access and Media Highway API technology developed within the company. TPS transmits from Eutelsat's Hotbird satellite and uses the conditional access - Viaccess - developed by France Télécom and the API technology from OpenTV. Two different versions of AB Sat are broadcast, both on Eutelsat and Astra using Viaccess conditional access. In addition Simulcrypt agreements have been negotiated with its two competitors.

Despite appearing to lead Europe, the overall number of subscribers is still very small. Canal+ estimates that it has penetrated only 5% of the French market and its competitors considerably less. Therefore some people are suggesting that there will be a trend that each European country will ultimately gravitate toward one dominant player.⁵⁴

Interactive services have been launched or are planned by both Canal Satellite and TPS. For example Canal Satellite proposes enhanced interactive TV through its pay-per-view service, enabling TV viewers to choose, in real time, what view they wish to watch for a particular event. They will also have the option to watch the action of several events happening at the same time. TPS is testing out the use of interactive advertising. There are also teletext-like interactive services giving sports results, detailed weather forecasts, ordering goods directly from several teleshopping channels. TPS launched a banking services in December 1998.⁵⁵

However, currently there do not appear to be any interactive learning services planned. The focus of these commercial operators seems to be on interactive services that are likely to generate enough revenue to become at least sustainable and ideally make a good profit. Should there be a good "political" or marketing reason for developing interactive learning services, TPS has shown that it is capable of developing a new service within six months of its conception.⁵⁶ In fact TPS are providing an experimental service called SAT&CLIC for high schools which will offer access to the Internet via satellite specially focused towards educational

⁵⁴ Bracken, Mike "Fuzzy Reception for Euro DigiTV", Wired News 14 September 1998

⁵⁵ TPS Press Release "TPS launches on-screen banking via OpenTV", 14 December 1998

⁵⁶ Based on discussion with Sophie Dingreville, TPS during meeting on 23 April 1999

materials and information about what educational programmes are on offer via the TPS bouquet of channels. (See 4.5 Case study 5)

France Télécom has also been experimenting with a high-speed satellite Internet service in the cities of Lannion and Issy-les-Moulineaux during the fourth quarter of 1998⁵⁷ and has just begun commercial trials from March 1999 in Beauvais, Compiègne, Quimper, Vannes and 70 schools across France. It is based on their commercial Internet service Wanadoo but provides high-speed Internet access via satellite at up to 400 kbit/sec for the downlink. It also offers a specific service designed for business users employing “push” technology to deliver theme channel packages of web content directly to subscribers’ computers. The service will cost 46 euro per month.⁵⁸ This service could include interactive learning offerings although there do not appear to be any such application being utilised at present.

This new satellite Internet experiment is part of France Telecom’s strategy to provide online access via all types of telecommunications networks, including PSTN, Numéris (the French name for ISDN) and cable. In addition to the satellite Internet trials, France Telecom is testing ADSL high-speed Internet access in Bourges, Le Mans, Nice, Noisy-le-Grand and Rennes.

Since February 1997 “La Cinquième”, the French TV channel, has been testing the BPS service (Banque de Programmes et Services) that allows schools and training centres to download video-on-demand, via satellite.⁵⁹ The user views or searches a catalogue of offerings on a web site and requests a video via the web site. The user is then automatically informed when the video will be downloaded via satellite to the user’s computer where it can be decompressed and viewed on the computer or on a television screen.⁶⁰

All three major cable operators - France Télécom Cable (a subsidiary of the dominant telecommunications operator), NC Numéricâble (a subsidiary of Canal+) and Lyonnaise Câble - have started to implement digital offerings to their subscribers, each following different strategies. France Télécom and NC Numéricâble maintain a cheap analogue service with digital options, whereas Lyonnaise Câble is aiming for an all-digital strategy attempting to equip each subscriber with a digital set-top box. Most of the major cable networks will propose digital services; however, the cost of digitisation has forced France Télécom to announce the sale of its small networks and Vidéopole (a subsidiary of Electricité de France) to announce the sale of *all* its interests in cable. Heavy reinvestments have also proven to be necessary for certain cable networks.⁶¹

Planning towards digital terrestrial TV is still in its early stages. A two-year project was launched in April 1999, where France Television and France Télécom are

⁵⁷ Press Release France Telecom “France Telecom presents new solutions to connect schools to the Internet via Numéris ISDN”, 24 June 1998

⁵⁸ Press Release “France Telecom begins commercial trials of high-speed satellite Internet service” France Telecom Paris, 1 April, 1999

⁵⁹ Information provided via email by Thierry Jacq, Marketing Product Manager, Edixa, France 22 March 1999

⁶⁰ Based on information found on web site at www.aupelf.fr/hanoi97/initiat/colloque/brunet.htm

⁶¹ “Development of Digital TV in France 1998 Report” IDATE P3

working together on a trial in Rennes (Brittany), with the aim of assessing the role of the public broadcaster in the digital multi-channel world. France Television intends to offer a basic package of programmes for free, and to offer space to other broadcasters. France Télécom will supply the transmission and reception infrastructure.⁶²

It is planned that a 30 to 36 digital channel service could be available to 70% to 80% of French households by the end of 2000 or the beginning of 2001 - as both free-to-air and subscription based services.

VDL, in Lyon, is planning a project about training using a digital audio broadcasting (DAB) network.⁶³

Eurosport Enterprises - who are based in Paris but broadcast all over Europe - are currently developing new services for digital distributors - satellite platforms, cable and ADSL. These services will be highly interactive, consisting of many games concepts and e-commerce applications. The company also plans to introduce various kinds of sports services that will augment their European sports portal. They have some initial plans to educate and train people in sports through interactive lessons (for example to practice skiing and tennis) and also to deliver sports rules via e-mail.⁶⁴

In conclusion, the prospects for the development of digital interactive learning services to the home in France seem to be rather better than some other European countries.

Germany

The development of the digital TV market in Germany appears to be lagging behind that of the United Kingdom, France and Italy despite there being a large German-speaking population, and therefore a large market. The reasons for this appear to be fourfold:

- There are a large number of free-to-air channels compared to the rest of Europe.
- The German government appears to be keen to support the dual broadcasting system of national broadcasting stations and private television. This has resulted in a balancing act of providing opportunities for competitive market development on the one hand, whilst at the same time ensuring equal development opportunities for the public broadcasting stations.
- The complexities of the German licensing system, which includes the need to also obtain licences at federal province (Länder) level.
- Finally, only a very limited number of players in the German media market seem to have the capacity to launch digital (pay) TV offers.⁶⁵ The market is primarily dominated by two the media giants Bertelsmann and the Kirch Group with Deutsche Telekom appearing in a number of different roles.

⁶² News item - "France to run Digital Terrestrial Trials", Inside Cable and Telecoms Europe, 15 February 1999

⁶³ Information provided via email by Thierry Jacq, Marketing Product Manager, Edixa, France 22 March 1999

⁶⁴ Information provided via email by Rmi Tereszkievicz, Eurosport Enterprises Deputy Director Head of Interactive Services & Licensing, 17 March 1999

⁶⁵ "Development of Digital TV in Germany 1998 Report", Techno-Z P2

By the end of 1998 two German digital TV satellite services were being broadcast - DF1 with 110,000 subscribers, and Premiere digital with 80,000 subscribers. The total number of subscribers, including cable was 385,000. DF1 and Premiere merged during early 1999.

The situation concerning the development of digital cable TV is rather complex. Germany does have the most widespread cable TV network in Europe with 89% of all German TV households passed by cable - about 50% actually subscribe to a cable network (18 million homes). However, most of this cable is still analogue and mainly owned by the largest cable TV provider, Deutsche Telekom - also the dominant telecom operator. Since 1995 Deutsche Telekom has been updating and digitising the existing network according to international standards for DVB (Digital Video Broadcasting) but its plans are behind schedule. Although Deutsche Telekom owns the underlying technical network for about 88 % of German cable households it only reaches about 30% of all cable TV customers directly - small cable operators that provide the final connection between the Deutsche Telekom basic backbone and residential users serve the other 70%. As a result, Deutsche Telekom only receives a small part of the cable subscription revenues.⁶⁶ In addition it is likely that Deutsche Telekom will also have to sell off its cable network due to deregulation of the telecoms industry.⁶⁷

However, a number of TV operators do broadcast digital services, including DF1, Premiere 1, ARD, ZDF and various foreign and regional channels.

The types of decoder a consumer can buy further complicate the situation. This relates to the dominance of one set-top box - the "d-box" developed by Beta Research (a subsidiary of the Kirch Group) - and the demand for open standards by the public service broadcasters.⁶⁸ This has resulted in confusion for the consumer who is already showing some resistance to moving to digital TV as there is already access to many free-to-air channels. Plans for DF1 and Premiere to merge were also blocked by the regulatory authorities - this delayed developments in one respect but also stimulated the emergence of two new service broadcasters - Digital TV Hamburg and Deutsche Telekom.

The German government has already declared that it wants to switch to all-digital broadcasts by 2010. This may stimulate further development of the market. Currently there are a number of trials in various parts of Germany testing out what technical problems may exist prior to the introduction of digital terrestrial broadcasting.

Although some interactive services are starting to emerge, it appears that new developments may come from converging technologies. Both public broadcasters ARD and ZDF are currently pilot testing services that bring the Internet onto the television screen or vice versa. ZDF is co-operating with Intel InterCast push technology to offer selected TV content as regular news-flashes on the computer screen, while ARD is working on a concept that combines the content of its online

⁶⁶ "Development of Digital TV in Germany 1998 Report", Techno-Z pp3-5

⁶⁷ "Deutsche Telekom to spin off cable interests", article in Broadcast Journal, 25 September 1998

⁶⁸ A detailed account of the debate surrounding the set-top box can be found in "Development of Digital TV in Germany 1998 Report", Techno-Z pp17-19

website with programmes on television. ARD Online Kanal offers selected Internet pages and multimedia content to be viewed on the television screen.⁶⁹ The launch of the new version of the “d-box” set-top box will also enable enhanced interactive applications including home shopping via the web and the ability to manage a stock market portfolio as well as providing email.⁷⁰

As in many other countries of Europe, ADSL trials are being conducted in Germany. Deutsche Telekom has been running a pilot project in North-Rhine Westphalia which has enabled 450 private households and companies to get high speed access to the Internet and provide data networks working at speeds of up to 1.5 Mbit/sec on the downstream (towards the customer) and 128 kbit/sec on the upstream. One educational application involves the virtual training and information centre “Virtuelles Bildungs- und Informationszentrum VBIZ” of the Macronet company which allows teaching videos to be loaded and run by trainees.⁷¹

Despite the many difficulties relating to the development of the digital TV market in Germany a new digital educational channel - IQ TV (Interactive Qualifications TV) is being implemented by the public service broadcaster SWR (Sudwestrundfunk in Baden-Baden, part of the ARD network). It is one of the few TV channels that has been broadcasting educational programmes since the 1960s. (See 4.9 Case study 9). IQ-TV is planned to be a platform for programmes produced for universities, industries and SMEs, as well as being utilised by public service and commercial educational providers. The development of IQ TV towards a sustainable service will be watched very closely in Germany and other parts of Europe. If successful, other service providers may be encouraged to develop similar services.

Greece

There are no digital satellite, cable or terrestrial broadcasters in Greece at present. However, the Nova Consortium and Antenna have shown an interest in broadcasting via satellite and there are some experimental cable networks in Athens (two districts), Komotini, Volos and the island of Mykonos. The Nova consortium also intends to offer some form of interactive services.

There appears to be little interest in the development of digital terrestrial networks as the key players are more interested in satellite broadcasting and there is limited spectrum that is available.⁷² However, many households can receive “foreign” digital satellite services.

A data broadcasting system was deployed in 2000 Greek schools at the beginning of May 1999 but not using digital techniques. Instead, it used the vertical blanking interval (VBI) of analogue terrestrial broadcasts. Applications include encrypted broadcasts of exam papers and, in time, subject-related material. Bocom International has developed the system for the Ministry of Education.⁷³ (See 4.6 Case study 6)

⁶⁹ “Development of Digital TV in Germany 1998 Report”, Techno-Z p10

⁷⁰ “Germany’s Next d-Box to use c-cube systems”, article in Inside Cable & Telecoms Europe 26 March 1999

⁷¹ Deutsche Telekom Press Release “Deutsche Telekom launches ADSL project in North-Rhine Westphalia”, 15 June 1998

⁷² “Development of Digital TV in Greece 1998 Report”, Databank

⁷³ John T. Clancy, Sales & Marketing Director, Bocom International, email received March 1999

Ireland

Digital satellite TV broadcasting services are available to Ireland through the Sky Digital service that was launched in the United Kingdom on 1 October 1998. In addition to the UK-based services, two Irish channels are also broadcast - Tara and Setanta. It is therefore possible for Irish households to receive the new interactive services due to be launched by Sky Digital in Spring 1999 if they are given permission to do so through the conditional access system on the set-top box. However, it is still unclear as to whether the Irish government will allow such services to be made available.

Ireland is one of the more cabled countries in Europe with over 450,000 cable homes connected, from a national population of just below 1.2 million TV households. Most of the cabled homes are in the urban areas. In the rural areas, with low population density or a mountainous terrain, MMDS (Microwave Multipoint Distribution System) is offered instead. Most of the cable network has needed upgrading to enable digital services. However, the launch of digital TV in the United Kingdom has stimulated this upgrading.

In addition it has also been found that there is also a demand for high-speed access to the Internet. According to a recent sample survey carried out by CMI (Cable Management Ireland) across its cable systems, PC ownership was as high as 33%⁷⁴ thus potentially generating quite a high demand for high-speed access to the Internet. Therefore CMI have started to offer CableNet which provides a broadband network, using high-speed cable modems to connect via the existing cable television system (used to transmit digital TV). The company claims that interactive learning from the home along with telecommuting, home banking and shopping and video conferencing are some of the possibilities for usage. But as yet, it appears that no interactive services are operational as the new service is still being rolled out.⁷⁵

The national digital terrestrial TV platform (DIGICO) is due to be launched in Ireland in September 2000.⁷⁶ An education channel is included in the RTE (public service broadcaster) proposals for digital terrestrial TV within the planned DIGICO Consortium. However, no mention is made of interactive services.⁷⁷

Services to home and office users will soon benefit from some experience of data broadcasting through the EdCast system planned to be launched to Irish schools.

Bocom International, who have recently completed a pilot project of their EdCast for the Ministry of Education, are hoping to offer a fully operational data broadcasting service to 3000 primary schools throughout Ireland in 2000. They have developed a low-cost means of delivering curriculum-based learning material for schools, teacher training material, and distance learning material using the vertical blanking interval (VBI) of analogue terrestrial broadcast over RTE, the public service broadcaster.

⁷⁴ Press Release by "Cable Management (Ireland) Ltd. - Announce: the first two-way cable Internet service in Ireland the company's intention to participate in the public bidding process for the acquisition of Cablelink Ltd", 28 May 1998

⁷⁵ According to information provided by John Mc Laughlin, Cablenet via email 31 March 1999

⁷⁶ 'Ireland's DTT Platform, Digico, to launch in Sept 2000' Digitag Newsletter Feb/March 99. P.2

⁷⁷ From RTE Online web site at <http://www.rte.ie/aboutrte/policydigital.html#intro> Last updated Tuesday 22 December 1998

Bocom plans to release digital TV and digital radio (DVB and DAB) versions over the next 18 months or so. Planned applications, as well as education, include real-time financial services and business Intranets.⁷⁸

A new company with apparently European-wide ambitions - FutureTV - appears to be working in conjunction with cable TV and telephony operators in Ireland. It has plans to offer a proprietary integrated network solution based around the idea of personalised TV and other systems enabling each member of the household to access their own individualised service when they insert their smartcard. It is claimed that the complete delivery system enables network operators to dramatically increase the range of interactive TV and Internet services they provide to consumers, simultaneously through the television and a PC. The system enables subscribers to access video-on-demand and audio-on-demand, receive an unlimited number of live digital TV and radio channels, send and receive email, browse the Internet, telephone everywhere and shop for goods and services. They are also interested in offering education and training services.

The FutureTV system could operate over a cable, telecommunications or private network. The home consumer would have a Media Access Station (MAS) that allows the subscriber to communicate with the full service network. This device converts digital signals into the composite video signal required by television and delivers audio, data and video from a variety of servers. It provides subscriber identification to the network operator as well as system controls, alarms and payment processing. The device connects to the physical network and to television, hi-fidelity audio and computer systems.⁷⁹

In summary, the prospects for the development of interactive TV learning services in Ireland appear to be better than some other European countries particularly as there will be opportunities to also link in with the larger English speaking market of the United Kingdom. There is also the potential for reselling services to the larger US market once interactive services start to develop there.

Italy

Digital TV was introduced in Italy in March 1996 with Telepiù providing a digital bouquet - called D+ - broadcast on Eutelsat's Hot Bird II satellite. A second digital pay-TV operator in Italy - Stream - started to offer a digital package over cable in September 1996 and since September 1998 Stream has also broadcast its bouquet from Hot Bird II. In September 1997 the public broadcaster RAI launched a free-to-air digital offer of three channels also on Hot Bird II.⁸⁰

Before 1996 Italy did not have any cable networks but since that time Telecom Italia has been developing a network across various parts of Italy. Stream's digital TV package has been utilizing this network and by about August 1998 it had 70,000 subscribers. Up till 27 April 1999 Stream was a wholly owned subsidiary of Telecom Italia.

⁷⁸ John T. Clancy, Sales & Marketing Director, Bocom International, email received March 1999

⁷⁹ Based on a discussion with Dennis Garrison, Director, Future TV on 30 April 1999

⁸⁰ "Development of Digital TV in Italy 1998 Report", Databank

Discussions concerning the launch of digital terrestrial broadcasting are still on going but a possible timetable is for 1 January 2002 as the deadline for all kinds of pay-TV broadcasters (terrestrial, cable and satellite) to shift to digital transmission and being to abandon the analogue technology. It is also proposed that by the end of 2010 all terrestrial TV will be in a digital format.⁸¹

The early development of digital satellite TV has resulted a number of interactive services become available including those for learning purposes. Stream, a commercial pay TV operator, offers as part of its subscription bouquet a language learning channel, and a separate interactive language learning channel to reinforce what has been learnt on the main TV channel. (See 4.1 Case study 1) There is also a university learning channel - Consorzio Nettuno. (See 4.2 Case study 2) The public service broadcaster RAI is also offering a so-called near video on demand service for schools. (See 4.3 Case study 3). Telespazio⁸², with its data broadcasting solutions - IPerSPACE and FullSat - is leading under the EC TEN-Telecom Programme, a European consortium - Genesis - which is involved in extensive adaptation of existing multimedia educational and training materials for delivery via data broadcasting systems. In parallel with this activity, extensive market research and market development studies are taking place with the view to ensuring a sustainable market niche.

In conclusion, the prospects for more advanced interactive TV learning services in Italy appear to be greater than most other European countries.

Luxembourg

Most households in Luxembourg have access to TV via cable but there are no plans to offer digital TV services in the country.⁸³ However it would be possible to receive services through “foreign” digital satellite broadcasters should they wish to overcome copyright issues.

The Netherlands

There is currently only one digital TV broadcaster - Canal+ - who are offering a service via satellite. The slow pace of development in The Netherlands has been many due to the country having one of the highest cable penetration rates in Europe with about 30 channels broadcast.⁸⁴ There has tended to be little incentive to move to a digital platform purely for TV since its main advantage is more channels.

However, this situation is likely to change in the near future. Many cable operators are now seeing themselves as integrated service providers and are being encouraged to upgrade to digital networks. They appear to want to diversify towards becoming full service providers rather than just technical network providers. Demand for high-speed access to the Internet seems to be one of the driving forces. But cable operators are also developing plans to offer their own digital bouquet, as is the case with MediaKabel (a consortium of ten cable operators).

⁸¹ “Development of Digital TV in Italy 1998 Report”, Databank p5

⁸² Telespazio web site: <http://www.telespazio.it>

⁸³ “Development of Digital TV in Luxembourg 1998 Report”, Lentic

⁸⁴ “Development of Digital TV in The Netherlands 1998 Report”, Lentic

Developments are also taking place concerning digital terrestrial broadcasting with the formation of the DIGITENNE consortium consisting of a mixture of public service and commercial broadcasters. They are hoping that digital terrestrial broadcasting will be operational in the main parts of the Netherlands by January 2000.

There has in fact been some experience of interactive learning services - in Amsterdam through the EC-funded pilot project DOMITEL. 168 new citizens were offered "social orientation" lessons broadcast as a near-video-on-demand service on a dedicated pay-per-view channel. After the broadcast the participants could answer multiple choice and open questions via interactive teletext on the TV and with a modem.⁸⁵

In summary, the prospects for the development of interactive TV learning services in the home seem reasonable once the cable network infrastructure has been updated.

Norway

Canal Digital - partially owned by Canal Plus and Telenor (the Norwegian telecom company) - started digital broadcasting via satellite to all the Nordic countries in October 1998. In July 1998 NRK (the public service broadcaster) came to an agreement with Canal Digital to be on the satellite and have a common electronic programme guide (EPG).⁸⁶ NRK is investigating the possibilities of starting a digital channel for education and training.

The existing TV companies are very interested in utilising space frequencies for terrestrial TV but still await a government decision later during 1999.

Portugal

The only digital TV service operating in Portugal is a satellite service launched towards the end of 1998 by TV Cabo Portugal, primarily a cable operator (and wholly owned by Portugal Telecom). The service is aimed at households that are not reached by its analogue cable network. They were hoping for about 35,000 subscribers. TV Cabo's analogue cable network has 500,000 subscribers.

Two other cable operators Cabovisao and Bragetel each have around 50,000 subscribers.⁸⁷ However there do not appear to be any plans to offer digital services.

Nor do there appear to be any plans to launch a digital TV terrestrial service. Therefore it seems highly unlikely that interactive digital TV learning services are likely to develop in Portugal.

Spain

As of the end of 1998 there were over 1 million subscribers to digital satellite TV through two providers - Canal Satélite Digital launched in February 1997 and

⁸⁵ "Review of research and development in technologies for education and training: 1994-98", Education and Training Sector, Telematics Application Programme, European Commission

⁸⁶ "Digital TV and public service in the Nordic countries" by Rolf Branderud, to appear as a contribution to the anthology "Television of the Future - or the Future of Television?" edited by Jens F. Jensen and Cathy Toscan

⁸⁷ "Development of Digital TV in Portugal 1998 Report", Databank

Distribuidora de Televisión Digital (Vía Digital) launched in September 1997. Some interactive services are now being offered.

Digital cable services are only now starting to be launched during 1999 after many companies were awarded licences during 1998. Initially they will offer telephony and TV, although at least one company - ONO (the brand name of Cableuropa) - has stated that it will offer digital TV with interactive broadband services and Internet access to telephony. It will be conducting pilots in Valencia during mid 1999.

Other cable operators - Telecable in Asturias, Retecal in Castilla Leon and Supercable in Sevilla - will also be starting to offer high speed access to the Internet via cable modems during 1999.

