DEVELOPMENT OF A CROSS PLATFORM SUPPORT SYSTEM FOR LANGUAGE LEARNERS VIA INTERACTIVE TELEVISION AND MOBILE PHONE

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Abstract

This thesis explores and develops the potential of interactive television (iTV) technology for language learning. Through a modified form of the socio-cognitive engineering approach (Sharples et al., 2002a), a range of learner centred design activities were carried out and a system developed to provide cross platform support, blending iTV and mobile phones, for adult language learners.

The focus group technique was used to study adult language learners' strategies, motivations and use of technologies for learning. The results of this study were integrated to shape a framework for iTV based language learning, drawing also on language learning theories and the learning affordances of the iTV technology. On the basis of this framework, a number of scenarios were developed, which were subsequently translated into a list of general requirements. TAMALLE (Television and Mobile Assisted Language Learning Environment), a prototype system based on these requirements, was designed and developed. TAMALLE is a cross platform informal language learning environment that supports learners' understanding of authentic materials broadcast on television, by scaffolding difficult language items with explanation. It supports learners' overall understanding and enables learners to construct and organise their own individualised knowledge environment, which can be also accessed on an anytime and anywhere basis. In this process, the system supports learners' comprehension of television programmes and learning of new language items.

A study was conducted with EFL learners to identify criteria for selection of language learning items from authentic English TV programmes that could further scaffold learners' understanding through the recommendation and annotations functions of the TAMALLE system. Three different television genres were studied: a popular UK soap opera, a news broadcast and a lifestyle programme. The results suggest a number of categories of language item that learners might find difficult to understand whilst watching a broadcast programme. In particular, names of unknown places, words referring to UK culture, Western references, figurative expressions and slang were perceived to be difficult. On the basis of this study, learning materials were developed for adult English foreign language learners and used in the TAMALLE prototype system.

A multi-method evaluation approach was used to gauge the usability, perceived usefulness and desirability of the TAMALLE system. The results revealed an overall positive response from language learners. Although there were some reported difficulties in reading text and on-screen display on the iTV side and for entering text and scrolling on the mobile side of the interface, TAMALLE was perceived to be a usable, useful and desirable tool to support informal language learning and also for gaining new contextual and cultural knowledge.

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Declaration

I declare that the research contained in this thesis, unless otherwise formally indicated within the text, is the original work of the author. The thesis has not been previously submitted to this or any other university for a degree, and does not incorporate any material already submitted for a degree.

Much of the discussion and content of this thesis has also appeared in different journal and conference papers (see Appendix A). Material from the papers formed part of the following chapters.

Chapter 6 User study: language learners reflect on techniques, approaches and technologies reworked the following papers which are the significant intellectual contribution of Sanaz Fallahkhair.

Fallahkhair, S., Masthoff, J. and Pemberton, L. (2004a). Learning languages from interactive television: language learners reflect on techniques and technologies. In Cantoni, L. and McLoughlin, C. (Eds.). *Proceedings of World Conference on Educational Multimedia, Hypermedia & Telecommunications (EdMedia)*, Lugano, Switzerland, 21-26 June. pp. 4336-4343.

Fallahkhair, S., Pemberton, L. and Masthoff, J. (2004b). A dual device scenario for informal language learning: interactive television meets the mobile phone. In Kinshuk, Looi, C., Sutinen, E., Sampson, D., Aedo, I., Uden, L., and Kahkonen, E. (Eds.). *Proceedings of the 4th IEEE International Conference on Advanced Learning Technologies (ICALT)*, Joensuu, Finland, 30 August - 1 September, pp. 16-20.

Pemberton, L., Fallahkhair, S. and Masthoff, J. (2005). Learner Centred Development of Cross Platform Language Learning Support System, *Journal of Educational Technology and Society, Endorsed by IEEE Learning Technology Task Force*, 8 (4), pp. 52-63.

Chapter 7 Shaping requirements: from theoretical framework to artefact design reworked the following papers which are the significant intellectual contribution of Sanaz Fallahkhair.

Fallahkhair, S., Pemberton, L. and Masthoff, J. (2004b). A dual device scenario for informal language learning: interactive television meets the mobile phone. In Kinshuk, Looi, C., Sutinen, E., Sampson, D., Aedo, I., Uden, L., and Kahkonen, E. (Eds.). *Proceedings of the 4th IEEE International Conference on Advanced Learning Technologies (ICALT)*, Joensuu, Finland, 30 August - 1 September, pp. 16-20.