It should be noted that Telefónica - the dominant telecom operator in Spain - is also involved in both the cable and satellite through partly owning Vía Digital and Telefónica de Cable. The latter has a direct licence to operate in every market and has deployed the infrastructure required to offer cable services in all the country but only 24 months after the first cable operator has obtained its licence in a particular area.⁸⁸

The government is in the process of agreeing a plan for the roll out of a digital terrestrial network across the whole country, reaching about 80% of the population within four years and 95% of the population within ten years. The first digital terrestrial services should be available sometime during 1999. The plan is to allocate two channels of terrestrial digital TV to the public broadcaster RTVE and one for each national private TV broadcaster - Antena3, Telecinco and Canal+.

No digital TV interactive learning services appear to have yet emerged in Spain. However, some companies do have some initial plans. Antena3 plans to offer thematic channels including an educational channel. Cable i Televisió de Catalunya (based in Barcelona) also has plans to offer interactive services on education and training in the near future.⁸⁹

As competition starts to increase in Spain over the next few years with the development of digital cable networks and digital terrestrial broadcasting, it seems highly likely that some interactive TV learning services of various types will start to emerge. A number of market factors would seem to favour this prediction. Market analyst Datamonitor considers that interactive services will have their strongest growth in Spain and Italy, compared to the rest of Europe and the United States, over the next four years.⁹⁰ Commercial broadcasting companies will increasingly want households to buy their subscription packages. Therefore some type of learning service could be an attractive component.

There is also a long tradition in Spain of distance learning through UNED - the Spanish open university - who broadcast many hours of television programmes. In recent years other regional institutions have entered this field. Universitat Oberta de Catalunya - the Open University of Catalunya, based in Barcelona - has started to

⁸⁸ "Development of Digital TV in Spain 1998 Report", Databank

⁸⁹ Email from Jaume Salvat, Tecnologia Cable i Televisió de Catalunya, 6 April 1999

⁹⁰ Datamonitor Press Release "Interactive digital television services in Europe and the US in 2003", 10 May 1999 referring to report "Interactive TV markets in Europe and the US, 1998-2003"

offer distance learning courses and has plans to broadcast some aspects of its courses, co-operating with regional cable operators or satellite broadcasters.

There is also the competitive advantage that any interactive learning services produced in Spanish could also be exported to other parts of the Spanish-speaking world.

Sweden

There is a low penetration of digital satellite TV in Sweden. It started in June 1998 with the launch of Canal Digital's services. From the beginning of 1999 SVT, the public service broadcaster, will also make its digital terrestrial services available over satellite. The channels that will be considered in the first phase are SVT1, SVT2 and the new digital-only News channel, SVT 24.⁹¹

Telia launched digital cable TV in Sweden in 1997 as Telia Infomedia TeleVision. This is today the major cable TV operator and a very important actor in the process of introduction of digital TV in Sweden. Their set-top box is called "Digital TV Box" - it is a Eurobox from SAGEM with Viaccess Conditional Access system and Open TV API. This system is also used in Denmark.

Stjern TV also provides digital TV services via cable. There are also analogue cable TV operators, one of which has plans to offer digital services during 1999.

Digital terrestrial TV started in Sweden in April 1999 making it the second country in Europe to offer an operational service. Amongst twelve companies offering digital TV, there are two educational broadcasters - UR (see 4.7 Case study 7), owned by the public service broadcaster, and the new commercial company Knowledge Network (Knet) with KunskapsTV (Knowledge TV). The government has just allowed UR to continue as a public educational broadcaster for another three years (1999-2001) using the digital channels of SVT1 and SVT2. Knet prefers to describe itself as a provider of learning services with a TV channel. It has plans to offer interactive services (see 4.8 Case study 8).

A local television channel - Landskrona Vision - in the south of Sweden also has received approval to start terrestrial digital broadcasting from April 1999. They aim to use digital broadcasting to widen local and regional television activities and also to develop interactive communication between institutions and citizens. This includes distance education towards the end of 1999 with an experimental course in "youth culture" with the University of Lund and the Highschool in Kristianstad.

In summary, the prospects for digital interactive TV learning services in Sweden look promising.

United Kingdom

Despite digital TV starting rather later in the UK than in some other European countries, rapid developments during the latter part of 1998 and into 1999 have made it perhaps the most dynamic country in Europe for interactive digital services.

⁹¹ "Development of Digital TV in Sweden 1998 Report", CTI

The UK's first commercial digital television service commenced in October 1998 with the launch of Sky Digital - the digital satellite service from British Sky Broadcasting (BSkyB) - beamed directly to homes from the Astra satellite.⁹² Based on the provision of set-top boxes at a price of around £200 (around 300 euros) per unit, the BSKyB service saw steady growth throughout the first quarter of 1999. In May 1999, the company began an offer of free set-top boxes, initially for a month. The uptake of the free set-top boxes to access BSKyB's 140-channel digital television service in the first week was estimated by analysts⁹³ to have run at about 10,000 per day - following 40,000 requests during the first two days of the free offer. Sky Digital customers were also offered cheap online access to the Internet as well as having discounted telephone services. Sky Digital had attracted 551,000 subscribers by 3 May 1999.

BSkyB's main rival, OnDigital, which broadcasts 30 digital channels through digital terrestrial to roof-top aerials, followed by also offering free set-top boxes for new customers buying access to its service.

BSkyB's moves in establishing its digital service, and encouraging the uptake by customers through discounts and free provision of hardware, demonstrates that it has committed to its digital future. It has announced plans to switch off its analogue service by 31 December 2002.

Sky Digital has attracted content providers such as British Interactive Broadcasting (BIB), which plans to launch its services under the title of "Open"⁹⁴. during the Autumn of 1999⁹⁵. BIB was formed in May 1997 to deliver digital interactive television services and is owned jointly by BSKyB (32.5%), BT (32.5%), Midland Bank (20%) and Matsushita (15%). BIB's service partners include well-known retail companies such as Great Universal Stores, Iceland, Kingfisher and Woolworth, as well as companies such as Midland Bank, Ford, Unilever and Coca-Cola. Reflecting the trend to offer integrated digital services into the UK market, subscribers to "Open" will also be provided with a free e-mail account, access to free interactive games, weather and travel reports and other information services.

The Sky Digital service will not offer integrated Web-based information services. The BSKyB group does, however, have a separate entity called Sky Online, which will develop a range of Internet-based digital interactive services linked to sports, documentary, quiz and other entertainment programmes. They are starting to think about offering some form of learning service.

The digital cable landscape in the UK is currently more complex than the digital satellite landscape. Generally, the installation of cable throughout the UK got underway later than in most of the neighbouring European countries. One advantage of this late start was that the advanced cable networks put in place were generally more capable of supporting digital services.

⁹² "Development of Digital TV in United Kingdom 1998 Report", CDG

⁹³ "Rush for free digital TV boxes", Financial Times, 17 May 1999

⁹⁴ Inside Cable and Telecoms Europe, 15 November 1998

⁹⁵ Stated in promotional video broadcast on Sky Digital.

The cable market in the UK has experienced considerable consolidation in the period 1996-98, with the number of significant providers falling from 24 to just five. The current leaders of the cable industry in volume terms are Telewest Communications, Cable & Wireless Communications and NTL. In May 1999 Telewest services passed 4.2 million UK homes and had 800,000 dual telephone and television subscribers. NTL services passed 3.945 million UK homes and had 764,000 dual telephone and television subscribers. Cable & Wireless Communications services passed 4.286 million UK homes and had 660,000 dual telephone and television subscribers.⁹⁶

Telewest and NTL are US-backed companies whereas Cable & Wireless is a UK-based company which has an international asset base of which Hong Kong Telecom is the most significant component.

An important development in the development of digital services via cable networks took place in May 1999 when Microsoft, the world's largest computer software company, took significant stakes in both NTL and Telewest. As part of its alliance with AT&T, Microsoft announced in that it was committed to buy the 29.9% stake in Telewest then held by MediaOne, the US cable operator. Microsoft already holds a 5% stake in NTL. Industry analysts suggest that the UK cable industry will finally consolidate with only one provider, although the industry regulator and consumer protection groups may prohibit this.

Microsoft's investments in the UK cable industry are seen as allowing the cable industry to compete more effectively with the satellite broadcasters. It is suggested that Microsoft may also buy the mobile telephone operator, One-2-One (currently jointly owned MediaOne and Cable & Wireless). Microsoft's entry into the UK cable market will provide it with a channel for the rich media content it already delivers through its Web and through its set-top boxes in the USA. It may also help the UK cable industry overcome one of its most significant problems, that of reaching agreement on the specifications of set-top box technology. The main strategy pursued by the cable companies to this time has been to provide Internet capability with their set-top boxes. This has brought them closer together in terms of technical specifications but there is no agreement on a unified platform. The history of rivalry within the UK cable sector has continued to delay its growth.⁹⁷ It may be that Microsoft's entry will help solve this problem quickly.

Cable & Wireless Communications has announced plans for digital interactive consumer services⁹⁸ during 1999. It is creating its "TV Mall", which will carry a wide range of entertainment, information and transactional services. Companies such as Barclays Bank, British Airways, Littlewoods Home Shopping Group, and the television group ITN are working to develop content and services for "TV Mall". In 1998 Cable & Wireless Communications bought a controlling share in Two Way TV⁹⁹, a media company that will provide interactive games shows as part of its "TV Mall" offering.

⁹⁶ Financial Times, 7 May 1999

⁹⁷ "Development of Digital TV in United Kingdom 1998 Report", CDG

⁹⁸ Broadcast Journal 8 January 1999

⁹⁹ Silicon News, 7 June 1998.

NTL are planning to launch an interactive knowledge channel¹⁰⁰ during the latter part of 1999. NTL plans to carry Elmsdale Media's "Yes Television", a range of digital cable interactive services using Elmsdale's own video-on-demand platform. This service will include movies, television programmes, home shopping, music, news, education and travel services. Initial commercial trials are to be carried out over part of NTL's Cardiff cable network. Yes Television will combine Internet technologies, broadband networking and digital video delivery. MPEG-2 video compression and copy protection systems from Macrovision will be used to provide cinema-quality viewing. Interactivity is provided through a hand-held TV-style remote control device. Dorling Kindersley, the leading publisher of educational books, videos and CD-ROMS will provide educational programming for this service.

The third major UK cable company, Telewest, plans to launch its digital package during the fourth quarter of 1999.¹⁰¹

The digital terrestrial television (DTT) landscape is just emerging in the UK. Apart from OnDigital, the BBC and other free-to-air analogue terrestrial broadcasters have all planned or launched digital services, having been allocated the three digital multiplexes with the highest national coverage (90%) by the regulators. A further three multiplexes, with lower national coverage of around 80% have been allocated to new pay TV services. The BBC is carrying BBC1, BBC2, BBC News24 and BBC Choice on its multiplex. The ITV group and Channel 4 group have also announced digital offerings from their shared multiplex. Other regional free-to-air broadcasters, including the Welsh channel S4C and some Gaelic services, have taken up their entitlement on the third largest coverage terrestrial multiplex.

Education is likely to have a significant role in the development of digital television.¹⁰² The UK has developed a national curriculum for schools only in recent years, but this has now stimulated the demand for national institutions of learning. The BBC launched its BBC Knowledge (formerly known as BBC Learning) channel on 1 June 1999. BBC Knowledge encompasses a range of programmes for children, parents, teachers and other learners at home. User interaction with BBC Knowledge is through the web initially, but ultimately via the TV screen itself. The Wales Digital College is also due to start a number of innovative interactive TV trials leading to a full service in Wales in conjunction with the Welsh Medium Channel S4C. (see 4.11 Case study 11)

The Open University, which has a long television history, is expected to expand its programming. Their Business School has recently been experimenting with a Business Café Project¹⁰³ involving a series of up-to-day Business programmes aimed at attracting people not on existing courses. An associated web site¹⁰⁴ provided interactivity for people to get further information, download additional papers and take part in an online discussion group.

¹⁰⁰ NTL press release "NTL's interactive Knowledge Channel: the gateway to interactive learning at home", 20 May 1999

¹⁰¹ Broadcast Journal, 12 February 1999.

¹⁰² "Development of Digital TV in United Kingdom 1998 Report", CDG

¹⁰³ "The Business Café Project" by Dr Gilly Salmon, Open University Business School May 1999 - see <http://oubs.open.ac.uk/gilly>

¹⁰⁴ Web site: <http://www.open.ac.uk/businesscafe>

The UK Government has also launched the National Grid for Learning on the Internet, aimed at supplementing the school curriculum. It plans soon to offer funds to a number of commercial operators to develop a number of pilot interactive learning services of various types focused on GCSE level learning resources (GCSE are the exams taken by most school leavers), which could be utilised by children at school and independent learners at home. The UK government is very keen to enhance the quality of learning and sees increasing the options for learning in the home as a key area which it can do something about.

Cable & Wireless Communications plan to launch a home interactive services channel in late 1999 that will be aimed at families with children and which will broadcast programmes for children in elementary, primary and secondary education. It is planned to link the programmes to the National Grid for Learning. Organisations such as Anglia Campus and BBC Online would provide the content.

A range of competitive technologies is also being tested for the provision of interactive television services in the UK. The US-based WebTV Networks Inc. (a subsidiary of Microsoft) has been working with BT since March 1998 to trial the delivery of interactive services through Pace Micro Technology's set-top boxes, over copper wire, to standard analogue televisions. Internet and multimedia e-mail access is part of this package. The use of VideoFlash™ technology, allowing the downloading of full-screen, full-motion, high-quality video, graphics, voice and music to standard televisions is also included in this package.

In 1998, Kingston, a small telecom company based in Kingston-upon-Hull, launched the country's first commercial ADSL service.¹⁰⁵ BT also ran an ADSL trial to deliver interactive services to consumers over copper wire in London¹⁰⁶ during the latter part of 1998 and the first quarter of 1999. The BT trial system could support video streaming - delivered to a set-top box - and high-speed access to the Internet.

BT is also planning to deploy other high-speed broadband networks to compete with the cable companies. Its BeTaNet is an advanced Internet/multimedia system based on terrestrial fibre networks. BT is also collaborating with other European Telecom companies to create the largest pan-European high-speed network. Both BeTaNet and the European network are based on SDH (Synchronous Digital Hierarchy) and DWDM (Dense Wave Division Multiplexing). When integrated with ADSL, BeTaNet will bring interactive digital broadband communications within reach of most residential telephone customers in the UK.

Central and Eastern Europe

With the exception of Poland, generally Central and Eastern Europe appears to be lagging behind the EU. This survey just covers the key features related to the development of digital TV.

Poland appears to have approximately 6% of households subscribing to digital TV services mainly through Wizja TV. This is owned by London based company

¹⁰⁵ Inside Cable and Telecoms Europe, 14 December 1998

¹⁰⁶ Inside Cable and Telecoms Europe, 22 December 1998

@Entertainment¹⁰⁷ and broadcast via satellite and the cable network run by its own subsidiary Poland Communications¹⁰⁸. Canal+Polska also entered the digital satellite market in October 1998¹⁰⁹.

The cable industry is the largest in Central and Eastern Europe dominated by Polska Telewizja Kablowa (PTK) which is owned by its US founders Chase Enterprises, Advent International - a private equity firm and several smaller companies¹¹⁰. It supplies around 540,000 subscribers in eight cities and at least 20 other smaller locations. It is currently actively involved in acquiring other cable networks. No doubt the Wizja digital TV developments will stimulate PTK to offer digital services.

Slovenia appears to be leading developments towards comprehensive digitisation. Currently cable operators are experimenting with pay TV, value added services and with the introduction of new innovative technologies on their networks. There are future plans to interconnect 80 per cent of the Slovenian cable networks with fibre optic cable with installation starting as soon as the financing of the project is in place¹¹¹.

In Hungary there are plans to provide digital cable services and Antenna Hungaria, Hungary's national broadcasting company provides a digital satellite channel.

Czech television is already broadcasting in digital from the Kopernicus satellite though few are taking the service¹¹². Czech cable networks seem to be moving towards digitisation with some offering telephony services¹¹³

There do not appear to be any developments towards digital terrestrial TV in Central and Eastern Europe.

At present there do not appear to be any plans for the development of interactive digital TV learning services. However, Poland is likely to be the first country to offer such services if they develop at all.

Europe-wide Developments

A number of Europe-wide commercial data broadcasting services have become available over the last few years. The services involve transmitting multimedia data from a satellite direct to a computer. The same type of satellite dish used for TV programmes can also be used for receiving the data broadcast. It is connected up to a PC card that is installed within a computer. The PC card needs to follow the DVB/MEG-2 standard that is now being used all over Europe.

Essentially the systems all offer similar services:

¹⁰⁷ "Wizja TV leads with Digital Subscribers" 1 February 1999 found at <http://www.inside-cable.co.uk/n99q1auk.htm>

¹⁰⁸ "Poland's Digital Competition Heats up" 21 September 1998 <http://www.inside-cable.co.uk>

¹⁰⁹ "Poles Tune in to Digital TV" by Joe Nickell, Wired News 28 October 1998

¹¹⁰ http://www.inside-cable.co.uk/c_pola.htm

¹¹¹ Central Europe Cable Industry Report found at http://www.inside-cable.co.uk/c_snia.htm

¹¹² Central Europe Cable Industry Report found - Czech Republic http://www.inside-cable.co.uk/c_czec.htm

¹¹³ Central Europe Cable Industry Report found - Czech Republic http://www.inside-cable.co.uk/c_czec.htm

- Package Delivery - where data is packaged together, compressed and transmitted at agreed times - for example, updating the price list to a group of retail shops.
- Streaming delivery - enabling a continuous stream of data to be transmitted - for example, a news or financial ticker tape service, or audio and video streaming.
- High speed Internet (turbo Internet) - where a user can request information from the Internet via a modem and telephone line, and the information is then delivered via the satellite at higher speeds than would currently be available via other methods.

The technology is better utilised for multicasting - one to many - rather than point to point which can be rather expensive using this kind of service. Companies offering such services include:

- Astra-Net, via the Astra satellite
- Polycom, France, via Eutelsat
- Telespazio, Italy, via Eutelsat
- Antenna Hungaria, Hungary, via Eutelsat
- British Telecom and Easynet have launched a pre-commercial service during 1998
- HOT Telecommunications - (formerly Hughes Olivetti) have their DirecPC service, via Eutelsat

The US experience with DirecPC suggests that in Europe also there is likely to be increased demand for a satellite direct to computer service. It is likely that a number of different data broadcasting services will start to emerge offering different speeds of delivery. Professional users, whether at home or in the office, may be prepared to pay for a premium express service, whereas others may only be prepared to pay for a “tourist class” cheaper bulk rate service.¹¹⁴ How widespread these developments will be will depend on how rapidly the main competitive technology of ADSL will roll out.

New satellite developments like Europe*Star¹¹⁵ and EuroSkyway¹¹⁶ are likely to emerge over the next few years, some offering two-way links via satellite. However, for the home user, cost will be the critical factor that will determine whether they are used. Currently it seems that they may be too expensive for home users for some time.

3.2 Outside Europe

USA

This section aims to give a flavour of the key developments that are taking place in USA rather than being a detailed overview.

¹¹⁴ “High Speed Internet access for every home. Using satellites to make the link”, interview with Dr Clausen in “Multimedia Broadcast”, published by ACTS Multimedia Information Window 1998

¹¹⁵ Inside Cable and Telecoms Europe, 31 December 1998

¹¹⁶ Web site: <http://www.euroskyway.alespazio.it>

In some respects the US has been lagging behind the leading countries of Europe with regard to digital interactive TV deployment - however there are clear signs of rapid developments, which started at the beginning of 1999. It is very likely that the US will become the leader in this area by the beginning of 2000.

The transition from analogue to digital

In the USA there is a multi-pronged approach to the rollout of digital TV. Fibre optic cable is widespread and growing and some consortia are building digital TV network operations based on digital fibre. Others are deploying digital satellite networks. Still others are investing in terrestrial wireless, xDSL and other technologies. The US Government's rollout timetable for digital television (described below) has put all broadcasters in the position of developing plans for digital television broadcast in some form or another.

In December 1996, the US Government's Federal Communications Commission approved the US standard for digital television. The FCC is the controlling body for communications in the country.

In April 1997 the FCC published the timetable for the transition to the new system. Overall, the transition period that the FCC has set is very short. The largest commercial Network TV broadcasters were obliged to have a DTV signal on air by May 1999. The remaining commercial stations in the top 30 markets must be on air in digital format by May 2000. All other commercial stations must complete their facilities by May 2002. Public television broadcasters, with their more limited funding sources, are obliged to be on air by May 2003.

Every television broadcaster has been allocated an additional channel to enable them to provide a dual service, both analogue and digital, during the transition. In 2006 all the analogue transmitters must be shut down and only digital television transmission will be licensed from that date. The closure date for analogue transmission can be extended only if 15% or more of the audience does not have access to a digital signal by that time.

One of the key issues that the digital television industry must address is the fact that none of the new digital television standards is completely compatible with existing televisions. Thus, to take advantage of all the features of digital TV, new digital TVs will have to be purchased by consumers, or set-top boxes purchased to augment current analogue consumer television sets. The set-top converter boxes enable the digital transmissions to be received by analogue TVs, but users will not be able to utilise the wide screen pictures, high quality sound and interactive features available to users with digital TVs. Although large number of set-top boxes have been deployed in the USA, most providers are developing their services on the basis that consumers will purchase digital TVs over time.

Digital Cable

Digital cable rollout has been taking place on a large scale in the USA. Two good examples of the implementation of digital cable are ICTV's broadband Internet service for TV, and Source Media and Insight Communications' two-way interactive range of digital services.

ICTV's Broadband Internet Service for TV

ICTV launched its Broadband Internet Service for the TV in February 1999.¹¹⁷ This service integrates high-speed Internet access (including e-mail) through cable-connected television sets. The ICTV service was the first of its kind in the USA. It includes an extensive cable-delivered CD-ROM library featuring a selection of popular games and software. The service is delivered via an infrared receiver that sits on the TV and links to a wireless keyboard. The initial response to this ICTV service has been very positive. The CD-ROM library consists of CD-ROM games and software from companies such as Broderbund, MacMillan, SegaSoft, Acclaim, The Learning Company and many others. This facility, combined with the provision of Internet access through an easy-to-use system through a television set, has proved appealing to customers without PCs.

ICTV's broadband Internet access is 100 times faster than ordinary dial-up services such as WebTV, delivering Internet speeds up to 10 Mbit/sec per user. Additionally, ICTV features a wireless keyboard with point-and-click navigation and full joystick capabilities.

The service is being made available in two packages: *Complete*, which includes five hours of high-speed Internet and e-mail services and access to CD-ROM games and software titles for \$9.95 a month; and *Arcade*, which offers access to CD-ROM games, education and reference titles for \$5.95 a month. This price includes three hours of use. Additional time for both packages is charged at \$1.95 an hour for peak periods (7am to 11pm) and at 95 cents an hour in off-peak periods (11 pm to 7 am).

Source Media and Insight Communications' two-way interactive digital services

In March 1999, Source Media, Inc. and Insight Communications, Inc. completed installation of the US cable industry's first fully operational two-way interactive digital cable system, in Illinois. Insight Communications will initially offer its subscribers a package that includes a server-based on-demand service bundled as the *SourceGuide* navigator and the *LocalSource* programming package (a suite of localised digital programming services such as restaurant and entertainment guides, local news and weather, local legal and medical services). Also included is an electronic program guide (*EPG*). *SourceGuide* provides features and functions such as personalised menus, the ability to surf channel listings without leaving the current channel, instant pay-per-view ordering, parental control options, and a digital suite of services, controlled through standard remotes handsets. The companies intend to phase in other applications including Internet-source content and a portal to instant "on demand" Video-On-Demand ordering from Interactive Channel's family of digital applications branded as *SourceSuite*. The systems run on General Instrument's platform of DCT digital set-top terminals, to which The Interactive Channel has added real-time, two-way interactive capability.

Digital Terrestrial

The FCC's April 1997 decision that all broadcasters must have digital signals on air by May 2003 has meant that every terrestrial broadcaster in the USA has plans to rollout digital terrestrial television.

¹¹⁷ ICTV Press Release "ICTV launches Broadband Internet service for the TV" 22 February 1999 http://www.ictv.com/press/pr1999/pr_022299.htm

The first digital terrestrial broadcasts went to air on 2 November 1998, although the first public TV station to broadcast in the FCC's digital transmission standard, KCTS in Seattle, turned on its experimental transmitter in January 1997. 35 terrestrial TV stations agreed to initially broadcast digital terrestrial in line with a voluntary deadline agreed within the industry ahead of the FCC's mandatory requirements. Although, theoretically, 60 million Americans in 30 cities could watch digital terrestrial television broadcast by these 35 stations, in reality very few people have purchased the digital receivers needed to view it. The cost of the digital equipment (some US\$5000 - US\$7000) is a barrier to mass-market penetration in the early stages of digital terrestrial rollout.

Since many higher education institutions in the USA own and operate public television stations, developments in digital television will inevitably have an impact on them, and the change to DTV will probably influence how distance education is accomplished. The DTV standard also provides for the use of ancillary data, including control data, conditional access control data, data associated with program audio and video services such as closed captioning, and independent program services, all of relevance to educational broadcasting.

Digital Satellite Television

Organisations in the USA such as the Hughes Electronics Corporation and Lockheed Martin are investing heavily in the development of digital satellite infrastructure.

Lockheed Martin Astrolink

In early May 1999, Lockheed Martin and collaborating companies, as part of the *Astrolink* joint venture, announced a US\$3.6 billion plan for the deployment of four high-orbit satellites to provide high-speed Internet access and broadband services. *Astrolink* services will be available not only in the USA, but also across the rest of the Americas, Europe and into Asia. The four satellites will be able to reach approximately 92% of the world's telecommunications market. This service is expected to come online in 2003. One of the key issues the consortium will have to overcome is how to price this service. Lockheed Martin's current plans are for a "by use" charge rather than a flat rate access charge. By the time the service is deployed, however, this pricing model may not be acceptable to consumers.

DirectPC

The Hughes Electronics Corporation, which owns DirectTV, the leading digital television entertainment service in the USA, is also still investing heavily in digital satellite. DirectTV provides more than 4.6 million subscribers with access to over 185 channels of programming, including popular television networks, commercial-free audio channels in digital-quality picture and sound, and more sports than any other direct broadcast satellite (DBS) service or cable provider. Hughes is involved in a number of initiatives, including linking DirectPC, its high-speed satellite Internet service, to Broadcast.com's multicast events - Broadcast.Com is the leading Internet broadcaster of live sporting events in the USA. This link-up will allow Broadcast.com's IP-based content to be multicast via satellite in high-quality digital format. Broadcast.com and DirecPC have already worked together on numerous IP multicast events, such as the Internet movie premiere of Francis Ford Coppola's "Koyaanisqatsi". These developments open up a range of possibilities for the

integration of digital Internet-based content reception with simultaneous digital television reception. The Hughes DirecDuo satellite dish allows simultaneous reception of both satellite TV and satellite Internet services.¹¹⁸

On-demand video via the web

@Home is the leading provider of broadband Internet services via the cable infrastructure within the USA. The company has partnered with RealNetworks¹¹⁹ - who produce high-quality streaming products - to merge broadband cable Internet access with multimedia. This combination of broadband cable access and audio/video streaming will compete with digital TV offerings for on-demand video and other multimedia. @Home reported its end-of-year subscriber figures for 1998 at 330,000, up from 210,000 at the beginning of Q4 of 1998. @Home has incorporated an interactive television department, and has partnered with content companies such as Bertelsmann's BOD Nederland, Segasoft, Liquid Audio, and Bloomberg. @Home's initial Internet backbone, due for deployment by AT&T in mid-1999, will support 5 million broadband users. AT&T will switch on two OC-48 (2.5 Gbit/sec) channels for @Home. Each of these channels will be available over a route of 15,000 miles of a DWDM (Dense Wave Division Multiplexing) optical network.

AT&T is also participating in the delivery of interactive content to both analogue and digital television customers through its subsidiary LibertyMedia¹²⁰ that, in turn, part-owns the interactive television company ACTV along with the company TCI (Tele-Communications Inc.). ACTV has deployed its HyperTV technology, which allows the viewer to select camera angles, commercial content, and sequence programming for live music interactive television. ACTV has also trialled its "eSchools Online" application, based on video and audio streaming of content from various Smithsonian Institutions and other museums. The Apple Corporation, Cox Communications and the US Department of Education are sponsoring this deployment.

Integration/Convergence with other digital technologies

In the USA, because the FCC has mandated the total conversion to digital, it appears that there will be pressure for consumers to replace their analogue televisions with digital sets, rather than install set-top boxes. However, the cost of digital television sets is still high at around US\$5000, so there is considerable consumer resistance. There are also considerable problems with the standardisation of set-top box components, especially for cable-delivered DTV. This is inhibiting rollout of what is seen as an interim technological solution. There is some consumer confusion as to whether a digital set-top box is the same as a cable modem¹²¹ or whether the two technologies will merge in the near future. Despite this, millions of satellite set-top boxes have been deployed, although cable set-top box deployment is still to occur in numbers. It may be that in the US cable modems - where the market grew 130% in 1998¹²² - will integrate DTV set-top box functions as the technologies converge.

Other technologies are also in the frame with DTV. The deployment of xDSL technologies in the USA, with AT&T and many of the Baby Bells having rolled out

¹¹⁸ Hughes Network Systems: <http://www.hns.com>

¹¹⁹ www.realnetworks.com (report source: CNET newswire)

¹²⁰ Interactive TV Today, 15 April 1999, Issue 1.91

¹²¹ Wired News, 1 April 1999

¹²² Dataquest, March 1999

ADSL, will also provide offerings of alternative technologies for consumers seeking on-demand television and video services. In addition Cisco Systems, one of the world's major network companies, announced in January 1999 that it is developing for AT&T a seamless end-to-end IP solution that will allow AT&T to offer data, voice and video services over the hybrid fibre-coaxial network being deployed by AT&T and TCI.¹²³

Japan

Digital TV is currently available via a number of pay TV satellite operators DirecTV, Sky PerfectTV but subscribers of these services amount to a very small percentage compared to the public service broadcaster NHK's (Japanese Broadcasting Corporation) 9.46 million¹²⁴ analogue satellite subscribers. However, digital TV is not really likely to take off in Japan until the end of 2000 when NHK plans to launch a digital satellite broadcasting¹²⁵. This will eventually include Hi-Vision (HDTV) and datacasting¹²⁶. A group of 40 Japanese investors has launched BS Japan, a joint venture specialised in digital satellite broadcasting, which would start to provide programming free of charge to build a initial consumer basis. This would comprise one high-definition channel and three conventional channels.¹²⁷

The start of terrestrial digital TV has been delayed by one to two years, to 2001 or 2002¹²⁸ with the start of regular broadcasts in 2003 in three large cities: Tokyo, Osaka and Nagoya. Full-scale deployment is due to be finished by 2006 and it is planned to switch off analogue broadcasts by 2010. There may be some further delays as Digital TV Japan, an association representing Japanese television networks, have asked the government to help foot the estimated 5.25 billion euro it is going to cost them to switch to digital terrestrial broadcasting over the next 10 years¹²⁹. Limited bandwidth is also likely to create problems for the launch of terrestrial digital TV. It appears that nearly a quarter of households will have to adjust their TV sets to receive the existing analogue broadcasting signal once terrestrial digital broadcasting starts¹³⁰.

Digital TV via cable should progressively start at the end of 1999¹³¹ However, Japan, also has a "Fiber To The Home" project that is due to be completed by 2005. This would enable any home to benefit from the 100 or perhaps 150 Mbps network¹³².

As would be expected there is little evidence of any developments towards interactive digital TV learning services. Currently NHK's Educational Channel is thinking of interactivity in terms of equipping new studios with video telephones and with

¹²³ Wired news Report, 11 January 1999

¹²⁴ Japanese Broadcasting Data <http://www.nhk.or.jp/bunken/>

¹²⁵ NHK web site <http://www.nhk.or.jp/pr/update/u55-2.htm>

¹²⁶ <http://www.nhk.or.jp/pr/update/u55-7.htm>

¹²⁷ Information Society Trends Issue number: 87 - (16.11.1998 - 20.12.1998)

¹²⁸ Wired News 25 March 1999

¹²⁹ EETimes 5 July 1999

<http://www.techweb.com/se/directlink.cgi?EET19990705S0030>

¹³⁰ Terrestrial DTV In Japan May Cloud Analog By Yoshiko Hara, *EE Times* 4 February 1999

<http://www.techweb.com/wire/story/TWB19990204S0010>

¹³¹ "Development of DTV in Europe Reference report/ 1998" Draft December 1998, IDATE

¹³² <http://www.wvvi.org/~hiyama/docs/position.htm>

computers with Internet access¹³³. However, as digital TV develops they may consider the development of interactive services as they have a mission to create the new distance learning systems in "the Digital Era"¹³⁴

3.2 Comparisons between Europe and the rest of the World

Technologies

The European Union is more diverse than the United States with developments towards digital TV. However, Japan seems to be following a similar pattern to the EU but is lagging behind in digital TV developments. The digital TV market in the EU is currently more developed than the US. But the focus of developments in the US has tended to be on more on high definition TV (HDTV). However, there are clear nationwide target dates for implementation of digital terrestrial systems. This is likely to stimulate a more rapid development of digital TV overall. There is then a strong likelihood that the US will take the lead in digital TV development and associated interactive services.

Generally Central and Eastern Europe is clearly lacking behind the EU however, but uptake of satellite digital TV is higher in a few countries compared to those in the EU.

Interactive TV Learning Services

Currently, the EU may just have the edge on the United States by leading developments. But, strategies in the US will lead to continent-wide developments and could enable the US to take the lead if digital TV uptake is rapid. However, the higher percentage of people in the US who use the Internet could restrict this type of development particular if ADSL technologies are rolled out rapidly.

There is little evidence of much activity in Japan or Central and Eastern Europe.

¹³³ <http://www.nhk.or.jp/pr/update/u55-3.htm>

¹³⁴ <http://www.nhk-grp.co.jp/n-gaku/e-fbf.html>

Chapter 4

Case Studies of Digital Broadcasting Learning Services

The following case studies have been selected to try to give an idea of the state of the art concerning the development of digital broadcasting learning services across Europe and also a flavour of developments in the United States.

As an indication of the very immature state of the market it was only possible to find one example of a digital TV interactive learning service focused towards home users in Europe. A number of other services are planned to start during the later part of 1999.

The case studies have been grouped according to the emerging new opportunities that digital broadcasting can offer. Some of the case studies include examples of fully operational services. Other examples are still at the trial or planning stage, but they do illustrate the state of developments towards utilising digital broadcasting services during the first quarter of 1999: -

- *Traditional educational channels who enhance their services by:* -
 - i. utilising the extra capacity available by increasing the number of programmes broadcast
 - ii. and may also provide some sort of interactivity via the Internet only
- *Data broadcasting services which provide:* -
 - i. high speed access to educational content on the Internet
 - ii. delivery of specific learning resources
- *New Interactive TV Services which can be*
 - i. interactive services which enable the viewer to access information independent of the TV channel
 - ii. enhanced TV services which enable the viewer to do more than passively watch a TV programme

In addition, there is also one case study of an analogue data broadcasting service that has been recently launched. As analogue services are still likely to be available in most European countries until 2010 it illustrates that there are still opportunities for utilising them for educational purposes if they are the most cost-effective way of providing such a service. (See Case Study 13)

4.1 Traditional educational channels which enhance their services

A number of public service broadcasters have been providing educational broadcasts via analogue TV for a number of years. Sometimes these have been targeted towards schools and sometimes to the general public in their own homes. The Internet has tended to first have an impact on many educational broadcasters. They have been able to provide additional information about their programmes via their own web sites. In

addition they have also been able to receive feedback via email. This is now the most common form of interactivity by educational broadcasters. The development of digital TV has enabled additional broadcasting capacity to be available to some educational broadcasters. This has resulted in the emergence of some new services like the video-clip ordering service to schools offered by the Italian public service broadcaster RAI. (See Case Study 1). This utilises the additional capacity available via the digital TV channel. It also utilises the web as a means for teachers to get additional information about programmes and immediately send their order for a particular video-clip that will then be broadcast.

Case Study 1: A near video on demand service for schools - Italy

RAI, the Italian public service broadcaster, has been providing an educational TV service (RAIsat E3) to schools via digital satellite since October 1997. It now provides two forms of interactivity to schools. One format is a so-called "near video on demand service" and the other format is a live broadcast with interactive feedback.

The near video on demand service is really a video ordering service, enabling teachers to order video clips from 4000 titles covering 27 subjects. The catalogue of offerings is accessible from the RAI educational web site.¹³⁵ Teachers can browse the catalogue and request a video clip via email. Within 10-14 days the video-clip will be broadcast by RAI Sat E3 - the teacher requesting the video-clip will have been previously informed when it will be broadcast. In addition all teachers can view the programme schedule off the web site and it is also published weekly in a national newspaper. Any teacher can record the video-clip and save it for future use. The video-clips may consist of existing educational programmes or taken from other RAI channels. All material used has been previously cleared of intellectual property rights before it is broadcast.

RAI, from within its own budget, is currently equipping 5000 schools with satellite dishes and digital receivers. Eventually all 12,000 schools in Italy could be utilising the service. As more schools can access the service, demand for video-clips has increased and programmes are now broadcast 24 hours per day. Consideration is being given to utilising a second digital channel that may make it possible for a teacher to receive a video-clip within a few hours of making a request via email. All the programmes broadcast are "free to air". There are plans to develop a Pan-European Service if there is the co-operation of other public service broadcasters.

The channel also broadcasts two hours of live programmes five days a week. These programmes are produced with school children that travel to one of two studios in Italy. The children choose the topic and other schools or experts interactive with the studio during the live broadcast via telephone, email and video-conferencing links.

Digital TV is also resulting in a changing role for many traditional public service educational broadcasters who may face new competition as in the case of UR - the Swedish educational Broadcaster. (See Case Study 2). South Carolina Educational Television, a US based PBS educational and community broadcaster, since 1960, has taken the opportunity to change in order to meet the US authority deadlines for conversion to digital TV before May 2003 (See Case Study 3).

A number of distance teaching universities have also for many years been broadcasting course related programmes through their public service broadcaster. Recently many have also been making extended use of the Internet to provide additional information to their students and receive feedback from them. Digital TV provides more opportunity for them to broadcast more programmes. It could also

¹³⁵ Web site: <http://www.mosaico.rai.it>

Case Study 2: Changing role of a traditional Public Service Educational Broadcaster - Sweden

UR¹³⁶ is a traditional public sector educational broadcaster in Sweden and currently the only one in existence. It has been operating as a separate company since 1979 but educational broadcasting started in 1926. UR is being broadcast at certain times on two of the public service channels SVT1 and SVT2. However, from September 1999 it will get new competition from Kunskaps TV (Knowledge TV) which won a government licence to take up an its own digital terrestrial channel. UR also bid this licence but was unsuccessful. Since then the government has allowed UR to act as public educational broadcaster another three years 1999-2001 in line with SVT and SR (Swedish Radio). Since April 1999 UR has provided broadcasts from both digital terrestrial and satellite. The output is more or less the same as the output in the analogue channels.

UR is keen to take part in developments towards "flexible learning" and actively work with a new media pedagogy that can be used in schools, universities and for the broad groups of adults. As a response to these developments UR will change its programme output and format. It will also co-operate with different user groups.

The programs will be more interactive involving users as part of the production process. For example a student watching a programme will be able to display their thoughts to other students on the common web page/TV. The broadcasting company will become more like an administrator of the learning process than a program producer. However, this does raise some legal aspects: Who will be responsible for the broadcasting in this interactive world?

UR has been reviewing its role as an educational broadcaster in the future. It considers that if people want to study on their own flexible conditions, the output from the educational broadcaster must be available as an easily accessible resource. There will be three important elements of the future service:

1. digital TV and radio broadcasting
2. additional services via web, TV and radio
3. media library with all the programs and additional material and information

What the different parts will contain is difficult to define at this moment. It depends on the direction of the technical development and the interaction with the different user groups. At the same time it will also need to provide parallel analogue broadcasting for several years.

Studies made in Sweden and UK about the attitude of the audience to digital TV show that the audience first of all expects a better quality of picture and sound. An important task is, within available bandwidth, to develop different services without decrease in the technical quality of the programmes. The ambition of UR is to offer different possibilities for deeper learning and additional information. Together with the media lab of SVT, different solutions for additional services are tested from both the technical and human aspects.

The strategy of UR is to use the terrestrial network, satellite, cable and Internet to reach the different user groups and increase the availability of service to them. All digital interactive projects for digital TV will during the coming years also be available on the Internet. But, even if the borders between television and data communication are becoming more and more diffuse, the available equipment in the homes and in the schools and institutions determines the types of programmes offered by UR. Media habits, interest and ability to absorb the new possibilities are the key factors in the process of new pedagogic services.

The digital broadcasting of UR will during the coming years concentrate on broadcasting mass communication. Set-top boxes with built-in telephone modems give the possibility to communicate with other people and the Internet. The good relations developed with their user base, which is being built up through the Internet service, will eventually strengthen through direct connections to the digital TV programmes.

An important task for UR as a public service company is to offer different combinations of broadcasting and web solutions. The different development projects within UR aim to integrate the digital broadcasting (radio and TV) with the web production and teletext development. As a consequence of this, all programme information can be found in one database. Increasingly, complete courses utilising radio and TV programmes will become available on the web. During the year 2000 several TV programmes will be distributed in the 16:9 (HDTV) format via digital terrestrial and satellite broadcasting. UR will carefully study their effect on learning.

¹³⁶ Web site: <http://www.ur.se>

Case Study 3: An educational and community broadcaster migrating to Digital TV - South Carolina, USA

South Carolina Educational Television - SCETV¹³⁷ - is a PBS educational and community broadcaster based in Columbia, South Carolina with a long history in educational television stretching back to 1960 when the South Carolina General Assembly created the South Carolina Educational Television Commission. It broadcasts programmes over the PBS satellite network and over its own closed circuit network.

SCETV has embraced the migration to digital TV deadlines set by the US FCC and will convert to DTV before May 2003. The organisation has budgeted \$41 million over the 5 years of conversion (this figure will cover merely the purchase and installation of new equipment and does not include personnel or operational costs). Some of this funding will come from US Federal funds, some from South Carolina State funds. The digital conversion means that many of SCETV's educational services, currently available only via its closed circuit system today, will be universally available in the home. The conversion to digital broadcasting will extend the value of South Carolina's investment in SCETV's existing infrastructure giving it greater reach and enhancing its offerings.

Using new DTV technologies, during the day SCETV will be capable of providing up to six simultaneous channels of educational programming. At night SCETV has the potential to broadcast in high definition television with crystal clear pictures and CD quality surround sound. Complementary datacasting means viewers could receive printed materials through their television sets or computers.

There are three new broadcast options available with digital transmission: multicasting, High Definition TV and datacasting. The digital transition plays an important role in SCETV's ability to continue to meet its mission and educational obligations to the state with universal access to every home in the state with a television. ETV proposes that the network operate a high definition signal during prime time along with one standard definition channel. At all other times the network will operate in a full multicast mode offering a minimum of four simultaneous channels of standard definition programming. The prime time programming will consist mainly of pass-through HDTV programming directly from PBS with some limited local production playbacks. The data component could take the form of printed material like program transcripts, computer software, or Internet-like web pages that complement the program airing.

SCETV currently offers a range of educational programmes including its "Ready To Learn" programme for pre-school children. It is envisaged that these offerings will be enhanced and made available through digital TV. SCETV is also looking at the possibility of providing services such as a "university of the air", a South Carolina "C-Span" to broadcast state legislative proceedings, adult and community education classes, and a range of other information and education services. The organisation is looking at using at least one channel purely for data transmission. Services such as paging could be offered over this channel.

provide the opportunity for interactivity. However, they may not actually want to take up this opportunity, as interactivity via the Internet may be most appropriate for their needs. Most students are now likely to have a computer for their studies, which for a small additional cost can provide access to the Internet. (See Case Study 4).

4.2 Data Broadcasting Services

It has been realised in some more remote regions of Europe high-speed access to the Internet via cable networks or the emerging ADSL technologies may not be possible because of the cost of providing such services. However, digital-broadcasting technologies particularly utilising a satellite does make it possible to obtain higher speed of access than is currently available. Such a service is being provided by TPS, a pay-TV via digital satellite service provider, on experimental basis to 100 high schools in remote regions. (See Case Study 5)

¹³⁷ Web site of SCETV: <http://www.scetv.org/dtv/>

Case Study 4: A university learning channel - Italy

Consortio Nettuno consists of a network of 34 out of 56 Italian universities, 8 Albanian universities, RAI (the Italian public service broadcaster) and Telecom Italia. Since October 1997 it has been offering distance learning courses via a digital satellite channel provided at low cost by RAI. There are now 6000 students registered for various university level diploma courses in various specialist areas like engineering courses, geographical information systems and tourism and cultural heritage. The students are actually registered with a specific university of their choice and will receive their diploma via that university and not directly from Consortio Nettuno.

Consortio Nettuno provides a co-ordinating role for the distance learning courses and centrally organises the broadcasting and manages the web site. It also has studio facilities where university lecturers can record their presentations. Although the lecture style approach is primarily used, increasingly computer graphics and video clips are being included to enhance the presentation, within certain cost limitations. Consortio Nettuno can also provide advice and guidance on appropriate techniques for television presentations that can be produced at lower cost compared to normal television productions. Some universities also have studio facilities, and costs are also kept down by using students as part of the production team.

Students follow a three-year diploma course that consists of between 6 and 10 modules per year. Each module consists of 40 hours of broadcast material. Therefore the TV channel is now broadcast 24 hours per day moving to a new module about every month. As the channel is "free to air", anyone with an appropriate satellite receiver is able to watch the TV programmes. Registered students also use printed material and additional information is available on the web site including discussion groups.

The TV channel does not have an interactive service and it is unlikely that this will be developed in the future. Most registered students will already have a computer for writing their assignments and many may already have access to the Internet. Therefore it seems that the Consortio Nettuno web site is likely to be the most appropriate way of providing interactivity for learning rather than moving the interactive services to the TV system at additional cost.