Pemberton, L., Fallahkhair, S. and Masthoff, J. (2004). Towards a Theoretical Framework for Informal Language via Interactive Television. In Kinshuk, Sampson, D.G. and Isaias, P. (Eds.). *Proceedings of IADIS International Conference of Cognition and Exploratory Learning in Digital Age (CELDA)*, Lisbon, Portugal, 15-17 December. pp. 27-34.

Chapter 8 Design and implementation of a television and mobile assisted language learning environment reworked the following papers which are the significant intellectual contribution of Sanaz Fallahkhair.

Fallahkhair, S., Pemberton, L., and Griffiths, R. (2005). Dual Device User Interface Design for Ubiquitous Language Learning: Mobile Phone and Interactive Television (iTV). *Proceedings of the IEEE International Conference on Wireless and Mobile Technology in Education (WMTE)*, Tokushima, Japan, 28-30 November, pp. 85-92. Best paper award obtained.

Fallahkhair, S. (2004a). Media convergence: an architecture for iTV and mobile phone based interactive language learning. In Masthoff, J., Griffiths, R. and Pemberton, L. (Eds.). *Proceedings of European Conference on Interactive Television: Enhancing the Experience (EuroiTV)*, Brighton, UK, 31 March - 2 April. pp. 177-182.

Fallahkhair, S., (2004b). Cross-Media Architecture: Delivering Language Learning Services to Digital Interactive Television (DITV) & Mobile phone. *Proceedings of Postgraduate Conference in Electronics, Photonics, Communications & Networks and Computing Science*. University of Hertfordshire, UK, 21-24 April, pp. 102-104.

Fallahkhair, S., Pemberton, L., and Griffiths, R. (2007). Development of a cross-platform ubiquitous language learning service via mobile phone and interactive television. *Journal of Computer Assisted Learning*, 23, pp. 312-325.

Pemberton, L. and Fallahkhair, S. (2005). Design Issues for Dual Device Learning: Interactive Television and Mobile Phone. *Proceedings of the 4th World Conference on Mobile Learning (mLearn)*, Cape Town, South Africa, 25-28 October, pp. 55-61.

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Fallahkhair, S. and Pemberton, L. (2007), Learner-centred Development of Learning Objects for Interactive Television. *Proceedings of World Conference on Educational Multimedia, Hypermedia & Telecommunications (EdMedia)*, Vancouver, Canada, 25-29 June, pp. 3877-3883.

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Signed Dated

Chapter 1 Introduction

1.1 Introduction

E-learning is widely developed and constantly evolving (Garrison and Anderson 2003). It inherits the functionalities of the World Wide Web and the Internet and presents many possibilities for learning that are mainly delivered through desktop computers. However, there are other 'non desktop' technologies, such as game consoles, mobile devices, media players and interactive television (iTV), that could offer many contemporary functionalities to support a learning society.

The integration of 'non-desktop' technologies is attracting increasing interest amongst researchers in informal, adult and lifelong learning. While conventional desktop computers are highly regarded in formal and curriculum-based learning in classroom settings, ubiquitous media technologies, including interactive television and mobile devices may provide a better 'fit' with the lives of learners who are in domestic settings or on the move (Atwere and Bates, 2003; Sharples, 2000).

One promising area is language learning; especially through new 'non-desktop' technologies a wide variety of activities and experiences can be supported that could benefit language learners (Bickel and Truscello, 1996; Pemberton, 2002; Milton, 2002; Chinnery, 2006). For example, they might include activities based on digital media in the target language, such as playing computer games in the target language, engaging in discussion with native speakers on a phone, and watching a foreign language television.

However, each technology has distinct characteristics that afford some types of use and hamper others (Bates, 2005). For example, while mobile devices afford a wide variety of personal activities and learning on the move, they are less powerful for enabling learning from authentic and immersive content. In contrast, television provides rich multimedia presentation of authentic and immersive content that is constantly renewed. Programmes such as news, soap operas and documentaries have the potential to enhance language learners' experience by showing the target language, culture and context of use (Meinhof, 1998; Broady, 1997; Lonergan and Swan, 1984; Sherrington,

1973). However, interactive television does not naturally provide facilities for personalized learning or learning on the move in the way that mobile devices do. The convergence of different technology can be a good thing (Robertson et al., 1996; Fallahkhair et al., 2004b), because it enables the combination of the different strengths of each technology, providing more opportunities and activities.