Case Study 5: Internet via Satellite to high schools in remote regions - France

TPS (Télévision Par Satellite) is a pay-TV via digital satellite service provider that has been operating in France commercially since December 1996, with over 650,000 subscribers. It offers over 90 channels consisting of national French channels, thematic, music and movie channels. In addition it is also offering its subscribers interactive services in the form of home banking, stock market and a weather channel. Although as yet it is not planning to offer an interactive learning channel, it is managing a trial for schools sponsored by the French ministry of Education. As a young company TPS has been able to offer new commercial services within six months of conception.

TPS are managing a consortium of companies who are providing an experimental service called SAT&CLIC for high schools and universities. It is planned to offer the experimental service to 100 high schools by June 1999. Schools have been selected for the trial if they are in remote regions where they are only likely to have low speed access to the Internet - because they will not have access to cable networks or ADSL technologies will not be easy to install. The service will offer access to the Internet via satellite, specially focused towards educational materials and information about what educational programmes are on offer via the TPS bouquet of channels.

Schools are being provided with a satellite dish consisting of two LNBs - one to connect to the digital set-top box and the other to connect to a multimedia computer to receive data from the Internet. The return channel to the Internet is via a normal telephone line.

An electronic programme guide has been prepared specifically for education-related programmes within the TPS bouquet of channels. This will help teachers choose what video material is available to them and it links them to the channel providers own web site. This information can be accessed via the television or via the computer.

In the UK, Espresso is providing a specific video rich multimedia content to enhance teaching and learning in English primary schools. The service utilises data broadcasting to deliver the material to schools. (See Case Study 6).

Case Study 6: Multimedia teaching and learning resources via satellite - UK

Espresso for Schools is a service which is being developed for English primary schools (7-11 years) to enable them to receive regularly updated video rich multimedia to enhance teaching and learning in the classroom. Although it is currently in its pilot phase there are plans to offer a fully sustainable service to primary schools within local education authorities who buy the service from September 1999.

The service utilises data broadcasting to deliver the material to the schools using a service provided by Astra-Net (based in Luxembourg). The service is designed to help children relate what they are learning in class to what is happening in the outside world, by providing regular news, web and TV updates and linking them to curriculum modules. In order to receive the service each school requires a PC containing a DVB card (approximately 225 euro) linked to a satellite receiver (approximately 300 euro including cable) pointing to an Astra satellite. The PC could be connected to a Local Area Network for distribution of material to other computers.

Espresso is both a service and a content provide - in fact the most important component is the content. Video is carefully edited to interest and illustrate particular points in the curriculum. Each video clip can be played full screen on the computer at near-video quality, as well as rewind and fast-forwarded. Each video segment is linked to activities, word games and further information resources that are aimed at challenging pupils' understanding of concepts and terminology. Most new material is sent weekly to the schools via the satellite with short bursts of updated material sent occasionally in between.

The pre-launch pilot - which is partially sponsored by the British National Space Centre and the European Space Agency - will eventually involve 200 primary schools in 18 English local education authorities. However, an initial 900,000 euro has been secured through Babcock & Brown (the international financial services company) for the full launch phase in September 1999. The launch of Espresso for Schools comes as the UK government is investing up to 1.5 billion euro in the National Grid for Learning (NGfL) to enhance the use of computers and information technology in schools. Espresso for Schools believe they have satisfied a key requirement of the NGfL - the provision of exciting and relevant educational content to enable the full and creative use of new electronic hardware.

In addition Espresso for Schools has also received accreditation by the Teacher Training Agency for providing teachers with materials to show them how they can incorporate the use information and communications technologies within the curriculum.

Trials are also taking place using cable modems for delivery via cable and there is also a planned trial for testing out ADSL technologies. However the satellite broadcast - point to multipoint - is still considered the most appropriate means of delivery.

4.3 New Interactive TV Services

As of mid 1999 there appears to be only one example of a digital educational interactive service operating in Europe. This is being offered by Stream - the Italian commercial service provider. They have an interactive service that enables the viewer to answer questions and receive limited responses from their set-top box. (See Case Study 7) However, this service currently does not make use of a return channel via a telephone. The viewer only really interacts with the content that is downloaded into the set-top box which is updated with downloads from the satellite at regular intervals.

One of the first interactive services that does make use of the return channel is likely to be NTL's Knowledge Channel in the UK due for launch in the Autumn of 1999. (See Case Study 8) It will operate on all three platforms cable, terrestrial and satellite. The return channel for terrestrial and satellite will be via a telephone line connected to the set-top box. As cable has the capability for a return channel this will also be used.

Case Study 7: Interactive Language Learning - Italy

Stream is an Italian commercial service provider offering a bouquet of channels for a fixed subscription to the Italian home user market via cable and satellite. Currently it has about 150,000 subscribers. Within its bouquet of channels is a language learning channel - TVL (TeleVision Language) - that offers various programmes aimed at helping Italians learn English and other languages. This has been on the air since 1998 and is broadcast 24 hours a day with the programmes repeated regularly.

In addition there is a separate interactive learning channel - TVL Interactive - which provides learning reinforcement. This consists of text and graphics but with no video or sound - however, sound is planned as an enhancement at a later stage. The channel contains a number of modules consisting of various topics each containing questions of different levels of difficulty. Using the remote control a home user can select a module from the menu. This module is then downloaded into the memory of the set-top box in the home. The level of difficulty can be chosen and the questions can be answered all using the remote controller. The home user is told via the screen whether the answers are correct or not and explanations are also given. The total results are presented on a scorecard. In total there are 200 different exercises available and documentation is also provided in the Stream interactive TV magazine.

Modules are broadcast on a carousel basis, rather like teletext, so that there may be a short pause until the software for the module has been downloaded. The interactivity is achieved through this module software - the set-top box does not need to be connected to a telephone line. However, as the set-top box only has a limited amount of memory it can only hold a module of a limited size before it is overwritten with another module that is required.

All the modules are replaced every two weeks with a new set of questions enabling the user to repeatedly return to the interactive channel. Neither the TV nor the interactive channel contains any advertising. In 1996 some research was conducted into the potential market of about 2,000,000 families in 19 Italian cities. It was found that 60% were strongly interested in a language channel and that it had the potential of doubling the number of subscribers to the bouquet of channels.

During 1997 the possibility of an interactive broadcast video channel was examined and experimented with utilising subtitles, a glossary, and help applications linked with the broadcast video. A second format used two video and audio flows where the user selects one of two possible presentations with exercises.

However, the results of the quantitative research indicated that people wanted to watch one TV channel and that interruptions in video flow had a negative impact. They preferred to just watch the TV programme and then have the option at a later stage to use the interactive service. Therefore in the design of the service, interactivity was not included as part of the TV channel.

Future plans include utilising a return channel (via a telephone line) for remote tutoring, feedback to editorial/teaching staff in Stream and for storing results of the exercises to enable evaluation.

Knet will run Sweden's Knowledge TV as part of its commercial learning service. It will be launched in September 1999 when it is firstly utilise its existing web site for interactivity. Then feedback facilities via a telephone line will be added to enable learners to respond during the programmes - thus moving towards interactivity through enhanced TV. (See Case Study 9)

PBS in the United States has started some nation-wide educational trials using interactive enhanced TV programming but early experiments have required the use of a computer capable of receiving the digital TV signals. (See Case Study 10)

Case Study 8: Knowledge Channel, an Interactive service from NTL - UK

NTL's Knowledge Channel - an interactive education service for parents and children - is due to be launched in time for the 1999/2000 academic year. It will be launched in partnership with two leading interactive education publishers, Dorling Kindersley and AngliaCampus, who will supply key content for the interactive service. NTL Interactive is a provider of TV-based on-line services to the home via three different TV platforms: analogue terrestrial TV, digital terrestrial TV, and the medium most suited to interactivity, digital cable TV based on established Internet standards. NTL's interactive TV services were first launched on 31 March 1999 through the analogue service with various interactive services including Entertainment, News, Sport, Travel, Local and Shopping. Knowledge and Games will join them in the autumn of 1999 utilising the digital terrestrial and digital cable networks.

Although called the Knowledge Channel it is in fact an interactive service. The underlying philosophy of the Knowledge Channel is to provide an educational resource that the whole family can use and trust. It will become an everyday educational tool, especially useful for those without PCs at home. At launch, subscribers to NTL's service will be able to view TV-friendly versions of the latest primary and secondary Maths, Science and English curriculum content, with other subjects following shortly after. Subjects will be categorised according to the English National Curriculum key stages where applicable.

It is planned that educational material will be presented in a "simple-to-digest" tutorial and lesson format, giving parents, teachers and children access to a new method of learning with an element of fun. Easy-to-read text and colourful images (with sound and video clips in later versions) will be used to bring the interactive lessons to life and, for children of primary-school age, tutorials will be given an added twist by playing the Dorling Kindersley interactive quiz. As the channel develops, NTL will be offering lifelong educational services to viewers, "from the nursery to retirement."

AngliaCampus, claimed to be the UK's largest on-line education service, will provide NTL viewers with selected subject content to support 11-16 year old students. Written exclusively for AngliaCampus by a team of over 60 teachers and subject specialists, educational modules extend to thousands of pages, providing important resources to support the school curriculum. The resources will support homework, project work, standard assessment test (SAT) preparation, exam coursework and GCSE revision. AngliaCampus already offers a web-based and CD-ROM service for schools and aims to use the TV-based service as a taster for households eventually buying the full service via the web or on a CD-ROM.. Future services could involve electronic commerce services for learning and the delivery of video-based curriculum resources along with web-based interactive services.

Dorling Kindersley, a leading international publisher of illustrated books, CD-ROMs and videos, is a specialist in the children's education sector. Dorling Kindersley's objective is to provide "a breathtaking learning tool that's both an invaluable reference source and great fun to use". To achieve this they will be providing NTL's viewers with access to a host of curriculum content tailored for children of primary school age from their renowned Children's Encyclopaedia and other CD-ROMs. The whole viewing experience will be enhanced by the presence of "Seemore Skinless", Dorling Kinderlsey's award-winning cartoon character. He will act as a guide to help children navigate through the content and as the host for an interactive knowledge quiz created specifically for TV, which will excite and stimulate the learning experience.

Case Study 9: An educational company with a learning channel - Sweden

The commercial company Knet will broadcast KunskapsTV (Knowledge TV) via a terrestrial digital network from September 1999. However, Knet should perhaps not be considered as an educational TV channel but rather as a company which uses a digital TV channel as one of its educational tools to satisfy the learning needs of their customers. Knet is planning to use the Internet and web-based learning material, multimedia products (such as CD-ROMs and DVDs), books and other printed material, the digital TV channel and even conventional tuition.

Knet has delayed the start of its broadcasts until the beginning of September 1999, thus avoiding the summer period, which is not a traditional time for learning in Sweden. However, it launched its web site in April 1999¹³⁸ - eventually this will be used for interactive learning.

The set-top box will also be connected to a telephone line enabling the subscriber to select simple responses to various questions presented during the programme. It will also be possible to send email messages and order a CD-ROM or a book but there will not be any acknowledgement through the TV set. Further enhancements to the set-top box are planned in conjunction with other digital channels.

Knet faces two major challenges before it can become fully sustainable. It has had to raise venture capital in order to cover start-up expenditure and it also needs to attract enough subscribers to its services. It appears to have overcome the first hurdle as it has now raised 6 million euro.

¹³⁸ Web site: <http://www.kunskapstv.se>.

Case Study 10: Moving to Digital Learning Services, PBS - USA

The Public Broadcasting Service (PBS), based in Alexandria, Virginia, USA is a private, non-profit organisation owned and operated by the 350 public television stations throughout the USA. Seen as an important community resource, PBS is fusing non-commercial television, the Internet and other media to provide a portfolio of entertainment and education services. PBS is available to 99% of US homes with televisions and to an increasing number of digital multimedia households. In all, PBS serves nearly 100 million people.

PBS sees the conversion to digital technologies as an opportunity for its member broadcasters to expand their offerings to their viewers. Not only is the facility for HDTV transmission an opportunity for the US public broadcasting service, but the facility for multicasting is also seen as an important development. For instance, broadcasters will be able to transmit multiple channels of Standard Definition TV (SDTV) simultaneously when not transmitting in high definition TV (HDTV). Although SDTV does not match HDTV in quality, it will offer a higher quality picture than is currently transmitted. It also means that with multicasting technology, the local PBS stations will be able to transmit several programs with supplementary data simultaneously. A student who finds a particular PBS show of interest will also be able to download a CD-ROM's worth of supplementary educational and interactive material while the program airs.¹³⁹

As a consequence of the US government's firm commitment to digital TV, the PBS has established the PBS National Datacast system. This is a for-profit subsidiary of the organisation and offers real-time data broadcasting services through a partnership with its participating PBS member stations. Distribution of electronic information through PBS National Datacast is planned to provide a variety of offerings available via subscription or advertising-supported "free" services, such as: financial, news, sports, entertainment, weather, electronic TV program guides, health and educational services, software updates, training, corporate applications, Web sites, CD-quality video and music, electronic shopping and other services.

In January 1999, the Intel Corporation and PBS¹⁴⁰ jointly announced the first enhanced digital TV program for children. The new program, called "Zoboomafoo", builds on the success of the first nation-wide enhanced digital TV broadcast carried out in November 1998.

This interactive enhanced programme, scheduled for broadcast later in 1999, offers an example of the opportunities for educational interactivity both during and after a digital TV broadcast. During the broadcast, companion data will be transmitted simultaneously as part of the television broadcast to computers capable of receiving the digital signals. With these PCs, Zoboomafoo viewers will be able to interact with on-screen animations that come to life with a mouse click; assist the programme's hosts to solve problems and answer questions; or play an interactive on-screen game. Children will also be able to collect enhanced audio, video or graphical media in the form of souvenirs, which they can interact with after the broadcast. There are also plans for the young viewers to be able to control activity during the programme through an activated 'toy' they can hold and manipulate.

Two new educational channels in Europe due to be launched in the near future have plans to offer interactive and enhanced TV services. The format that this will take has yet to be fully defined and will be dependent upon experiments as to what is most appropriate for the type of learning experience being provided.

IQ-TV based in Germany has plans to utilise a full digital transponder that will support 6 to 8 programme or data channels. (See Case Study 11). The Wales Digital College seems to have the most pioneering plans. It will actively try to capture the interest of the passive viewer of entertainment programmes through enhanced TV and offer them various types of learning experience. (See Case Study 12)

¹³⁹ PBS Digital TV Web site: www.pbs.org/digitaltv

¹⁴⁰ PBS Press Release " PBS and Intel collaborate on enhanced DTV program for children" 17 January 1999 found at <http://www.pbs.org/insidepbs/news/zoboomafoo.html>

Case Study 11: A vocational training and further education channel, IQ-TV - Germany

Although not operational yet, IQ-TV (Interactive Qualifications TV)¹⁴¹ is being established as a separate company by a private-public partnership of 15 companies and institutions. The concept was conceived by SWR (Sudwestrundfunk) - the public broadcaster in based south-west Germany. SWF is part of the (German Public TV) ARD network and one of the few TV stations that has offered educational programmes since the 1960s. It is planned that IQ-TV will offer an integrated, interactive platform for vocational training and further education that will enable private, state and public sectors to offer their programmes using a digital system. It claims that it will be able to offer high powered and cheap solutions to meet the requirements of universities, business, educational television and to promote commercial educational institutes.

IQ-TV plans utilise a full transponder on a digital satellite that will support 6 to 8 programme (data) channels, as well as an electronic programme guide. This television service could be complemented with other digital services, such as Internet and Intranet and satellite return channels, thus making it interactive. The services are likely to be broadcast via one of the Astra satellites, enabling them to be accessed across the whole of Europe. The electronic programme guide is considered to be important as it will enable easy access to the variety of programmes on offer.

IQ-TV plans eventually to offer to the workplace and the home, free-to-air, encoded and pay-TV programmes under the following categories:

- Business TV
- University TV
- Educational institutes
- Conventions/conferences via TV
- Data services
- Commercial educational channel
- Public Service

Initially, IQ-TV will provide programmes for small and medium enterprises (SMEs) based in Germany. It will soon receive funds from the federal and regional governments to support this initiative for SMEs. These are planned to start towards the end of 1999.

Case Study 12: An interactive educational channel for Wales - Wales Digital College

The Wales Digital College has been established as a joint venture with the aim of combining the services and skills of educationalists, trainers, business and industry, BBC Wales and S4C to provide a first class lifelong learning service for TV viewers. Digital television is seen as becoming a virtual "front door" to education reaching 1.2 million households. From September 1999 onwards it plans to trial out a number of interactive learning services through a number of digital TV platforms.

Potential students watching digital broadcasts in their own homes through digital terrestrial TV, satellite or cable will be able to use their remote controls to access a range of innovative interactive skill-developing services. Eventually, it is planned to offer the following services: -

- TV programmes
- Key contacts with hyper links to service providers
- Advice and guidance
- Video tasters
- On-line and downloadable skill packages
- On-line assessments
- Instant on-line booking, registration and transaction systems
- A range of access languages
- Webcasting of selected items from course providers web sites
- Filling in job application forms and CV's to be instantly sent to potential employers

The College has started from the perspective of what aspects of interactivity it would like to make available to attract and engage TV viewers as learners. It is now in the process of testing out what is now possible and what will become possible as the technology develops. The College will also make full use of the Internet, phone and fax services, paper based materials, and of course face-to-face experiences in learning centres. Colleges, community education centres, training agencies and schools will also eventually be able to access and store Digital College materials for in-house use.

¹⁴¹ <http://www.iq-tv.de>

It is planned that the Digital College logo will appear in the corner of the screen when educational or training programmes are broadcast or whenever popular general programmes are discussing an issue that could lead a viewer towards a new skill or interest. Clicking on the logo will give viewers access to additional information. As the technology develops hyperlinks may be created between some commercial services and the Digital College so that a viewer booking a holiday in Spain, for instance, is instantly made aware of Spanish courses.

The Wales Digital College will enable course providers will have a live and effective interactive access medium for all their courses and study programmes. Potential students will be able to choose courses, discuss funding, and arrange visits and book places without leaving their living rooms. Course providers will also be able to deliver parts of their courses and arrange back up and reference materials on-line.

Where student numbers tend to be low (e.g. in the case of some Welsh medium courses), providers in different areas could work together to provide effective interactive multimedia experiences. In time, direct links could take students straight to provider Internet sites.

Some providers may wish to take advantage of opportunities to target new markets for their distance learning courses outside their normal catchment areas or to establish new joint study schemes with colleges in other parts of the country. On satellite, the Digital College could reach out all over Europe - and through a choice of languages.

The College has received some initial funding from the government's Welsh Office and is only seeking industrial and commercial partnerships, through commercial services and from public sector funding channels including European sources. However a number of critical factors are coming together which are likely to make it possible for an interactive learning service to become full operational and sustainable in Wales.

A recent review of post 16 education in Wales is calling for a reorganisation of funds at this level. Since May 1999 Wales now has its own Assembly for national government including education. It is likely that the Assembly will want to have an integrated and co-ordinated approach to lifelong learning encouraging co-operation and the sharing of resources. This could result in the reallocation of funding releasing existing mainstream funds for the sustainable development of the Wales Digital College.

The Welsh medium Channel - S4C - which, has been broadcasting for a number of years over analogue terrestrial throughout Wales, has been provided with a digital terrestrial channel for its own usage when the UK government were distributing the bandwidth. In addition, it also has two digital satellite channels from Sky Digital. It is currently broadcasting over the whole of the UK. Therefore S4C has spare capacity to broadcast educational and training activities in addition to its normal schedule.

The vision of an educational channel by Huw Jones, the chief executive of S4C and the combined interest of Welsh education institutions have led to the formation of the Wales Digital College. In addition there is also the vision that Wales could become a worldwide centre of excellence for learning with the ability to export its knowledge and know-how. From September 1999 the College will start broadcasting via satellite for about three hours per day on S4C2 which will also carry live broadcasts of the Welsh Assembly. In addition the College will also broadcast on digital terrestrial and on the cable networks.

It has still to be decided how the UK government's University for Industry (Ufi) initiative will link in with the Wales Digital College but the two bodies are working closely together in order to provide complementary services in Wales.

Case Study 13: Delivery of examination papers to 2000 schools - Greece

Utilising the EdCast system developed by an Irish multimedia data broadcasting company, the Greek Ministry of Education has entered into a contract with Bocom International worth approximately 550,000 euro. The EdCast system is being used to delivery examination papers to 2000 schools across the country in an encrypted format. Following a three-month trial period the EdCast system successfully passed the stringent performance requirements of the new Ministry communications specifications. Low cost, speed and ease of access as well as the high reliability of the system performance were cited as reasons for choosing the system.

There are also plans for a similar type of service in Ireland for the distribution of educational content.

Chapter 5

Understanding the Development of the Market for Interactive Services to the Home

This previous chapter has provided a number of examples of the types of interactive learning services that are beginning to emerge through the use of digital broadcasting services. However development of the market for digital TV interactive learning services in Europe is very much dependent upon the development of the broader market for interactive services to the home.

This chapter aims to provide some observations and trends for the development of this broader market in terms of: -

- Online Internet based interactive services
- TV based Interactive Services

5.1 Some trends and observations

Uptake of interactive services via computer predicted to continue for the foreseeable future

Although most European households have access to a television as the table (Figure 5.1) below shows, uptake of interactive services is only just beginning to develop.

Figure 5.1 Household appliances - % in European homes (Source Ethos ¹⁴²)

Household appliance	Percentage of European homes
Telephone	90.7
Television	98.2
Cable Television	43.4
Satellite Television	13.7
Video Recorder	61.1
Personal Computer	27.7
Video Games	17.2

Uptake of interactive services via a computer is greater despite only just over 25% of European households having a computer. This is confirmed by a report by Datamonitor¹⁴³ who predicts that this will continue for the foreseeable future with the growth in online-enabled computer households starting to reach its peak by 2002.