This thesis explores and develops the potential of two new digital technologies, interactive television (iTV) and mobile phone, for language learning. Using a modified form of the socio-cognitive engineering approach (Sharples et al., 2002a), a range of learner centred design activities were carried out and a system developed to provide cross platform support, blending iTV and mobile phones, incorporating English television programmes and learning materials, for adult English foreign language learners.

We believe that the design process, for learning technologies as much as for other designed artefacts, should be seen as a process of creativity under constraints (Pemberton et al., 2005). Firstly, designers should take into account the inherent properties of the technology, so that appropriate functionality is designed. For instance, it would be possible, but strange, to develop an *audio* language laboratory primarily to support the development of second language *writing*: the characteristics or affordances of the audio-tape and headphones approach clearly suit the practice of *spoken*, not *written*, language skills. Secondly, many researchers have pointed out the need, when designing such services, to align them with the recommendations of current language learning theories. To take the example of audio language labs again, they went rapidly out of fashion as methods based on communicative theories replaced those based on behaviourism.

However, there is generally less attention paid to the attitudes and behaviours of language learners themselves with regard to new technologies. If the technology is 'new born', as was the case with the Internet, then simply using technological capabilities in a way that conforms to current second language learning theory may be enough for a successful outcome. There are fewer ingrained attitudes to take into account. However, when new capabilities are grafted onto existing technologies, a new set of constraints appear that are associated with the established characteristics of the medium or

technology itself and to people's relationship with that medium. These issues will be tackled throughout the process of cross platform development in this thesis, taking into account not only the capabilities of the technological platform and theories of language learning but also the views and reported behaviour of learners with regard to these technologies.

In sections (1.2) we discuss the state of the art in research and development into iTV and mobile technologies. Section 1.3 presents our research aims and questions, while section 1.4 outlines the original contributions of this project. Finally, overviews of the structure of the subsequent chapters are provided in section 1.5.

1.2 Background

In this section we review some of the recent research and development in the field of iTV and mobile telephony. However, a more detailed discussion, together with an overview of a number of existing developments of these technologies for learning, is provided in Chapter 3 and Chapter 4 of this thesis.

1.2.1 Interactive television: research and development

ITV is a new media technology that combines Internet style functionality with traditional television. In recent years, with the advancement of digital technologies, the rapid development of iTV has been witnessed. ITV is currently delivered in the UK via different digital platforms (satellite, terrestrial, cable and IPTV), and provides opportunities for viewers to interact with their television, for example, by accessing additional information about a programme, using enhanced teletext service, accessing Internet, sending emails, purchasing goods and more. This rapid development of iTV technology has attracted huge interest among industries and academics who are undertaking new development and research. While in 2003 when this research was started, there was little iTV development and research, today the number of iTV related conferences and developments across the globe is growing. Research and development is strong in the areas of hardware and infrastructure, user centred design, usability and accessibility, personalization and adaptivity of content and interface and learning potential of television (t-learning), and is reported in a number of books (Gawlinski, 2003; Lekakos et al., 2007) and a regular international conference (EuroiTV).

Unlike the Internet, iTV research and development have been affected by its deployment and take-up, as the main providers are usually public broadcasters and platform providers. Therefore, its development varies across nations and is also influenced by socio-cultural, political, demographic, and many more issues in relation to the country in question. UK is the most well-developed iTV market in the world, which is due to its aim to turn off analogue TV by the year 2012 (POST, 2006). Currently, there are over 80% of UK's households that receive digital television (Ofcom, 2007).

ITV technology, as well as its potential for delivering all sorts of applications, has been recognised as having great potential to support learning. The 2003 report commissioned by the Learning Skill and Development Agency suggests that the role of digital TV should be more closely linked to e-government initiatives and points out that "interactive digital TV should be part of an overall e-learning strategy aimed at widening participation and increasing new learning opportunities in the home" (Atwere and Bates, 2003, p.41). This report also introduced the definition of t-learning or learning from television as a new learning paradigm in the field of e-learning and indicates a number of learning opportunities that may be supported via iTV technology, including:

- Pre-school learning activities (e.g. colour coordination and recognition using remote control)
- Learning about parenting (e.g. having baby, bringing up children)
- Home-school link
- Revising for GCSEs (e.g. assessment and feedbacks)
- Developing basic skills (e.g. literacy and language learning)
- DIY for developing new skills
- Learning for continuous professional development

Chapter 4 of this thesis will discuss iTV technologies and applications in more detail. A survey of a number of t-learning projects is also included. However, as the work reported in this thesis attempts to explore and develop iTV's potential for delivering cross platform support by combining iTV with the mobile phone for language learning,

the next section (1.2.2) will overview the latest research and development in the mobile phone domain.