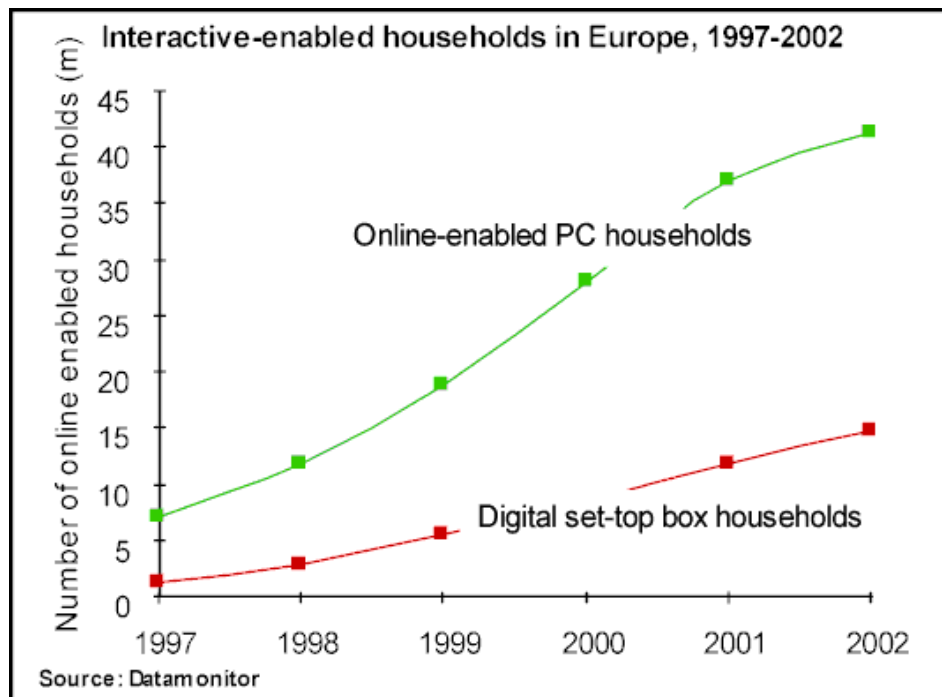
However, Datamonitor considers that the computer will remain the dominant platform for residential access to interactive services partly due to the higher current installed base of computer/modem households and partly due to the sluggish development and up-take of digital TV offerings in Europe. By the end of 2002, there will be 40 million

¹⁴² "Interactive Television Report", Ethos, November 1998

¹⁴³ "Consumer interactive services in Europe to 2002", Datamonitor Report, December 1998 - taken from Press Release "There will be 55 million interactive services households in Europe by the end of 2002", 14 September 1998

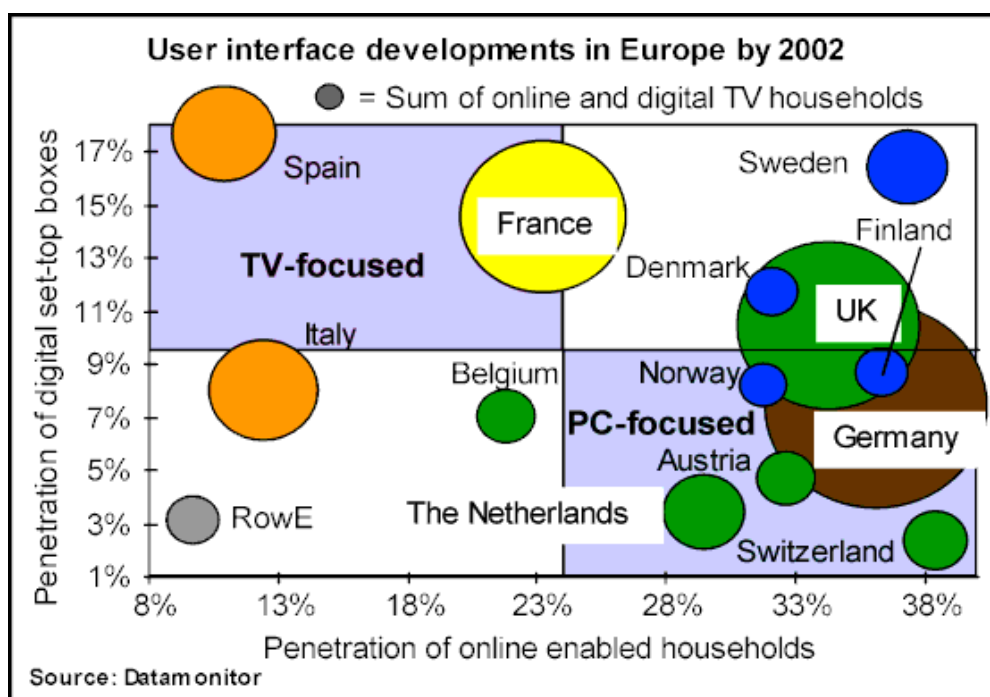
online-enabled PC households in Europe, compared to 15 million households with digital set-top boxes. (Figure 5.2)

Figure 5.2



Datamonitor considers that there will be regional preferences for using either the computer or the TV as an interactive service retrieval device that will influence the business opportunities for device vendors. As the Figure 5.3 shows, France, Spain and Italy will be TV-focused, with more interactive TV households than PC ones. The PC as a consumer interactive device will dominate in the German-speaking markets. The UK, along with Sweden, will show a high penetration of both interactive technologies. This has implications for those considering developing interactive learning services.

Figure 5.3



Spreading the risk

It is very important to have some understanding of the dynamics of the market place for digital broadcasting technologies. With the exception of demand for high-speed access to the Internet, the home consumer is not demanding interactive TV services. Suppliers have to create new markets for such services and create a critical mass of early adopters before they can create a secure foothold in the market. Therefore all key players entering the market place through a number of different channels in order to spread the risk to themselves. This is resulting in a number of key players with a recognised brand name for one sector in this market place also investing in other sectors, which they may have once considered as competitors. For example:

- Cable companies are also involved in digital terrestrial developments.
- Terrestrial broadcasters including public sector broadcasters are involved in satellite and cable developments to transmit their services.
- Telecom and IT hardware companies have made investments in digital broadcasting developments.
- Software companies - Microsoft, etc - have also made investments in digital broadcasting developments

In fact this is also linked up with the wider developments of convergence between the TV and the PC in the home as well as the development of mobile communications. Many companies are now considered to be integrated communications companies. It is very important for education and training providers not to “badge” or typecast a company or organisation as just providing one type of delivery mechanism.

Data broadcasting separate from digital TV

Providers of “satellite direct to PC” type services have largely operated as a separate market from that for the development of digital TV services. This is mainly because they have tended to offer their services to businesses although they are increasingly focusing on the home consumer with so-called “turbo Internet” type services. Curiously in Europe they have tended not to join forces with those offering digital TV services, which is particularly odd since both require similar equipment and both sectors could gain from each other’s services. One factor may have been because “satellite to PC” services to the home has tended to be a very niche market compared to the Digital TV market. Providers of Digital TV services would also have their plans for offering interactive services including Internet services. However, in the United States some operators are starting to co-operate together - some like Hughes even offer both types of service - and there are signs that this may happen in Europe.

Broadcasters act as gatekeepers

Broadcasters are the prime gatekeepers of interactive TV services to the home. As they have done with traditional television they want to control what the user has access to as well as the quality of the services on offer and the development of these services. This clearly differs from access to interactive services on the web where the user has been actively involved in the innovation process as the services develop and evolve. This is may be a critical factor in the market uptake of interactive broadcasting services in general and could impact, adversely, on the development of learning services.¹⁴⁴

¹⁴⁴ Stewart, James, August 1998

Dominant Internet players will emerge and compete with broadcasters

According to Strategy Analytics,¹⁴⁵ by the new millennium most of the World's leading Internet players will have merged with complementary vendors in adjacent positions in the industry value chain - resulting in large dominant players. This process is also likely to involve web content providers who may eventually start to seek other channels through which to make their content available. The TV is a key possibility as there already are a number of offerings on viewing the web via a TV. services that many European broadcasters are expecting to offer for free.

Interactive services predicted to be available to 25% of European and US households by 2003

A Datamonitor report¹⁴⁶ also predicts that by 2003, service providers will be able to offer interactive services such as e-mail, interactive shopping and banking and web access via the TV set to one in four households in Europe and the United States. With television penetration close to 100% in Western Europe and the US, Datamonitor considers that the market for interactive TV will grow at a rate of 45% over the next five years, generating attractive revenue opportunities for the digital television and Internet industries. By 2003, more than 67 million households in Europe and the US (Figures 5.4 & 5.5) will be able to use interactive TV services including e-mail, interactive commerce and games. Although interactive digital TV services will be mainly exclusive, "gatekeepered" services, run by broadcasters and specialist service providers, in the short-to-medium term, Datamonitor expects unrestricted TV-based Web access in Europe and the US to increase from 790,000 households in 1998 to 10.9 million in 2003. The total user base of interactive TV services, including digital TV and dedicated Internet ones, will be largest in the US, followed by the UK and France.

Figure 5.4 Total interactive set-top box installed base in Europe and the US 1998-2003

000s	1998	1999	2000	2001	2002	2003
Dedicated STB	800	1,400	2,300	3,500	4,900	6,300
Interactive digital STB	9,500	16,700	26,500	37,700	48,400	60,800
Total	10,300	18,100	28,800	41,200	53,300	67,100

However, the strongest growth will be seen in the southern European countries such as Spain and Italy. This may have something to do with a lower penetration of computers per household.

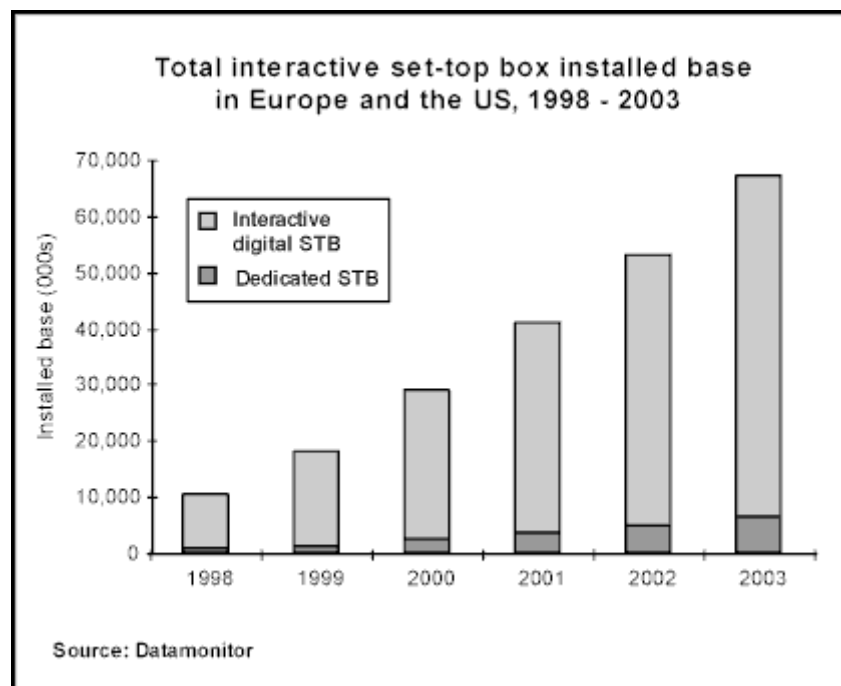
Interactive services will become an essential feature of digital TV services from broadcasters, in particular digital cable TV operators, to attract more subscribers, and to establish a new source of differentiation and income. They will form part of television subscription packages and reach consumers as a bundled service together

¹⁴⁵ "Mergers within the Internet Industry Value Chain: Strategies for Success", Report by Strategy Analytics - information based on Press Release, 5 May 1999: <http://www.strategyanalytics.com>

¹⁴⁶ Datamonitor Press Release "Interactive digital television services in Europe and the US in 2003", 10 May 1999 - referring to report "Interactive TV markets in Europe and the US, 1998-2003"

with television programmes. In contrast, dedicated Internet TV services have to be viable stand-alone.

Figure 5.5



The interactive digital set-top box will dominate the interactive TV market. By 2003, Datamonitor estimates an installed base of 61 million in Europe and the US, almost ten times bigger than the dedicated Internet set-top box installed base (6.3 million).

The success of dedicated Internet TV services will rely on the backing of major ISPs, such as T-Online and AOL, and content providers (e.g. banks, retailers). In the medium-to-long term increasing competition from large digital TV broadcasters will limit their growth which will peak in 2002 as the market approaches saturation. According to Datamonitor, with increasing Web access and other interactive features offered through digital TV services, the dedicated Internet set-top box will lose market share and its functionality will migrate into the digital TV set-top box in the long term.¹⁴⁷

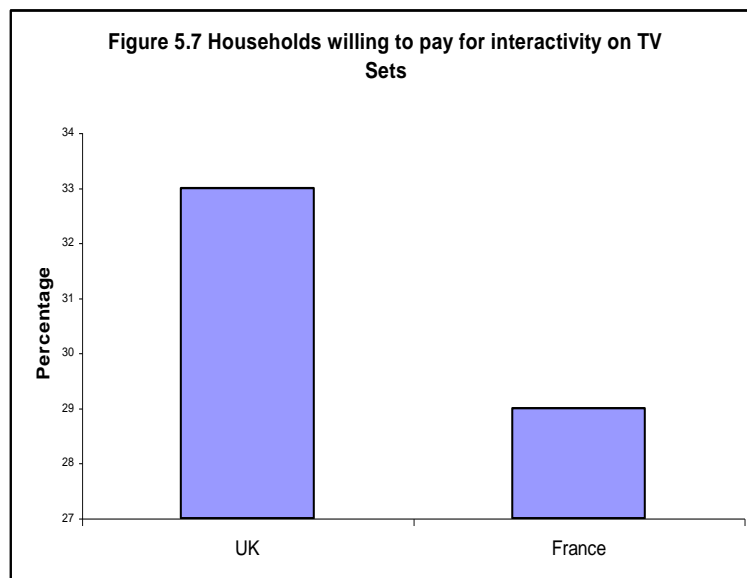
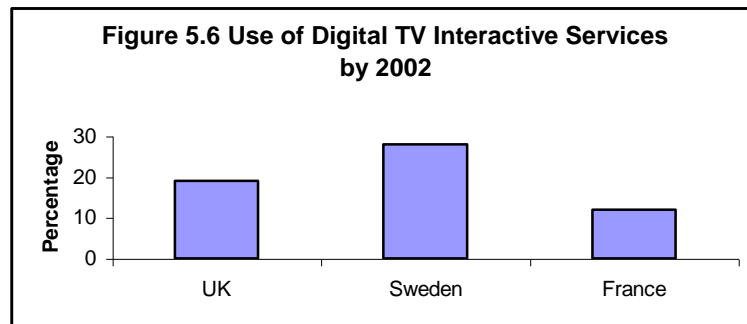
European consumers' use of digital TV is rising faster than in the United States

European households have access to interactive services via a computer and will increasingly have access to them via a television. According to research by Jupiter,¹⁴⁸ European consumers' use of digital TV is rising faster than their US counterparts - interactive services will reach over 19% of households in the UK, 28% in Sweden, and 12% in France by 2002 (See Figure 5.6). The research also found that 33% of UK households and 29% of French households (See Figure 5.7) are willing to pay for

¹⁴⁷ Datamonitor Press Release "Interactive digital television services in Europe and the US in 2003", 10 May 1999 referring to report "Interactive TV markets in Europe and the US, 1998-2003"

¹⁴⁸ Press Release from Jupiter, 27 October 1998

interactivity on their television sets, services that many European broadcasters are expecting to offer for free.



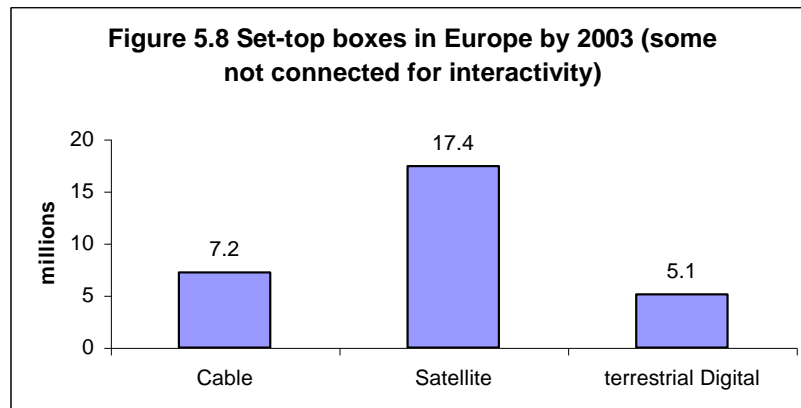
European market more diverse than US

Currently nearly half of European households have cable television (both analogue and digital). Digital cable networks technically offer the best solution for broadband interactive services. But only a small percentage of European households have digital cable networks and many cable companies have still to incur major costs to upgrade their analogue networks. However, the country by country survey in chapter 3 has shown that this upgrading is happening in many European countries. A Datamonitor study¹⁴⁹ predicts that by 2003 there will be 7.2 million cable, 17.4 million satellite, and 5.1 million terrestrial digital set-top boxes in Europe. (Note this is different from enabled households, as some set-top boxes will not be connected for interactivity) (Figure 5.8)

Datamonitor considers that while the US remains dominated by cable distribution, the European market is more diverse. Owing to the speed to market of satellite services, satellite set-top boxes accounted for over 95% of the digital installed base in 1997.

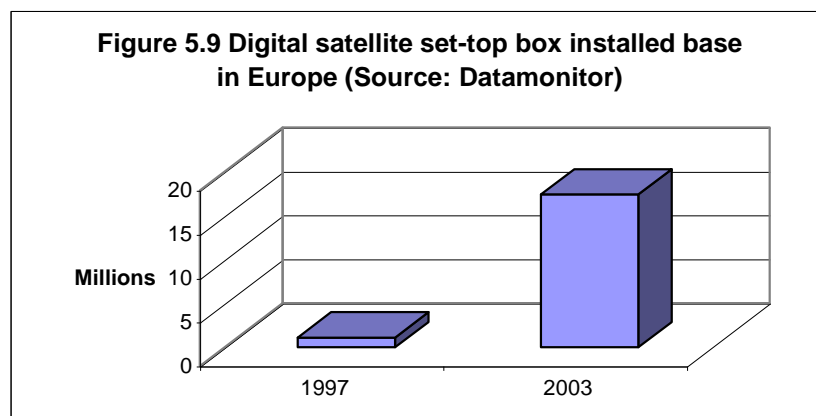
¹⁴⁹ "Set-top Markets in Europe and the US: profit opportunities in digital television", Datamonitor Report December 1998, taken from press release "Installed based of digital set-top boxes in Europe to reach 30 million in 2003", 14 December 1998. See <http://www.datamonitor.com/dmhtml/dm/dmwtsnew.htm>

Digital services are rolling out steadily on cable networks, while digital terrestrial launches are lagging behind.



European digital satellite set-top box installed base predicted to increase to 17.4 million in 2003

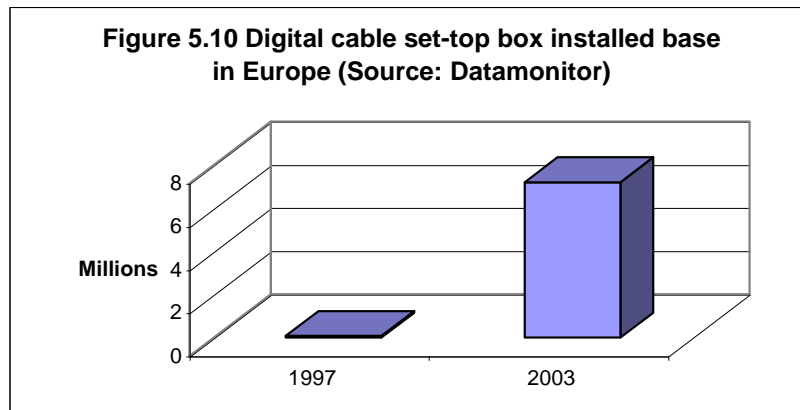
The digital satellite set-top box installed base in Europe will grow from 1.1 million in 1997 to 17.4 million in 2003. (See Figure 5.9) Growth will be strongest in the UK, France, Italy and Spain, where digital pay-TV operators such as BSkyB, Canal Satellite, Tele+ and Via Digital have appealing content packages.



European digital cable set-top box installed base predicted to increase to 7.2 million in 2003

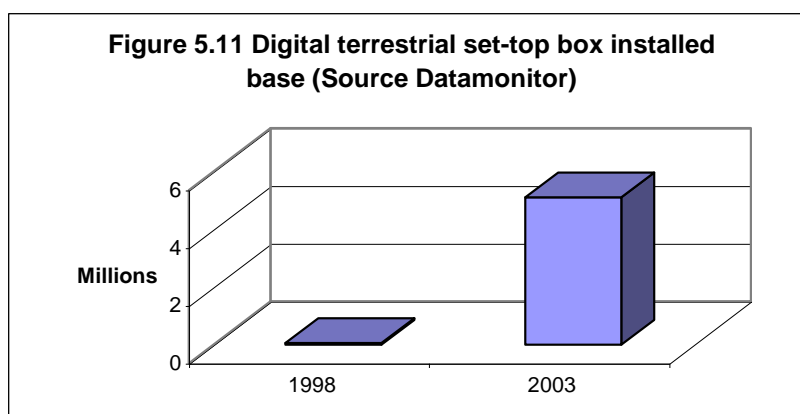
Datamonitor¹⁵⁰ predicts the digital cable set-top box installed base in Europe will grow from 70,000 in 1997 to 7.2 million in 2003. (Figure 5.10) Operators will quickly convert the current installed base of analogue set-top boxes to digital ones, but growth will be retarded by the underdeveloped cable pay-TV sectors in countries such as Germany, the Netherlands and Austria.

¹⁵⁰ "Set-top Markets in Europe and the US: profit opportunities in digital television", Datamonitor Report December 1998 - taken from press release "Installed based of digital set-top boxes in Europe to reach 30 million in 2003" 14 December 1998: see <http://www.datamonitor.com/dmhtml/dm/dmwtsnew.htm>



Digital terrestrial set-top box installed base predicted to increase to 5.1 million in 2003

For the digital terrestrial set-top box installed base, this will increase from 50,000 in 1998, to 5.1 million in 2003. (Figure 5.11). Datamonitor considers that UK and Sweden are leading digital terrestrial television (DTT) service provision, with a commercial service in the UK from ONdigital and a public service one in Sweden. Uptake will be strongest in the UK and Spain where set-top boxes will be subsidised.



A demand for video-on-demand services

Some evidence is emerging that there is a demand for video-on-demand services through digital TV.

Although not a particularly scientific survey ZDNet's Web site has been conducting an online survey relating to functions most wanted from a convergence device. The results as of 12 May 1999 (Figure 5.11) showed that over one third of respondents wanted video-on-demand. The ability to pause, rewind or fast-forward a program was demanded by another quarter of respondents.¹⁵¹ This may seem to suggest that there is a possible mismatch between the "wants" of end users and what can be offered at present.

¹⁵¹ The web site where this could be found is at <http://cgi.zdnet.com/zdpoll/question.html?pollid=12167&action=a>
Note the results are changing each time someone votes.

Figure 5.11 Which of these five functions do you most want from a convergence device?

Surf the Internet over your TV 1	661	21%
View video-on-demand	2930	38%
Pause, rewind or fast-forward a program	1925	25%
Watch TV with a wraparound Web page	606	8%
Access an electronic program guide	653	8%

Microsoft's WebTV small-scale trial in the UK involving 115 household has also found that 73% wanted video-on-demand services¹⁵².

¹⁵² Quoted in presentation given by Sharon Baylay, Microsoft TV, UK Manager on 15 July 1999.

Chapter 6

Implications for Education and Training

6.1 Introduction

The previous chapter has revealed that there is likely to be a continuous growth in interactive TV enabled households over the next decade. It is predicted that this second platform for interactive services to the home is becoming a serious contender with the possibility of a quarter of European households capable of receiving interactive TV services within four or five years. However, online-enabled computer households will dominate for the foreseeable future providing another means to enable interactivity to the home.

However there will also be variations across Europe as to whether various interactive services via the TV will take off or not. In some countries the computer will be the most appropriate means whereas in other countries with a lower penetration of computers to the home the TV may be more appropriate. The delivery mechanisms used - satellite, cable or digital terrestrial - will also vary across Europe.