1.2.2 Mobile telephony: research and development

Recent developments in telecommunication technology have opened up new possibilities for wireless and mobile devices and services. New generations of telecommunication platforms like 2G, 2.5G, and 3G (Generation) and GPRS (General Packet Radio Service) offer far greater capability in data transmission and new services, such as video clips, photo-messaging, e-mail, games, MP3 player, Internet on mobile, commerce, banking and so on. The mobile phone is no longer perceived as a pure communication tool, as many people are adopting it to access information, play games, take photos and videos, listen to radio and watch television. More mobile devices with improved functionalities, PDAs and smart phones are appearing on the market. Mobile TV seems to be the next breakthrough in mobile technologies.

As a result of this rapid evolution, a number of developments are under way. Academics and industries are working together towards the development of more added-value functionalities, applications and improved access. In particular, the learning potential of mobile devices has attracted research interest worldwide (Sharples, 2006; Naismith et al., 2005; Kukulska-Hulme and Traxler, 2005). The mobile learning (m-learning) field is becoming the most fashionable area of research in the field of educational technology. While five years ago there was little known about this area of research, there are now a dozen conferences world wide with the same interest in the applications of wireless and mobile technologies to education.

Research in this field is predominantly concerned with the possibilities that these devices may offer to the learning society, with opportunities to facilitate formal, informal, blended, just-in-time, collaborative and lifelong learning. A number of papers have investigated not only the technological, pedagogical, social, cultural aspects of mobile learning, but also the implications of design, development and adaptations of new applications within this new field of research. This thesis aims in particular to address the latter issue, developing the potential of this medium for language learning in conjunction with iTV technology. The following section provides an outline of the

research questions addressed in the project (1.3), the contribution to knowledge that it makes (1.4), and the development of the rest of the thesis itself (1.5).

1.3 Research questions

The research originally aimed to explore the potential of iTV technology for language learning. It was intended to exploit the capabilities of this medium to design and develop a useful, usable and desirable system for adult language learners. As we see the design practice for a new system as a process of creativity under constraints, a working framework of iTV based language learning has to be developed in order to put some constraints on design, and to inform the development process. To carry out this investigation, a very first research question was:

(Q1) What should be the elements for a framework for iTV based language learning in order to inform the design?

A working framework of iTV language learning was established which pulled together a user study (the study of adult language learners), theory of use (the language learning theories), and the learning affordances of iTV technology. Two elements of this framework, the user study and theory of use, are the components of socio-cognitive engineering methodology (Sharples et al., 2002a). However, we believe that for the iTV technology it is also important to take into account the inherent properties of this technology, of traditional TV and the functionalities it could afford. These constraints are put together to shape a working framework of iTV based language learning and to inform the design of a new language learning support system for this technology. Therefore, to answer the above question, a study should be carried out to investigate adult language learners' approaches and use of technologies. The following questions were investigated:

(Q2) What approaches, techniques and technologies have been used or adopted by adult language learners for second language learning?

(Q3) How do adult language learners perceive iTV as a medium for language learning and what technological supports, tools and contents may extend their language learning experiences from the use of this medium?

A number of focus group studies were carried out to elicit how independent learners go about their language learning, what their approaches are and what technologies they find useful. This knowledge can be combined with other elements of the framework, theory of use and learning affordances of technology, to generate a set of general requirements for technology to support language learning. So, the next question was:

(Q4) What requirements can we infer from the framework of iTV based language learning?

The results of the focus group with the other elements of the working framework, at this stage, took the research in a new direction; using cross platform approaches: iTV and mobile devices, taking advantage of the best aspect of each medium, rather than concentrating on a single technology. A scenario technique was used to conceptualise the system design and to infer a set of general requirements that could be used for system development. The next question was:

(Q5) How can the set of requirements inform the design and development of a cross platform language learning support system?