For education and training providers it increases the choice in which distance learning can be made available. However, what is the most appropriate method really depends on whom the target group is and what type of learning is to take place. Clearly interactive learning via TV offers new opportunities to reach people who may not have participated in learning since they left school. It also fits in nicely with a philosophy of lifelong learning.

This chapter takes these factors into consideration when considering the implications that interactive digital broadcasting has for education and training.

- Firstly it looks at what evidence exists to suggest a demand for interactive TV learning services
- Secondly, it looks at the nature of education and training provision and how it is funded
- Thirdly it provides an analysis of service providers involved or likely to be involved in offering digital broadcasting learning services
- Fourthly, an assessment is made on the impact digital broadcasting systems are likely to have on education and training, in terms of traditional and innovative services
- Fifthly it attempts to provide an analysis of the different ways of paying for such services

6.2 Demand for interactive learning services

One of the few publicly available surveys that gives some insight as to possible consumer interest in education and training is a Gallup survey¹⁵³ conducted for Pace Micro Technology Plc - Europe's largest producer of set-top boxes. It was carried out in the UK during September 1998 just before digital TV services started to become available a month later. It also took place at a time when the BBC (the UK public service broadcaster) was running a campaign to raise awareness of digital TV.

¹⁵³ "The Pace Report 1999", Executive Summary

Compared to a survey conducted in November 1997, awareness of “what digital TV is” had grown from 36% to 62%. In the September 1998 survey, 42% of people surveyed stated that they would value interactivity through Digital TV. This option was found to be most appealing by those aged 16-35 years old. It was also found that 39% of people were interested in accessing the Internet through digital TV. Only 22% of people stated that impulse pay per view would be of any value to them. However, according to the survey the experience of BSkyB shows that impulse pay for view is sufficiently attractive to viewers to make it a commercially viable service.

The most significant finding for this study was revealed by a question that asked which public services they felt they would use if they were offered through digital TV. From choices offered 67% said they would use education and training if they were offered. This came second to medical advice at 69%.

The Gallup survey also revealed that 41% of those surveyed wanted more language tuition on television. This is clearly a potential market, which could be enhanced with interactive services as in the case with TVL in Italy. The UK Gallup survey found that 28% of men and 22% of women were prepared to pay for more language tuition on television.

Microsoft's WebTV trial in the UK has also revealed¹⁵⁴ that 57% of the 115 households involved would be prepared to pay for educational material on interactive TV. When asked what type of educational information they wanted, the survey revealed the following: -

Figure 6.1 Microsoft's UK WebTV trial Type of educational information wanted

level of education	Percentage
University	41
6th Form (16-19 yrs)	41
Secondary/middle school (10-16 yrs)	52
primary	37
Pre-school/nursery	28

6.3 Nature of education and training provision

Education and training provision is primarily national, regional or local in nature, but rarely trans-national. The exceptions may be multinational corporate training and professional retraining in highly specialised areas like the IT, telecom and medical professions.

There is also a very broad spectrum of learning experiences being supplied by education and training providers. In terms of the funds available, some of these learning offerings can be considered as having a “high revenue” or at the other end of the spectrum having a “low revenue”. The value attached to a learning offering depends on a number of factors:

¹⁵⁴ Quoted in presentation given by Sharon Baylay, Microsoft TV, UK Manager on 15 July 1999.

- number of learners
- price that learners or their employers will be prepared to pay, if they pay at all
- subsidies available from public sector funding or other sources

Thus the learning provided to children in a school may be considered to be "low revenue generating" because it is entirely paid for by limited public sector funding. Whereas the professional updating of employees in the IT industry may be considered to be "high revenue generating" because companies would be prepared to pay a high price for their employees undergoing training in order to remain competitive.

Thus at one side of the equation is the revenue or funds available. The other side of the equation is the cost of "production", not just TV production but distributing and administering the learning experience. Therefore a learning experience may be:

- low revenue but be low cost to produce
- low revenue but be high cost to produce
- high revenue but be high cost to produce
- high revenue but be low cost to produce

Clearly the ideal situation for the learning provider is to be able to move to a "high revenue, low cost to produce" scenario. In a commercial situation this results in more profit and in a non-commercial situation this results in more funds to enhance the learning experience or to cross-subsidise "low revenue but high cost to produce" learning experiences. Public service broadcasters also want to see value for money.

Therefore when education and training providers are looking at the use of digital broadcasting technologies or other new technologies they should be taking these factors into consideration:

- Will it make it cheaper to produce the learning experience?
- Will it reach a larger number of learners and potentially resulting in increased revenue?
- Will it make it possible to offer a learning experience that previously was too costly to produce?
- Is it appropriate to use this form of technology for the learning experience?
- Do the learners have the appropriate technology to access the learning experience or are they willing to pay an additional cost for it?
- Are there additional costs for making the technology available to the learners by the provider?
- Is there a demand from potential learners for accessing the learning experience through a particular technology?

A rather more altruistic question would be:

- By offering one type of learning experience through innovative technologies, will it be possible to increase the overall numbers of people participating in learning, thus increasing the uptake of people who may then participate in other existing learning experiences?

Therefore the participation of education and training providers in utilising innovative approaches to learning is very much dependent on the context of the learning experience. However, it is noted that there are some entrepreneurs *not* from the traditional education and training world who are seeing a market opportunity in offering learning services in a new format.

6.4 *An analysis of service providers involved or likely to be involved in offering digital broadcasting learning services*

6.4.1 Current Status

The case studies in chapter 4 have revealed the current status of European usage of digital broadcasting technologies for learning.

Utilising increased capacity and interactivity via an associated web site

A few public service educational broadcasters and commercial broadcasters have started or are about to offer learning programmes through the increased capacity made available by digital TV. Most of the interactive components will be through associated web sites as the facilities to offer interactivity through the set-top box and TV are still limited.

In some instances it may not be appropriate for educational providers to offer interactive services via the TV at this stage, as interactivity will be best achieved via the Internet. For example, a university level course may involve broadcasting a TV programme, but as most people taking a university course will have a computer for writing assignments it is likely to be easier to offer the interactivity via the Internet.

However, where there is a need to target people who would not normally participate in further education, interactivity becomes very important to turn them from being a passive viewer to an active participant. BBC Knowledge is attempting to get its viewers to become more active by encouraging them to visit a separate web site. But this is dependent on two factors. Firstly as the viewer has to decide to tune into BBC Knowledge and secondly the viewer also has to have access to the Internet usually via a computer.

Data broadcasting learning services mainly targeted at institutions not homes

Data broadcasting learning services are currently and in the future likely to be targeted at institutions or companies rather than homes. They will broadcast specific learning resources that will be generally accessed via a computer. In a few cases the distributor will also be the content provider as in the case of Espresso for Schools in the UK that is focused towards providing multimedia learning resources for primary schools to assist in the teaching of the National Curriculum.

Interactive Broadcasting Services independent of TV channels

TVL- run by Stream in Italy is the first European interactive service focused on language learning using a simple question and answer system. But interaction is really only with information stored in the set-top after it has been downloaded with the broadcast.

Interactive services utilising the telephone line as the return channel are soon to emerge with services like NTL's knowledge channel in the UK. However, it seems that most information will come from a customised version for TV, of resources already available from an existing but subscriber accessed web site.

Enhanced Interactive TV Services

The Wales Digital College is about to embark on a number of innovative trials to capture and engage viewers in learning. For example during the watching of a "soap" it may raise issues on a topic where viewers will have the option to get further information. Also booking a holiday to Spain via an interactive service could result in the viewer immediately receiving information about what Spanish language learning courses are available in their area or on the television. It is noted that they do have the close co-operation of an existing broadcaster - S4C. Both S4C and the Wales Digital College also have a mission to serve the specific needs of one country which aims to create its own identity.

6.4.2 Future trends for the development of interactive digital TV

Based upon the current situation and the likely development of interactive digital TV services in the future, existing broadcasters are likely to continue to have a dominant role in the development of interactive TV. A few new players who have a stake in the delivery systems may also emerge to supply such services as they may gain increased revenue from the value-added services.

Future trends for the development of interactive digital TV could be in a number of directions:

Informal education or "edutainment" type programmes

National public service broadcasters may offer "edutainment" type programmes aimed at a mass market with the opportunity for interacting by requesting further information through an interactive icon. There will also be the opportunity to "take part" in an activity by answering multiple choice type programmes.

Conditions required

Public service broadcasters are taking the lead as they may be encouraged by government to enter the "digital revolution". They may want to be seen to be innovative yet perhaps don't have the constraints to be commercially viable. They may also have existing experience of providing informal type education programmes.

Commercial broadcasters offer some programmes where they have an obligation to provide an educational element to their programme schedules.

Knowledge-based resources through channel-independent interactive services

Commercial broadcasters may offer channel-independent interactive services linked to school national curriculum learning experiences or knowledge-based resources like online encyclopaedias. The broadcasters will co-operate with traditional publishers to offer these services, which may be available upon payment of a fixed subscription or on a pay-as-you-view service. The fixed subscription is likely to be most popular with

the consumers particularly if it is targeted towards children. It will also be in line with current offerings through online services.

Conditions required

Such services could develop where commercial service operators wish to make their subscription packages more attractive to family households. The educational component may be the element of the bouquet of offerings, which encourages a household to take out a subscription. "We bought it for the kids" is seen as better justification than buying it for the sports channels.

Service suppliers co-operating with recognised and well-established brand names of educational resources are likely to be critical for success.

Teach yourself Pay TV services

Teach yourself Pay TV services particularly in the area of language learning may develop. They may offer some form of interactivity in the form of a directory of key words that can be selected at any point during the programme. Publishers of language learning videos and tapes may identify digital TV as a new delivery mechanism for their existing products.

Conditions required

Service suppliers co-operating with recognised and well-established brand names of language learning materials is likely to be critical for success. Language learning suppliers could actively seek co-operation with service providers in order to gain a competitive advantage over their rivals.

"Learning videos on demand" services

There is already evidence that there is a market for "videos on demand" once it becomes technically possible to download a video into a set-top box and view it when required. This demand is likely to extend to learning videos. Teach yourself videos and "do it yourself" house or car repair videos could be very popular. Publishers of existing materials may complement their offerings through digital TV. Public service and commercial broadcasters would be able to offer video clips of gardening activities or house alteration tips that have been previously broadcast as just one of a number of items in a programme. Viewers may pay for each clip or viewing in the form of some form of electronic cash.

Conditions required

There will be a need to upgrade existing set-top boxes and supply new subscribers with set-top boxes that have large storage capacity. Such boxes are starting to emerge on the market but it will be dependent on the service supplier identifying the demand to supply such boxes. Particularly as there is now a trend for the service supplier to rent them or supply them free of charge.

It will also depend upon whether alternative technology solutions start to emerge to compete with the broadcast solution. ADSL technologies could provide another way of streaming video to the home that would not require the large storage capacity on the set-top box.

Distribution network organisations would also need to be established.

Enhancing existing thematic channels

Existing thematic channels like the National Geographic Channel and the Discovery Channel could enhance their offerings by offering interactive services that supply additional information, updates since the programme was filmed or quizzes to test knowledge acquired.

Conditions required

Thematic channels tend to be a popular component of many subscription bouquets of offerings. But with increased interactivity offerings from other channels they may wish to gain a competitive advantage by turning a passive viewer into a more active viewer which would also increase the learning experiences on offer from channels which already are well respected for the educational value.

Sports channels may wish to gain a competitive advantage

Sports channels may wish to gain a competitive advantage over their rivals by offering enhanced interactive services that provide some sort of learning activity. This could be in the form of statistics where viewers may be able to interact with the TV to gain different graphical interpretations. It could be in the form of skills training enabling an activity to be viewed from a number of different angles. A mixture of enhanced interactivity through an existing TV channel and interactivity independent of the TV channel is possible.

Conditions required

Maintaining the loyalty of the viewer may be a driving force for sports channels to offer interactive services.

Sponsored thematic channels

There could be the development of new thematic channels that may be sponsored by a recognised brand or a specific product. This is an area that offers the big potential for increasing the types of learning experience on television. For example a channel targeted towards parents of young children may offer practical advice on parenting, training courses for nursery carers and programmes on the latest research on how babies learn to talk. Whilst these programmes may be produced by independent producers they may be sponsored by a supplier of baby food or babies clothing. There may be some interactive learning activities, which also have the aim of “capturing” details about the viewing audience.

Conditions required

A critical mass of digital TV viewers would be required before such services would emerge in order to get a reasonable sized audience for the specialised channels. Sponsored thematic programmes may be the first stage of development. They would also test the regularity conditions which broadcasters would have to comply with in each European country.

Personal TV

Personal TV is an interesting concept that could take off in the next three to five years. This involves customising all the content requirements for each member of the family who will access their personal TV service by inserting their own smartcard. This will involve each user being able to watch their favourite “soap”, sports, news or any other type of programme on demand when they wish to watch it. It could also

involve the setting up of a knowledge profile by each user and it could then be “pushed” to the user every time they switch on to the service. This could also be in the form of a learning package to ensure the user has acquired the new knowledge and can apply it in their work situation. This could see the emergence of knowledge or personalised learning brokers - an offshoot of the traditional trading provider. However, they are also likely to offer similar services via the web.

Conditions required

There are signs that commercial service operators will emerge to offer such a service however, it is questionable as to whether this will really emerge as a broadcasting service. Satellite and terrestrial digital delivery mechanisms may not have the capacity to transmit data on a point to point basis. Therefore this leaves digital cable networks as the most appropriate solution plus the utilisation of ADSL technologies where cable is not available. Rollout of such services will be on a much more localised basis as the server technologies are installed to hold the resources locally and the distribution mechanisms are established.

Such a service may not be dependent upon the dominant role of existing broadcasters. There could be some opportunities for the development of learning services sourced locally from traditional education and training providers.

6.5 Assessment of the impact that digital broadcasting systems are likely to have on education and training, in terms of traditional and innovative services

Dominance of broadcasters will dictate impact on education and training

As illustrated in the previous section, broadcasters in partnership with educational publishers and other recognised brand names are most likely to maintain a dominant role in terms offering innovative learning through digital broadcasting. The education and training community will not be able to influence development where interactive services do not already exist; but it could influence the uptake of such services once they become available. Interactive learning services could act as an incentive for households to buy into a package as a whole.

Popularise learning activities through interactive TV

However, there are opportunities for commercial and public service broadcasters to popularise learning activities through interactive TV in the form of “edutainment” - providing education through entertaining programmes. It could encourage passive viewers to become active learners. This could impact on traditional providers in at least two ways:

- The increased profile that learning has on TV could encourage a wider participation of learning with the more traditional providers.
- Traditional providers may need to make their offerings more attractive to their clients.

A second platform for delivering learning to the home

Interactive digital TV will offer a second platform for delivering learning to the home alongside the Internet. It is very likely they will complement each other rather than

seriously compete with each other. The type of learning on offer and the target group will determine the type of delivery mechanism to use. There will also be a convergence of activities particularly in the case of accessing the web and the ordering of materials.

Enriching the home with learning sources through mass media

Some governments, in particular the UK, see the new opportunities raised by interactive digital TV learning to the home as a new way of enhancing the quality of learning that they can actually do something about without a major increase in resources needed. They are politically unable to increase the length of the school term or of the school day, but they can encourage the enrichment of the home with learning resources through mass media. Whether this approach will succeed really depends on whether the learning resources on offer can actively engage the learner in appropriate tasks. The interactivity that is increasingly becoming available could aid this process. It may create a movement towards more independent forms of learning which may lead onto new paradigms for learning - raising questions about the future role of schools.

New opportunities for the establishment of local learning services through cable

Once interactive digital TV services start to become available via cable there are some new opportunities for local or regional traditional educational institutions to offer some forms of learning via the cable network. Blackburn College in the UK was a pioneer in this area during the mid 1990s when it had its own analogue channel on the local cable network. It was able to offer courses on learning English for immigrants based in their own homes. A similar type of learning offering has also taken place in the Amsterdam area. The development of Personal TV may also provide new opportunities.

Online learning services will offer a wider variety of learning experiences than digital TV

Despite the opportunities for digital TV to popularise learning, online learning services will continue to offer a wider variety of learning experiences. Once high-speed access to online services becomes readily available, good quality video will be easily available. This will remove the competitive advantage that digital TV currently offers.

Although a TV viewer may be attracted to a particular learning experience through interactive digital TV they are likely to turn to an online service provided by a traditional education or training provider for more in depth knowledge or for the acquisition of qualifications. Alternatively they may just decide to take a campus-based course.

Traditional providers of learning need to exploit the opportunities offered by digital TV

Traditional education and training providers will have limited control over how interactive TV develops. But they could assist in developing strategies at regional and national level to encourage a much more coherent and effective approach to increasing learning opportunities. This could be done through developing comprehensive strategies which best exploit the mass media potential of interactive

TV with the more in-depth learning services available through online methods and the traditional distance or campus-based courses.

The Wales Digital College is pioneering such an approach. But it requires educational broadcasters to act in a less autonomous way than they have done in the past.

6.6 *An analysis of the different ways of paying for education and training digital broadcasting services*

6.6.1 Trends

As the market very immature it is very difficult to get a clear picture as to what people are prepared to pay for digital TV learning services. Paying for education and training digital broadcasting services is currently or soon to be via a number of different ways:

- Public service broadcasters who see it their role to offer certain types of interactive learning programmes “free to air” as part of their public service brief. So this will be paid for through licences or from government grants to the service provider - e.g. RAI in Italy and BBC in the UK. This assumes that public service broadcasters will continue to be paid for via a licence fee. Developments towards narrowcasting and personal TV in the long term may make this form of paying for TV inappropriate.
- Commercial broadcasters or distributors who fund programmes or learning channels themselves as a means to attract new subscribers to their bouquet of offerings - e.g. Stream in Italy with TVL - their language learning channel - and their separate interactive service associated with the channel
- Subscription to a specific service - e.g. after the pilot phase of the Espresso for Schools service, local educational authorities or schools themselves will pay a subscription for service in the same way they may buy books.
- “Free to air” TV programmes but learners who wish to get accreditation must pay for joining a course. The cost of the course may or may not be subsidised by a regional or national education budget - e.g. Consorzio Nettuno, Italy.

However, a number of new innovative approaches to paying for such services may emerge in the near future:

- Pay per view learning on demand.
- Sponsors of thematic programmes who may wish to raise the profile of their product or brand names and capture details of the viewing audience.

6.6.2 Cost comparisons with other delivery systems to the home

It is possible to take a distance learning course from the home via a traditional correspondence course with all materials text, video, and audiotape delivered via the post. Or it is possible to just register for a course via the Internet. In addition many distance learning courses offer mixed media including online access.

The costs for these courses tend not to be dependent on the media used, but depend on: -

- subject content
- level of course
- length of course
- materials used
- tutorial support
- qualification received
- any subsidy available
- market price for the course

Market price is a critical factor. Courses in high demand like upskilling in IT and electronics for professionals tend to cost more than courses in history or literature.

Accessing learning via the Internet is the nearest equivalent to accessing any future learning via the digital TV. Browsing through directories of online courses¹⁵⁵ reveals a wide variation in prices.

- Six half hour private Spanish lessons using Internet telephony and video with individual tuition. 110 euro approx.
- Ten week course on the "The Modern Scottish Novel" other a fixed period 63 euro approx.
- "The cost for the Networked Open Learning" course covering the costs for all resources you will need for participation including books, reading and tutor guides 675 euro approx.
- An "Applied linguistics and ESOL" Master's degree with video lectures and readings mailed out, weekly tasks and discussions online by email with fellow students and tutors and termly assessment 6750 euro approx.
- A "Small Business Success" course consisting of 50 Sessions over a fixed period 250 euro approx.
- A 100 hour "Hotel Management" course 350 euro approx.

Therefore cost comparisons even within one type of delivery system are very difficult to do. Suppliers of specific courses using digital TV really have to price their courses based on traditional or online delivery mechanisms used and then they have to test the market and rely on market forces to price them at the most competitive and sustainable rate.

As TV is a mass media, economies of scale may be achieved by using TV once there is a critical mass of digital TV users has been reached. However, technological developments enabling access to full screen video may also end up a cheaper option.

Some interactive services via digital TV are soon to emerge in the form accessing information from an online encyclopaedia. However, no prices are available for such services although they are likely to be on a monthly or annual subscription. It is likely that they will be comparable with paper-based or online Internet based services.

Pay TV, where the viewer pays for a specific sports event or a film has only started in Europe over the past few years. Depending on the event prices seem to vary from

¹⁵⁵ Found at <http://home.nettskolen.nki.no/~morten/cisaer/catalogue.html> and <http://telecampus.edu/>

around 4 to 15 euro per event. Some learning on demand may emerge within this price range but it may be a passive viewing rather than an interactive experience. What few interactive services are currently available tend to be part of an existing subscription. Comparisons are also very difficult. What people are prepared to pay for interactive games could be very different from an interactive learning experience.

A further complication is that many people see delivery by interactive digital TV as being targeted towards those who may not normally have "opted in" to registering on a course therefore charging for a particular learning experience may present another barrier to the potential learner.

Recommendation

The European Commission should stimulate knowledge and know-how in this area by encouraging organisations developing or planning to develop interactive digital TV to come together to share their experiences. The Commission should not get involved in creating artificial markets by subsidising course developments that may not be sustainable under market conditions.

Chapter 7

Overall Conclusions and Recommendations

7.1 Conclusions

Data broadcasting

1. The further development of learning services utilising data broadcasting technologies is primarily dependent on content providers identifying this technology as an appropriate means of delivering the service they wish to offer. Therefore commercial technology suppliers need to make learning service suppliers more aware of their offerings.

Digital Audio

2. This study was unable to identify any potentially unique digital audio application that could be utilised by education and training.
3. However, as with all technologies, the development of digital audio broadcasting should be monitored in case any technical breakthrough offers new opportunities for the delivery of education and training.

Digital TV

Interactive TV Services

4. Generally, there is currently little demand from home consumers for interactive services via TV so a demand will need to be created before consumers will buy the appropriate equipment needed.
5. However, where public awareness has been raised, there is some interest in interactive services and even a willingness to pay for such services.

Development of Interactive TV learning services

6. The uptake of interactive TV learning services across the EU will be very uneven. Prospects for the development of such services is high in only three countries Italy, Sweden and the United Kingdom and prospects will be low in another six countries.
7. However this may not necessarily put some European countries at a disadvantage to others. Because other competitive technologies may be more appropriate and have a more dominant role.
8. Most of these interactive TV learning services are likely to be in an informal or “edutainment” format.
9. Early developers of interactive TV learning services are likely be public service educational broadcasters and commercial operators who may wish to gain a competitive advantage over their rivals like sports channels.
10. However, there does appear to be a demand for language learning, which may encourage the uptake of interactive digital TV.
11. Interactive TV may offer some innovative approaches to tackling the problems of basic skills in an informal and entertaining way.
12. Separate “TV channel independent” interactive services utilising the return channel are starting to emerge in the form of: -

- c) learning resources related to the national curriculum for school children and
 - d) Online encyclopaedias involving new alliances with traditional publishers.
13. Until a critical mass of households are “interactive TV enabled”, traditional education and training providers will be reluctant to consider offering interactive learning services.
 14. Broadcasters will continue to be the prime gatekeepers of interactive TV services to the home. As they have done with television they will control what the user has access to as well as the quality of the services on offer and the development of these services. Compared to the web this may act as a barrier for traditional education and training providers to offer interactive TV learning services.
 15. Therefore it seems unlikely that interactive TV learning services will be dominated by traditional education and training providers. However, they may find new market opportunities for offering their learning services through local cable networks once they are able to offer broadband accessibility.
 16. In some parts of Europe there is a strong affinity for a regional or national identity linked closely with their culture and education. If these areas have access to their own digital TV channel there could be some opportunities for developing interactive TV learning services closely with local traditional educational and training providers, as is happening in Wales. However they must be part of an education and training strategy funded from mainstream public sector funding.

Internet-based learning services to the home

17. Most education and training providers will find it easier to utilise the Internet for interactive learning services than for using interactive digital TV.
18. There will also be new opportunities for accessing good quality full screen video and audio with further improvements to increasing speed of access via ADSL technologies, which would increase usage.
19. However, these technologies could still be used to access the Internet through a TV set.
20. Low cost set-top boxes linked to a TV for accessing only online services could provide an alternative means of accessing such services without the need for a computer. This may meet a socially important need to offer online learning services to people that cannot afford to buy a home computer.

Digital TV Technology issues

21. The technologies to support interactive TV services are developing fast. Incompatibility issues relating to hardware and software are beginning to be addressed by the industry, which is aware that these issues need to be solved.
22. Therefore, over the next few years the industry is likely to resolve problems like different conditional access systems and different interactive software, through a mixture of mutual co-operation and competition.
23. As most households would generally only subscribe to one type of digital TV service with its bouquet of channels and interactive services, these incompatibility issues are not really a problem to them.
24. But it can create additional costs for broadcasts that make their services available on a number of different platforms. This would be due to the cost of adapting the interactive software for the different platforms.

Other Competitive Technologies

25. As the Internet is now relatively easily accessible from the home it will continue to develop as the main technology for utilisation by remote learning services.
26. As ADSL technologies develop it will be increasingly possible to distribute full screen video with interactivity via the telephone to a computer or to a TV.
27. There are also developments towards personal TV where the viewer is able to decide what programmes they want view and when they want to view them. They could access them from a remote server or they could be stored in a high-capacity storage device in the home.

Decisions for organisations supplying learning services

28. Organisations wishing to offer interactive learning services to the home will need to make decisions on what is the most appropriate and cost effective delivery mechanism for their purpose. It could be broadcast or it could be accessible online. Knowledge and know-how in this area is only starting to emerge.

Process of Innovation transfer

29. As has been stated in a previous report to the EC¹⁵⁶ it is very important to understand the process of innovation transfer. This helps to determine what recommendations should be made for the development of interactive digital TV learning services across the European Union.
30. An innovation can involve the development of products, tools and devices. Or it can involve a process with the development of new ideas, approaches or techniques.
31. The products tools and devices are already available and being further refined in the case of interactive digital TV. But the new ideas and approaches in the context of interactive digital TV learning Services are at a very immature stage and limited to isolated pockets of development across the EU.
32. Therefore, to ensure the even diffusion and transfer across the EU of new ideas and approaches for the utilisation of interactive digital TV learning Services, human networking of those involved in broadcasting, education and the IT is critical.
33. This would also enable equality of opportunities for such services to develop and would be an important ingredient in securing and increasing competitiveness across the EU where there are clearly cultural and linguistic barriers within broadcasting and education. This is compared to the United States where a common language certainly can encourage the rapid diffusion of ideas and approaches nation-wide.

Need for Intervention

34. The development of interactive digital TV learning services could be left entirely to market forces. This would eventually result in the development of some sort of sustainable services but unevenly and slowly spread across the EU because of lack of knowledge and know-how.
35. The other approach could be to actively stimulate interest, knowledge and know-how through the bringing together of education, broadcasting and the IT sectors. This could result in some early solutions to large-scale training needs across

¹⁵⁶ "Developing Telematic-based Learning Services - the Role of SME Networks" A Study for the DGXIII C3 Telematics Applications Programme Education and Training Sector 1995

regions or countries and enable EU organisations with expertise in this area to gain a competitive advantage over rivals from other parts of the World.

7.2 Recommendations

These following recommendations describe ways in which the European Commission may intervene to stimulate developments in utilising new digital broadcasting technologies for education and training without distorting existing market developments.

However educationalists and broadcasters need to be aware of the continuing technical developments and constantly review their potential utilisation. Manufacturers and suppliers of digital broadcasting technologies need to be aware of the potential education and training market for such services and actively exploit it.

A market for digital broadcasting technologies is already developing with a number of suppliers already offering products and services for data broadcasting and digital TV. In particular digital TV with fledgling interactive services is emerging within a consumer market. Other competitive technologies are also emerging rapidly, which could provide alternative solutions. As previously stated the education and training business has little control over these technology and market developments.

Within this context the European Commission's primary roles should be raising awareness, disseminating good practice and stimulating a body of research which will ensure that the interactive TV learning services are utilising sound pedagogical practices and are sustainable within the mainstream funding mechanisms which are available. This will help education and training providers make decisions as to whether they should be utilising these technologies for their particular learning offerings.

The recommendations are therefore:

1. As a first stage this report could be made available to policy and decision-makers in broadcasting, education and training and the IT industry.
2. But, in order to further raise awareness, disseminate knowledge of technological developments and encourage co-operation, a series of workshops should be funded in order to bring together key players from across Europe to share knowledge and know-how.
3. With some assistance from the industry and from the EC a web site should be established in order to collate technological, pedagogical, managerial and costing issues relating to using digital broadcasting and other technologies for learning.
4. This should be linked to an information service consisting of a helpline where organisations will be able to get further assistance and where knowledge and know-how can be disseminated via presentations and articles to the education and training world.
5. This should lead to the establishment of a European-wide forum in order to bring together all key players who are active or interested in using digital broadcasting technologies to develop interactive TV learning services. In particular it should be a vehicle to encourage strategic alliances between public-private partnerships and to reduce the cultural differences that currently exist between broadcasters and those in the telecommunications industry. It should take into account the

convergence of the technologies and should consider the impact of new developments in online technologies. Although the Forum may initially have a particular technological focus, this should always be in the context of the appropriate use of the technologies for enhancing learning.

6. It is proposed that the Forum will identify specific areas of research where a greater understanding of the learning process through interactive TV is still needed. Involving the key players in this decision process will ensure that the research that is carried out will be of value to them and will also be state of the art research not already covered by the industry.
7. Areas of research may be:
 - i. Gaining better understanding of the various approaches for utilising interactive TV learning services where there is a need for a high impact with a mass audience.
 - viii. More market research into the types of interactive TV learning services that home users really want and their effectiveness over traditional education and training systems.
 - ii. To create a body of research into good design practice of user interfaces, for interactive learning services, from a pedagogical perspective.
 - iii. As the market starts to develop, to conduct research, which gains a better understanding of the costs of utilising interactive TV, compared to other online services for learning purposes.
 - iv. A feasibility study into the potential usage of very low-cost devices linked to an ordinary TV set and an existing telephone line utilising ADSL technology to access local learning resources via an Intranet. This must include the ability of people with computers to also access the same resources.
 - v. Exploring the potential of local or regional educational institutions utilising local digital cable networks for interactive TV learning services.
 - vi. Exploring the potential of utilising interactive TV for tackling national or regional skill shortages and basic skills deficiencies in an informal and entertaining way.
8. Other activities undertaken by the Forum should be:
 - iii. Monitoring developments towards interoperability of set-top boxes and identifying whether there are any factors containing the development of interactive TV learning services.
 - iv. Addressing standardisation issues with particular reference to enabling learning resources and interactive components to be easily moved onto a number of different platforms and delivery systems.

Appendix A

Database of organisations active or planning to be involved in offering Learning Services through Digital Broadcasting

BBC Knowledge

Ms Jane Quinn
BBC Education
BBC White City
201 Wood Lane
London
W12 7RJ
United Kingdom
Tel +44 181 7525252
Fax +44 181 7524465
Email jane.quinn@bbc.co.uk

Bocom International

Mr John Clancy
The Anchorage
Charlotte Quay
Dublin 4
Ireland
Tel +353 1 6601550
Fax +353 1 6601545
Email jclancy@bocom.ie

Consorzio Nettuno

Mme Marisa Garito
General Director
Corso Vittorio Emanuele II n. 39
Roma
Italy
Tel +39 6 69207628
Fax +39 6 69942065

Espresso for Schools

Mr Tony Bowden
Managing Director
Espresso Productions Ltd
Riverside Studios
Crisp Road
Hammersmith
London
W6 9RL
United Kingdom
Tel +44 181 237 1200
Fax +44 181 237 1201
tbowen@espresso.co.uk
www.espresso.co.uk

NTL Knowledge Channel

Mr Andy Crossley
Marketing Director
NTL Interactive
90 Long Acre
London
WC2E 9RA
United Kingdom
Tel +44 171 909 2100
Fax +44 171 909 2101
andy.crossley@ntl.com

IQ-TV

Mr Horst Cramer
Projektgruppe
c/o Südwestrundfunk
Postfach 76522
Baden-Baden
Germany
Tel +49 7221 929 4407
Fax +49 7221 929 6415
horst.cramer@swr-online.de
www.iq-tv.de

KunskapsTV

Södra Hamngatan 26-40
S-115 41 Stockholm,
Sweden
Tel +46 8 662 4013
Fax +46 8 662 4018
Email info@kunskapstv.se
www.resume.se

RAI Educational

Dr Renato Parascandalo
Responsable Progr Educatifs
RAI Educational
Via Ettore Romagnoli 1
Pallazina A - Stanza 223
Roma 00195
Italy
Tel +39 6 8276898
Fax +39 06 8276481
Email parascandolo@rai.it

TVL Interactive

Ms Alessandra De Carlo
Stream
via Salaria 1021
Roma 00138
Italy
Tel +39 6 88663418
Fax +39 6 88663391
Email alessandra.decarlo@stream.it

TPS

Ms Sophie Dingreville
Television par satellite (TPS)
145 Quai de Stalingrad
Issy Les Moulineaux Cedex 92137
France
Tel +33 1 41 33 89 68
Fax +33 1 41 33 89 01
Email sophie.dingreville@tps.fr

UR (Swedish Educational Company)

Ing Marie Olofsdotter
Tulegatan 7
S-113 95 Stockholm,
Sweden
Tel +46 8 784 42 05
Fax +46 8 784 4100
Email iol@ur.se

Wales Digital College

Ms Elen Rhys
1 Bridge Street
Cardiff
South Glamorgan
CF1 2TH
Wales
Tel +44 1222 668 810
Email digidol@aol.com
www.colegdigidol.co.uk

Appendix B

Database of European Organisations involved in Digital Broadcasting Services that are relevant to the provision of interactive learning services.

Eurosport Enterprises

Mr Rémi Tereszkievicz
Head of Interactive Services &
Licensing
Tel +33 1 40 93 80 16
Fax +33 1 40 93 83 83
Email rteresszkie@eurosport.co.uk

Are interested in developing
interactive learning services associated
with their sports channels

EuroSkyWay

Mr Carlo Des Dorides
Alespazio
EuroSkyWay Multimedia
via Giulio Vincenzo Bona 85
Roma 00156
Italy
Tel +39 6 4151471
Email desdorid@roma.alespazio.it
www.alespazio.it

Are keen to offer their EuroSkyWay
data broadcasting solution for
education and training purposes

Anglia Multimedia

Mr Peter Stibbons
Managing Director
Rouen House
Rouen Road
Norwich
NR1 1RB
United Kingdom
Tel +44 1603 7600000
Fax +44 1603 284141
Email peters@anglia.co.uk

A UK educational multiple media
content supplier for schools. Currently
supplying content to NTL's interactive
Knowledge Channel and keen to offer

educational content to other providers
of interactive learning services.

Astra-Net

SES Multimedia S.A.
Chateau de Betzdorf
Luxembourg
Tel +352 7198981
Fax +352 71 98 98 7610
Email info@astra-net.com
www.astra-net.com

A supplier of a satellite data
broadcasting service. Currently being
utilised by Espresso for Schools.

Sky Digital

Mr Paul Cackett
Channel Development manager
British Sky Broadcasting
6 Centaurs Business Park
Grant Way
Isleworth
Middlesex
TW7 5QD
United Kingdom
Tel +44 171 705 6717
Email paul.cackett@sky.bskyb.com
www.sky.co.uk

Sky is interested in developing a
learning channel

Cable & Wireless Communications Ltd

Mr John Ingham
United Kingdom
Tel +44 1923 436 063
Email john.Ingham@cwcom.co.uk

Cable and Wireless Communications some plans to offer an interactive learning channel on their digital cable networks later in 1999. Details unknown. They will probably reply on other content providers.

Cable i Televisio de Catalunya

Mr Jaume Salvat
Barcelona 08025
Spain
Tel +34 934 46 31 00
Fax +34 93 450 00 98
Email jsalvat@ctc.es
www.cablecat.com

Have some plans to offer an interactive learning channel in the future on their local cable network.

Cabot

Ms Diane Liddicoat
1-4 Portland Square
Bristol
BS2 8RR
United Kingdom
Tel +44 117 944 2454
Fax +44 117 944 2457
Email diane.liddicoat@cabot.co.uk
www.cabot.co.uk

They have developed some software that converts HTML files into MHEG 5 files. MHEG 5 is one of a number of application programme interface (API) applications in set-top boxes used to provide interactive services on digital TV.

Channel 4 Learning

Ms Davina Lloyd
Chief executive
United Kingdom
Tel +44 171 291 8709

A UK broadcaster currently providing non-formal learning programmes and programmes for schools.

Dorling Kindersley Ltd

9 Henrietta Street,
Covent Garden
London
WC2E 8PS
Tel +44 171 836 5411
Fax +44 171 379 7050

A provider of educational content to NTL Interactive's Knowledge Channel and probably through other interactive service providers in the future.

Edex

Mr Adrian Carey
Head of Edex
Edex Internet
The Education Exchange
Pinnacle House
17-25 Hartfield Road
Wimbledon
London
SW19 3SE
United Kingdom
Tel +44 1181 239 5000
Fax +44 181 239 5001
Email info@edex.net.uk
www.edex.net.uk/

Has plans for setting up an interactive broadband network for UK schhols.

Elmsdale (Yes Television)

Mr Derek Williams
Director of Operations
Elmsdale Media Ltd (Yes Television)
London
United Kingdom
Tel +44 171-462-5601
Email derekw@yestelevision.com

One of the first providers of interactive services including video on demand via cable in the Cardiff area of Wales

EuroPACE 2000

Prof. George Van Der Perre
EuroPACE 2000
Celestijnenlaan 200A,
Heverlee B-200
Belgium
Tel +32 16 32 75 73
Fax +32 16 32 79 95
Email
georges.vanderperre@europace.be

A long established European Network providing currently providing limited digital broadcasting of educational programmes via RAI. Also offering a brokerage service

The Fantastic Corporation

Mr Kim Weis
Director Northern Europe
The Fantastic Corporation
St Andrews House
West Street
Woking
Surrey
GU21 1EB
United Kingdom
Tel +44 1483 772 262
Email kim.weis@fantastic.com

Very keen on offering its management solution for distance learning purposes

ARD/WDR

Mr Peter Teckentrup
Head of Further Education
Westdeutscher Rundfunk - ARD/WDR
Appelhofplatz 1
Postfach 10 19 50
Koln 50600
Germany
Tel +49 221 2202709
Fax +49 221 2205549
Email peter.teckentrup@wdr.de

Interested in educational TV developments

FutureTV Ltd

Mr Dennis Garrison
Director
11 Cross Keys Close
London
W1M 5FY
United Kingdom
dgarrison@futureTV.com.hk

Offers a solution for personal TV including learning services.

HOT Telecommunications

Mr Russell Arrowsmith
Saxon Street
Linford Wood
Milton Keynes
MK14 6LD
United Kingdom
Tel +44 1908 221127
Email r_arrowsmith@hnsLtd.hns.com
www.direcpceu.com

Provider of direct to PC digital broadcasting services across Europe.

IZI- Bayerischen Rundfunk

Mr Manfred Meyer
Deputy Head
Rundfunkplatz 1
München 80335
Germany
Tel +49 89 59002140
Fax +49 89 59002379
Email izi@brnet.de

Interested in educational TV
developments

Mediautbildning

Mr Lars Hansson
Linbodavägen 91,
S-125 58 Älvsjö
Sweden
Tel +46 8 99 49 60
Email
lars.hansson@mbox323.swipnet.se
Consultant in educational TV
developments. Former Managing
Director of UR in Sweden.

MSU (UK) Ltd

Elder House
526-528 Elder Gate
Milton Keynes
MK9 1LR
United Kingdom
Tel +44 1908 232 100
Fax +44 1908 231 321
Email info@msu.co.uk
<http://www.msu.co.uk>

Provider of a low cost appliance for
accessing the Internet via TV

NetGem

Mr Joseph Haddad
31 Rue Victor Hugo
Courbevoie 92400
France
Email info@netgem.com
<http://www.netgem.com>
Provider of a low cost appliance for
accessing the Internet via TV

NPTV

Mr Etienne Grange
18 rue du Faubourg du temple
Paris 75 011
France
Tel +33 1 53 043 548
Email eg@nptv.fr
www.nptv.fr

Interactive TV services developer

OpenTV Europe

Mr Regis Saint Girons
160 bis,
rue de Paris
Boulogne Cedex 92645
France
Tel +33 1 55 38 22 55
Fax +33 1 55 38 22 99
Email regis@opentv.com
www.opentv.com

Provider of an application programme
interface solution enabling interactive
services to be provided with a set-top
box

Plymouth University

Mr Mic Cady
Media Industry Adviser
School of Computing
University of Plymouth
Drake Circus
Plymouth
PL4 8AA
United Kingdom
Email micc@soc.plym.ac.uk

The university has experimented with
live interactive TV and data
broadcasting for a number of years.

S4C International

Mr Huw Jones
Chief Executive
S4C International
Parc Ty Glas
Llanishen
Cardiff
CF4 4DU
Wales
Tel +44 1222 747444
Fax +44 1222 741417
s4c@s4c.co.uk
<http://www.s4c.co.uk>

Keen on developing interactive learning services and the provider of digital channels for the Wales Digital College

Two Way TV Ltd

Mr Simon Cornwell
Two Way TV Ltd
The Chiswick Centre
414 Chiswick High Road
London
W4 5TW
United Kingdom
Tel +44 181 995 1664
Email simonc@twowaytv.co.uk
www.twowaytv.co.uk

One of the first providers of interactive TV in the UK

WDR

Mr Peter Teckentrup
Head of adult and Further education
Cologne
Germany
Email peter.teckentrup@wdr.de

Interested in educational TV developments

WebTV

Mr Jim Beveridge
Business Development
WebTV
United Kingdom
Tel +44 870 6010100
Fax +44 171 632 5555
Email jimbev@microsoft.com
www.microsoft.com/dtv

Running trials of Microsoft's WebTV in London and Liverpool

ZDF-Zweites Deutsches Fernsehen

Dr Frank-Dieter Freiling
Head, International Programme
Coordination
ZDF-Zweites Deutsches Fernsehen
ZDF-Strasse 1
Postfach 4040
Mainz 551000
Germany
Tel +49 6131 701
Fax +49 6131 705329
Email freiling.f@zdf.de

Interested in educational TV developments

Appendix C Survey of Future Interactive TV learning Services Scenarios

In order to get a better understanding of the developing market it was decided to conduct out a survey of possible scenarios for interactive learning services. Originally it had been planned to conduct a survey of end users that would be willing to make use of interactive TV learning services in the home. However, it was decided during the desktop research phase that this would be very difficult to conduct due to the immaturity of the market and the lack of awareness amongst home users of what types of interactive learning services could be on offer.

Some organisations have conducted their own market research in this area but due to the commercial sensitivity of the results they were not willing to make any of this information available for this study. For a similar reason organisations that are planning to offer some form of digital TV learning channel or an interactive learning service were unwilling to disclose what they would charge for such a service. It has further been complicated by the fact that a learning service may be offered free by a public service broadcaster or bundled into a bouquet of other offerings by a commercial broadcaster, thus disguising the price of the learning component.

Another complicating factor is that when people actually do pay for a “learning experience” it tends to be in the form of a course with accreditation. The best examples are those of open university courses which involves registering for a course, receiving a mixed media package of learning material including the opportunity to view a TV broadcast that was offered free-to-air. As yet there is no culture of buying learning services via the TV. This is mainly because it has not been technically possible to do so until recently so there have been no offerings.

In order to try to gain a better understanding of how the market may develop in the future a survey was conducted based on a number of possible future scenarios. Unfortunately responses to the survey were very limited and do not really make any significant contribution to this study. Time constraints for conducting the study have made it impossible to adopt another method for trying to get the views of a broad selection of people.

Description of methodology used

Eight possible scenarios were developed as detailed below. Each scenario deliberately included a number of different technology configurations, educational considerations and marketing issues. The main aim of the scenarios was to stimulate thinking and raise awareness of the wide variety of possible interactive learning services that might develop. The scenarios did not specify which delivery system - cable, satellite or digital terrestrial - could be used.

The survey was targeted towards network operators, broadcasters, and educationalists, particularly involved in distance learning. People were invited to take part in the survey mainly via an email although a few were distributed by hand at face to face interviews. These included: -

- 100 plus on the educational mailing list of the European Broadcasting Union and educational broadcasters who attended the Rotterdam Market
- 80 people on a European Education Partnership listserv
- 100 plus people who are involved in educational issues
- 80 people attending the FLISH99 “The Business Case for Online Learning” conference
- 2944 subscribers to the DEOS-L listserv which goes to people interested in distance learning throughout the world.

People were invited to fill in a comment form which requested comments on market issues, technical issues and other issues. People were also invited to indicate on an eleven-point scale for each scenario the likelihood of it happening. This ranged from -5 for very unlikely to +5 for very likely.

The Scenarios

1. Video-clip Archive Scenario

John Pickard is about to make his first visit to Bologna in Italy as part of a business trip. He will only have a few hours free to explore the city. He wonders what video archive material may be available from his public service broadcaster. The broadcaster has for many years been selling books, information packs and videos related to existing TV programmes. Recently they have started to provide a new service through interactive TV that enables home consumers to access video and audio clips of archive material of items that appeared in past TV programmes.

John presses the interactive button on his remote control and selects the archive library from the electronic programme guide. He fills in the online search form using his remote control keyboard. Within a few seconds a list of several possible video and audio clips related to Bologna appears. The first item is from a recent travel programme that he did not see. Another item comes from a scientific-historical series of programmes shown on TV a few years ago. John remembers the presenter standing at the bottom of the steps of the cathedral in Bologna describing a significant historical event that took place. John remembers the series well so he selects this item and the first item.

The screen informs him how much it will cost him to view these video-clips for a 24 hour period. Each clip only costs a few euro-cents as the broadcaster can still make considerable money "renting" to millions of people. John can either pay by inserting his microcash credit card or it can be billed to him rather like a telephone bill along with all the other interactive services that he uses.