The TAMALLE (Television and Mobile Assisted Language Learning Environment) is designed based on the requirements proposed. TAMALLE is a cross platform informal language learning environment that supports learners' understanding of authentic materials broadcast on television by scaffolding difficult language items with explanation, supports learners' overall understanding and enables learners to construct and organise their own individualised knowledge environment, which can be also accessed via mobile phone. In this process, the system supports learners' comprehension of television programmes and learning of new language items (vocabularies). The TAMALLE system is intended to support learning a second language from the television programmes. However, the prototype is demonstrated through English television programmes and the learning materials were developed for

advanced learners of English as a Foreign Language (EFL). The development of this facility involved answering the question of exactly which aspects of the broadcast materials are more problematic for EFL learners. So, the following research questions were proposed:

(Q6)What language items/objects in televised programmes are problematic for the EFL learner?

(Q7)How do EFL learners perceive different television genres for language learning?

To answer the above, a study was designed to elicit criteria for selection of those language items - which we refer to as Language 'Learning Object'[1] (LLO) - whose annotation or explanation could best enhance the advanced learner's understanding of broadcast television programmes in the target language. Three different TV genres[2] were studied: a popular UK soap opera (EastEnders), a news broadcast and a lifestyle programme (Relocation, Relocation, Relocation). On the basis of the results, we developed a number of LLOs, which were integrated into the TAMALLE system and used in the evaluation stage.

The TAMALLE system was evaluated in order to establish if it satisfies the general requirements, and to check whether it is a system that learners consider to be a usable, desirable, useful and acceptable learning tool. A multi method evaluation technique combining observation and questionnaire was used to answer the following question:

(Q8) Is this language learning environment (TAMALLE) perceived to be usable, useful, acceptable and desirable as a tool to support EFL learners?

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[1] We use the definition of 'learning object' developed by Learning Technology Standards Committee (LTSC) of the IEEE as "any entity, digital or non-digital, that may be used for learning, education or training" (LTSC, 2002, p.6).

[2] We used the selected programmes under the educational license of University of Brighton Copyright agreement. Ten minutes of each programme were recorded by the staff in the Media Centre of the University and were used for the study. BBC News broadcast was digitized and streamed into TAMALLE system. There were no amendments to the original content of any of these programmes.

The next sections discuss the original contributions that were made by this project followed by an overview of the structure of the thesis chapters.

1.4 Contribution to knowledge

The work described in this thesis makes a number of contributions to knowledge in the field of e-learning. Here, the main points are listed:

- An extensive survey of existing literature that draws different interdisciplinary fields together. The analysis of language learning and adult learning theory, a historical survey of language learning technologies and an overview of iTV technology and its application are provided. This survey highlights the potential and opportunities provided by iTV and mobile phone technologies for language learning.

- An original investigation of independent adult language learners' techniques, approaches, and use of technologies. This study provides a large number of desirable attributes for learning environments that could also be used in directing the design of a number of different projects. The results of this study were published in *Educational Technology & Society Journal* and at two of the largest e-learning conferences, *World Conference on Educational Multimedia, Hypermedia, and Telecommunications (EdMedia 2004)* and *the IEEE International Conference on Advanced Learning Technologies (ICALT 2004)*.

- Novel cross platform solution architectures combining iTV with mobile telephony were proposed. These architectures are extensible to include other technologies and devices for future integration. They could also be applied to other cross platform developments, which aim to deliver digital and interactive content to the user. The analyses of these investigations were proposed at the iTV conference, *European Conference on Interactive Television (EuroiTV 2004)*.

- On the basis of the proposed architecture, TAMALLE was developed and a detailed analysis of interaction design issues that arise in the context of cross

platform systems for ubiquitous language learning via iTV and mobile phone technologies was investigated. A number of issues, including, on-screen display, navigation and interaction, were tackled. These original investigations were published at the two mobile learning conferences, *World Conference on Mobile Learning (mLearn 2005)* and *the IEEE International Workshop of Wireless and Mobile Technology in Education (WMTE 2005, where the best paper award was obtained).*

- The development of TAMALLE as a cross platform support system required the incorporation a multi-method evaluation technique that could be used to gauge a number of different criteria, usability of its dual interfaces and its usefulness, desirability and acceptance as a learning tool. An original investigation for designing an evaluation study for cross platform systems was carried out. The results of this study were also published in a special issue on mobile learning of the *Journal of Computer Assisted learning*.