The video-clips are then sent to him over the air and stored automatically on his set-top box for later viewing. During busy periods there may be a delay in sending the items particularly during peak viewing times during the evening, but there is guaranteed delivery by the next morning. However, the latest delivery time is displayed on the screen and a message will also flash up when the items have arrived.

His fourteen-year-old daughter Fiona now takes over the remote keyboard, as she wants to do a search for her school project on volcanoes. But before Fiona can access any material she needs to put her smartcard into the set-top box. John has given Fiona a monthly allowance to spend on video archive material. This information is contained on Fiona's smartcard.

2. Life Long Learning by combining open and closed user groups

A big national insurance company wants all its sales force around the country to update their knowledge on the international stock market. The sales force is very busy so the training has to take place at the local office every Monday morning before the working week starts.

The national digital TV learning channel and the insurance company have reached a deal. During six Monday mornings half-hour programmes on the international stock market are broadcast free to air from a studio in Stockholm. This means the general public can watch the programmes as well as the sales group. The general public also gains a positive image of the insurance company, which is good for business.

After the half-hour program the TV channel is divided into two channels. One is just seen by the sales force (a closed user group) and the other shows the daily school programme to a general audience. In the studio of the closed session specialist staff from the insurance company and other experts are able to answer questions from the sales staff across the country. They put questions to the specialists through the remote controller, which is equipped with a small keyboard. As this is a closed user group the answers can be very focused and internal. The programs are saved on a central server by the TV company and those who are interested can download them to their own company computer and study them later.

3. Interactive Information Services scenario

Helmut Braun has just returned home from work having just been told by his employer, in the automotive industry, that he is going to be made redundant in three months time. Very depressed, he switches on his TV to the Employment Opportunities Channel to see what is available within his region.

The programmes have been prepared by the regional TV company in conjunction with the regional employment agency who have reallocated their resources away from physical offices scattered across their region to utilising mass-media for advertising jobs. They have also established a 24 hours a day call centre for dealing with enquiries about employment opportunities and learning needs. Other income comes from the employment “flashes” or advertisements paid for by employers who urgently need to fill vacancies.

Helmut views the programmes passively as they are broadcast 24 hours a day. He becomes interested in an item about the owner of a rural vehicle repair service. The owner is getting too old to run his business and he cannot persuade his sons to run it for him. However, the local community is very dependent on his business, as it is the only one in the area. The programme describes what regional development grants are available for taking over or starting new businesses in the region and also highlights skills that would be required for running a business.

At this point the information icon appears on the screen. Helmut presses the interactive button and the screen displays in a graphical format (high quality teletext) various options for further information. Helmut is able to move an arrow around the screen to point on a map where he lives. He is able to display a list of skills that may be required for running a business. He is able to “bookmark” that page and return to it later. By selecting further options he is able to find out what courses are available locally and also what job vacancies exist relating to the automotive industry. He is also able to find out what existing businesses require new partners.

An additional service on offer is a learning needs analysis where Helmut is able to answer various questions by selecting options using his remote control. He is then presented with a diagnosis of his learning needs and suggestions as to what to do next. He is also given a unique identification number. At all points during this information service there is an option to receive further information via email or ring up the helpline with a freephone number. As Helmut does not have email he rings up the helpline and asks for the information to be sent through the post by giving the ID number to the call centre operator. He is also given the immediate opportunity to discuss with a personal adviser, a strategy to get him back into full employment. As they talk she can point him to information available on the TV screen and produce a personal development plan that is displayed on the TV screen as they talk. This is achieved by linking the unique ID to the address of Helmut’s set-top box.

4. The virtual car driving school using interactivity and simulations

Stefan has for many years been waiting for his 17th birthday when he is allowed starting his driving training. Next week is his birthday but the problem is that he cannot afford the driving lessons at the driving school in town. He is very unhappy about this, but his mother comes up with the solution - training via TV. Every second month the driving school programme starts on their digital educational channel. It will cost Stefan nothing to follow the driving course as a big insurance company and the National body for safety in traffic sponsors the course and the programmes.

There will be a long series of programs that will prepare him for the final test for a driving licence. During this period he will practise “real” car driving with his mother and she will also have instructions through special TV programmes for “amateur” instructors.

On the virtual driving school web Stefan can find a lot of simulations of real traffic situations which he can download onto his computer and then used for practice. They are educational as well as entertaining so he learns with joy and with high concentration. Every simulation has a test level that he must pass to be allowed to continue. The simulation is also available on a DVD and Stefan can order it by clicking his remote TV controller. Within two years it will be possible for the simulation programs to be downloaded to the set top box and the TV then used for the simulation.

At the end of the course there is a big test in one of the final TV programmes and Stefan has a lot of complicated questions which he answers with his remote controller. Immediately after the programme has finished he has his result displayed on his screen. The web site also has a simulation test based on different traffic situations. He is not allowed to apply for a real formal driving licence test until he has passed the virtual test in the virtual driving school.

5. Impulse learning Scenario

On the family life style channel, Naomi and Dmitri have just been watching a TV programme about how young children learn to talk. This is of particular interest to them as they have a six-month-old son - their first child.

Although an independent producer supported by the National Health Council has produced the programme, it is actually sponsored by a baby food supplier. This private-public partnership also consists of a national training organisation that is keen to utilise the interest created by the programme. They want to encourage people to train to become child-care assistants for nurseries and playgroups and teacher's assistants in primary and secondary schools. The national training organisation has received a grant from the government to do this but it must meet certain targets for training people up to a specific level of qualifications.

During the TV programme, the interactive icon is displayed on the screen. This means more information is available. Naomi presses the interactive button to find out what else is available. Dmitri wants a fact sheet about the programme, which can be sent via email. That option is selected from the menu. All their contact details have already been pre-programmed into their set-top box so they don't have to enter the details again. Before their request is sent off they are asked if they have any children under three years and also asked whether they would object to receiving any news about young children's products. (This is the opportunity for the baby food supplier to capture information about parents with young children.)

Naomi also notices that an online course is available leading to an introductory qualification in child-care. She selects this option from the interactive menu and a two-minute video-clip is shown about the course. It involves receiving a booklet via email, watching various programmes which are broadcast on the learning channel and completing various exercises based around various observations on young children which are submitted for assessment via email. The course is divided into various modules that can be taken individually. There is also an opportunity to do a taster module at no charge.

With encouragement from Dmitri, Naomi decides to have a go on the course, which costs around 50 euro per module with four modules leading to basic-level recognised national qualification. She is even able to charge this to her individual learning account - an initiative from national government to encourage people back into work through learning.

After selecting and paying for the first module of the course through entering a PIN number on the remote control, Naomi almost immediately receives details about the course via email. She gets a welcome letter, the course booklet to print out, details of her online tutor should she require help and the timetable for the TV programmes. In fact this timetable has also been programmed into the set-top box so Naomi can be alerted when her programmes are due to be viewed. The set-top box can also be programmed to record the programmes on their videotape recorder. If they had a later version of their set-top box the programmes would have been automatically recorded on the set-top box for up to forty-eight hours. Each programme for the course is regularly repeated on the learning channel so it will only be a few days before the first programme is shown.

The next day Naomi also receives an email from her online tutor who happens to be based at her regional college 70 km away. Her tutor informs her that they organise monthly meetings at the college for those taking the child-care course and crèche facilities are also available. She looks forward to the day away from her home and the college hopes that they will eventually be able to persuade Naomi to follow one of their other courses.

6. Utilisation of high definition TV (HDTV) and interactivity

Many people have problem with their knees and there are different methods to fix the injuries. One of the leading university hospitals in the country has developed a new method with clean and simple surgery to operate on the knees. If it is introduced all over the country a lot of people will be cured and the hospital's workload in this area will diminish substantially.

To introduce this method rapidly, digital television is used. Every department is equipped with a HDTV receiver and live operations are broadcast to doctors across the country. Specialists comment during the live operations. The screen is sometimes divided into parts so it is possible to see details at the same time as the whole. Those viewing can ask questions using the return channel of the TV receiver. A moderator co-ordinates the questioners who can indicate that they wish to ask a question using their remote controls.

7. Educational campaigns with interactive edutainment

A national government wants to explain the European monetary union to its citizens. The challenge is to reach those who are ignorant and not interested. A powerful tool is to use television in series of a “edutainment” style programmes during the night peak hour. The programmes are hosted by a well-known presenter in the form of a quiz show. Different regions of the country are competing with each other. Every viewer can answer the questions with their remote control and those regions with more correct answers will win. It is only possible to give one answer per household. If any question receives a high percentage of wrong answers there will be more explanations and more questions in that area. The computer that collates the responses can control this. The computer is also able to “weight” the responses from each region so that those regions with a larger population do not have an unfair advantage. This same computer is also used regularly for instant option polls and has been found to be very accurate compared to traditional methods.

Using their remote control, those with a deeper interest in specific areas can open an extra window on their screen and text or video clips giving more detailed information as well as watching the quiz show at the same time. After the program viewers can order free information material via ordinary mail email by clicking on their remote control.

8. Pan-European Professional Learning Channel

Fabrizio is working in the mobile telephone industry and needs to regularly keep up to date the future developments in this field. His employer also needs to be assured that Fabrizio is regularly upskilling himself as this is vital for the company to remain competitive. The demands of the working day increasingly make it difficult to offer professional upskilling during work time. Sending people away on courses is also time consuming and expensive for the employer.

However, a satellite broadcaster has approached the company with a deal that involves giving its professional employees a free set-top box and satellite receiver if the company subscribes to the pan-European professional learning channel.

This learning channel offers regular professional updating for science and engineers across Europe who are involved in the IT, Telecom, multimedia and broadcasting industry. Known as the Convergence Channel, it is in fact not a viewing channel but purely a digital distribution channel. An advanced set-top box is used, which can be programmed to receive specific programmes. These programmes are transmitted in a compressed format and stored on the set-top box for viewing anytime over a limited period. The set-top box is able to decompress the programmes when they are viewed which means they take up limited storage space.

Should the professional home user wish to do so, they can also take out a subscription for any of the other satellite TV offerings made available by the satellite broadcaster. This is a good deal for the broadcaster as they not only receive revenue from the company for subscribing to the Convergence Channel - a high value premium service, but they are also able to reach professional people who have tended not to be early adopters of satellite subscription services. In addition they are also able to take advantage of the higher incomes of the professionals and target specific interactive home shopping and other interactive services.

From the point of view of the mobile telephone company its an ideal way of keeping their professionals updated in their own time at home. In addition employees like Fabrizio can also take part in interactive quizzes to ensure that they have acquired the additional skills and knowledge. This information is also relied back to the employer. Fabrizio is also able to subscribe to specific interactive training courses. The convergence channel also offers other related interactive services like asynchronous discussion groups enabling people from across Europe to discuss specific issues of professional issue by submitting textual, audio or video comments which are transmitted by the Convergence Channel. These comments can be submitted via email and translated into multiple languages.

The Convergence Channel is successful because it is a high value premium service that can be offered to a specific community of 100,000s of professionals across Europe in multiple languages.

Results and Conclusions of Survey

Despite over 3300 broadcasters, network operators, educational technologists and others involved in education and training being invited to take part in the survey, the returns were very low. Only six people returned the comments sheet.

The responses came from:

- One Spanish person involved in cable TV developments
- One US person involved in distance education via educational TV
- One UK person involved in interactive TV
- One UK person involved in educational technology consultancy
- One UK person responsible in a business school for new developments
- One UK person who is involved in live interactive training via satellite.

From the very limited response it is very difficult to make any generations on the comments received. However, most people with the exception of the Spanish person seemed to consider that most of the scenarios were likely or very likely to happen within the next two to three years if they were not already occurring; and that the technologies needed were either already available or were not considered to be a constraint in the future.

In order to actually develop such services one person pointed out that public-private partnerships were needed. A critical question is who would benefit from the different types of services. The benefactors, being the most likely organisations, institutions or individuals who would be prepared to invest in such services.

Although there may have been some flaws in the method adopted in order to capture the views of potential key players, it might also be acceptable to conclude that overall interest and awareness of the utilisation of interactive TV learning services to the home is still very low. This is not really surprising as this study and survey were being conducted at a time when interactive TV services of any type are almost non-existent in Europe and other parts of the World. Most educationalists offering distance education courses are totally focused towards using various online services via the Internet (and most of these oriented to the web).

Participants of a consensus-reaching workshop run in Brussels, as part of this study, also seemed agree that stimulating interest in utilising interactive TV for learning purposes required a number of awareness raising measures amongst the education and training communities.

Recommendation

Therefore a key recommendation is to develop mechanisms that raise awareness of the potential for utilising interactive TV learning services amongst the education and training community.

Comment Sheet for Scenarios

Thank you for assisting us in this survey. All the information that you provide will be kept confidential, but we do need the following information in order to get a profile of yourself and have a contact point in case we need to clarify anything. Thank you very much for your time.

Name..... Country.....

Your Position in the Organisation.....

Organisation.....

Type of organisation.....

Tel No.Email

Please can you indicate how likely each of these scenarios may become a reality using the scale provided. Can you then comment on the technical, market and other issues, which have influenced your decision. We are keen to understand whether there are more realistic versions these scenarios and whether there are any constraints that don't make them realistic at all from a technical or market perspective. Can you also indicate whether you think it is more likely that the scenario is better deployed on using web-based technologies, which could include high-speed access to the Internet.

If you don't have enough space please feel free to add additional comments on a separate sheet.

Please fax this Comment Form to +44 1353 661707 or post to

pjb Associates, Alexander House, 38 Forehill, Ely, Cambridgeshire, CB7 4AF, United Kingdom.

**You can also obtain an electronic html version of this form from: -
<http://www.pjb.co.uk/comments.htm> so you can email to:- dbt@pjb.co.uk**

1. Video-clip Archive Scenario

Very unlikely											Very likely
-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5	

If you think this scenario is possible please indicate after how many years will it happen.

<1	1	2	3	4	5	6	7	8	9	10	10>
----	---	---	---	---	---	---	---	---	---	----	-----

Your comments on market issues

Your comments on technical issues (including utilisation of scenario on other competitive technology configurations)

Your comments on other issues

2. Life Long Learning by combining open and closed user groups

Very unlikely
-5 -4 -3 -2 -1 0 +1 +2 +3 Very likely
+4 +5

If you think this scenario is possible please indicate after how many years will it happen.

<1 1 2 3 4 5 6 7 8 9 10 10>

Your comments on market issues

Your comments on technical issues (including utilisation of scenario on other competitive technology configurations)

Your comments on other issues

3. Interactive Information Services scenario

Very unlikely
-5 -4 -3 -2 -1 0 +1 +2 +3 Very likely
+4 +5

If you think this scenario is possible please indicate after how many years will it happen.

<1 1 2 3 4 5 6 7 8 9 10 10>

Your comments on market issues

Your comments on technical issues (including utilisation of scenario on other competitive technology configurations)

Your comments on other issues

4. The virtual car driving school using interactivity and simulations

Very unlikely
-5 -4 -3 -2 -1 0 +1 +2 +3 Very likely
+4 +5

If you think this scenario is possible please indicate after how many years will it happen.

<1 1 2 3 4 5 6 7 8 9 10 10>

Your comments on market issues

Your comments on technical issues (including utilisation of scenario on other competitive technology configurations)

Your comments on other issues

5. Impulse learning Scenario

Very unlikely
-5 -4 -3 -2 -1 0 +1 +2 +3 Very likely
+4 +5

If you think this scenario is possible please indicate after how many years will it happen.

<1 1 2 3 4 5 6 7 8 9 10 10>

Your comments on market issues

Your comments on technical issues (including utilisation of scenario on other competitive technology configurations)

Your comments on other issues

6. Utilisation of high definition TV (HDTV) and interactivity

Very unlikely
-5 -4 -3 -2 -1 0 +1 +2 +3 Very likely
+4 +5

If you think this scenario is possible please indicate after how many years will it happen.

<1 1 2 3 4 5 6 7 8 9 10 10>

Your comments on market issues

Your comments on technical issues (including utilisation of scenario on other competitive technology configurations)

Your comments on other issues

7. Educational campaigns with interactive edutainment

Very unlikely
-5 -4 -3 -2 -1 0 +1 +2 +3 Very likely
+4 +5

If you think this scenario is possible please indicate after how many years will it happen.

<1 1 2 3 4 5 6 7 8 9 10 10>

Your comments on market issues

Your comments on technical issues (including utilisation of scenario on other competitive technology configurations)

Your comments on other issues

8. Pan-European Professional Learning Channel

Very unlikely
-5 -4 -3 -2 -1 0 +1 +2 +3 Very likely
+4 +5

If you think this scenario is possible please indicate after how many years will it happen.

<1 1 2 3 4 5 6 7 8 9 10 10>

Your comments on market issues

Your comments on technical issues (including utilisation of scenario on other competitive technology configurations)

Your comments on other issues

Please fax this Comment Form to +44 1353 661707 or post to pjb Associates, Alexander House, 38 Forehill, Ely, Cambridgeshire, CB7 4AF, United Kingdom.

You can also obtain an electronic html version of this form from: -

<http://www.pjb.co.uk/comments.htm>

that you can email to:- dbt@pjb.co.uk

Appendix D Consensus Reaching Workshop

"Development of Satellite and Terrestrial Digital Broadcasting Systems and Services and Implications for Education and Training"

Consensus Reaching Workshop

28 May 1999

Purpose of meeting

To presentation the initial findings of the study and to see whether a consensus can be reached over the conclusions and recommendations which will be made to the European Commission.

Agenda for the Workshop

28 May 1999

10:00 - 16:30 hrs

10:00 hrs	Registration and Coffee
10:30 hrs	Introduction and Welcome by Roger Broadie (Chair) Managing Director of the European Education Partnership and Wim Jansen, European Commission.
10:45 hrs	Presentation on the purpose and the initial results of the study by Peter Bates, pjb Associates
11:45 hrs	Initial discussion on the findings
12:15 hrs	lunch break. (You will be able to buy a lunch in the Commission Restaurant)
14:00 hrs	Discussion on specific issues that the study has covered: - (a) Technical solutions already on the market relating to the types of decoder, conditional access systems, high-speed data interfaces plus standardisation issues - implications for education and training. (b) Take-up of the various digital systems and assessment on the impact they will have on education and training. (c) Different ways that interactive TV learning services may be paid for.
15:15 hrs	Coffee
15:30 hrs	Opportunity for participants to make a short (5 minute) presentation of an issue related to the study.
16:00 hrs	Reaching a consensus on the conclusions of the study.
16:30 hrs	End of Workshop.

Meeting in Brussels 28th of May 1999.

Based on minutes prepared by Lars Hansson Mediautbildning, Sweden

The minutes of meeting just the key comments that are valuable for the report and with keywords.

1. Comments based on the presentation

- i. Integration of web site with the programs. There should be a link between the two. BBC Knowledge is launched 1st of June 1999. *Paul Robinson BBC.*
- ii. There is a convergence of web and TV. *Tony Bowden, Espresso.*
- iii. Interactive broadcasting is the key area in the report. One- way digital broadcasting is nothing new. Internet and terrestrial broadcasting are promising areas. If you lack creativity you always start with technology *Wim Jensen*
- iv. There are two aspects of interactivity, the technical aspect and the human one at work and learning situation. Interactivity are the two things together.
- v. G-band possibilities and multimedia via satellite.
- vi. The report looks too much at non-formal learning and too little on formal.
- vii. The report is written only from technical point of view and not from the need of the users.
- viii. The return channel is a very important tool.
- ix. *Interactive TV to the home is the main focus in the report (Peter Bates)*
- x. The report looks too much at the situation of to day and gives no ideas of the future.
- xi. The distribution of set top boxes will change the market for digital TV.
- xii. There will be too many channels for the contents available, which will delude the programming. The government must act as a quality controller.
- xiii. The broadcasters will act as gatekeepers, which can prevent the new and small actors from an important market. Internet has no gatekeepers, yet.
- xiv. The videodisc in the 80's and the CD-ROM in the 90's burnt the publishers so they are not so interested in digital broadcasting.
- xv. But the multicast full screen is the future.

After lunch the following issues were focused on: -

- a) Interactivity – what is it?
- b) Formal vs. informal training
- c) Convergence of the future
- d) Collaboration to make it happen

2. Specific Comments

- i. Real time or not in interactivity?
- ii. Knowledge based learning has different levels of interactivity. People learn by stimulating their different senses
- iii. EC shall look at policy to stimulate to close " the gap" by using tax policy.
- iv. Interactivity in the 80's was man-machine communication with CBT. Now we have human interaction, if this not happen it will just be mass information.
- v. Tutoring is very important.

- vi. *Trends are that there will be more interactivity in informal than in formal training (Peter Bates)*
- vii. The actors must learn to act together.
- viii. Three areas of interactivity - Talking heads, Tutors, Collaboration
- ix. There are enormous archives of material, which can be digitised and then used.
- x. Use workshops to get developers to co-operate (Terry Brockley)
- xi. ZDF is losing money and market share. Difficult to obtain awareness. Intercast gets 7 hours a week but normal broadcasting 2 hours a week. ZDF has insufficient funds to produce programs. Internet links strengthen the market brand. (Michael Pochert)
- xii. Technical standards are very important to make it easy for software developers.
- xiii. Is training regional or not. Discussions with examples from the oil industry. SMEs have problems to get training so they welcome home-based-training possibilities in all forms. SME channel. The bigger companies can run their own in house training but it will become so expensive that they want their staff to learn at home too. Examples learning all employees win NT.
- xiv. Mobile access to learning. Just-in-time learning. Killer application!
- xv. Learning regions with all telematics facilities. The primary school is the centre. Learning network to support the region.
- xvi. Small SMEs will take the lead in the market of digital learning.
- xvii. Internet is the growing area and not digital TV.
- xviii. UFI and BIB important in UK
- xix. PBS has its own web site instead of franchising
- xx. E-commerce has development of technology, which can be used digital learning.
- xxi. This is a big threat among UK universities from virtual universities in the US.

Meeting finished at 16:30 hrs

Action from Meeting

The views expressed were sometimes quite diverse and not always specifically relevant to the key issues of the study. Unfortunately some of the key players involved in these developments were not able to attend the workshop despite being invited. However, where appropriate the study took into account the various comments made bearing in mind the various perspectives of the participants. In particular this included:

- The importance of technical standards
- Convergence of web and TV
- Future developments of Interactive TV - towards Personal TV
- Distribution of set top boxes will change the market for digital TV
- Broadcasters acting as gatekeepers, who can prevent the new and small actors from an important market compared to the Internet that has no gatekeepers, yet.
- Actors must learn to work together

List of Participants

1. Peter Bates, pjb Associates, UK
2. Tony Bowden, Espresso Productions Ltd, UK
3. Roger Broadie, European Education Partnership, Belgium
4. Terry Brockley, Gwynedd Technology Centre Wales
5. Horst Cramer, IQ-TV, Germany
6. Detlef Garbe, Deutsche Telekom, Germany
7. Lars Hansson, Mediautbildning, Sweden
8. Paul Robinson, BBC Education, UK
9. Michael Pochert, ZDF, Germany
10. Detlef Skaley, GMD, Germany
11. David Squire, DESQ/BBC Education, UK
12. Giuseppe Tomasicchio, Alenia Aerospazio, Italy
13. Mathy Vanbuel, ATiT & Associates, Belgium

Plus Wim Jansen, European Commission