- An original investigation was carried out into the development of LLOs from broadcast authentic TV programmes. We report on the study that was conducted to elicit criteria for selection and provision of LLOs for advanced EFL learners. The possibility of segmentation and automatic selection of these LLOs was tackled. Not only does this study provide a useful contribution to the e-learning field, it also provides insightful knowledge from which others might benefit: for example, language teachers who would like to design and develop learning materials from broadcast materials or independent language learners who would like to develop the strategies to better understand target language television programmes. The result of this original work was also published at the *World Conference on Educational Multimedia, Hypermedia, and Telecommunications (EdMedia 2007).*

In addition to the above, this project provides further contributions to the field of e-learning through a number of other publications listed in Appendix A of this thesis.

1.5 Overview of the thesis chapters

The thesis is organised as follows:

Chapter 2 presents a brief survey of second language learning and teaching theories, followed by an overview of the theories of formal, informal, and incidental learning together with a discussion of adult learning theories and practices. Finally, design implications that arise for new language learning technology are discussed.

Chapter 3 provides an overview of different media technologies and their affordances for language learning. This overview covers printed material, language lab, audio tapes, CD, film, TV, CD-ROM and DVD. Historical reviews of computers for language learning are then provided, followed by applications of the Internet and World Wide Web. Communication technologies, including email, chat-rooms, discussion boards, video conferencing and blogging are discussed. An overview of the latest projects to have developed the potential of virtual reality and mobile technology for language learning is also provided.

Chapter 4 presents a review of the iTV technology, platforms, standards and applications literature. It also describes a number of projects demonstrating the potential of iTV to support learning. A definition of t-learning is introduced and an overview of a number of t-learning projects is provided.

Chapter 5 presents the overall research methodology used in this project.

Chapter 6 reports on focus group studies carried out to investigate the approaches that a number of independent adult learners adopt towards their language learning and their attitudes towards a range of language technologies, including iTV and mobile phones.

Chapter 7 discusses the process of shaping requirements. In this chapter we incorporate the result of the study discussed in Chapter 6 to propose a framework for iTV based language learning. Two scenarios and a list of general requirements, which were developed on the basis of our proposed framework, are also provided. Finally, we provide a detailed description and rationale for a set of general requirements.

Chapter 8 provides a description of the TAMALLE application. It describes two solution architectures proposed for the TAMALLE development, followed by our

rationale and analyses for interaction design issues that arise in the context of a cross platform system.

Chapter 9 describes a study designed to elicit criteria for selection of LLOs from broadcast TV programmes for advanced EFL learners.

Chapter 10 describes the TAMALLE evaluation. A multi-method evaluation approach to gauge the usability, perceived usefulness, desirability and acceptability of the TAMALLE system is described.

Chapter 11 provides insight into, and reflections on, the overall research process. It looks at how the research questions were addressed and at directions for further research.

Chapter 2 Adult foreign second language acquisition

2.1 Introduction

It is generally agreed that there is no unified view of second language learning theories and approaches. As Mitchell and Myles point out, "we have not yet arrived at a unified or comprehensive view of how second language are learned […] No single theoretical position has achieved dominance, and new theoretical orientations continue to appear (Mitchell and Myles, 1998, pp. ix-x). Language learning itself involves acquiring different skills, as the separate functions of speaking, listening, reading and writing have to be addressed, each at many levels, from phonetics to discourse and pragmatics (Pemberton, 2002). In addition, there is not a single best approach to learning and teaching a second language. As Milton asserts:

> "There is no one best way to learn a foreign language, nor a single optimal set of teaching materials. This is because the learners will vary in both how they learn and what they want and need to learn. Good teaching materials may, therefore, be produced according to a number of different approaches to language description, different interpretations of the theory of language learning, and according to different approaches to the process of teaching" (2002, p.2).

In order to understand more about how adults learn a second language, this chapter aims to provide a brief survey of second language learning theories (section 2.2), language teaching approaches (section 2.3), and factors influencing second language learning (section 2.4). This is followed by an overview of theories of formal, informal and incidental learning (section 2.5) together with discussions on adult learning theories and practices (section 2.6). Finally, section 2.7 discusses design implications that arise for new technology for language learning. This gives us a better insight into how second and foreign languages are learned, and more particularly into matching the capabilities of iTV to adults' needs, approaches and strategies.

2.2 Language learning theories

This section briefly outlines some of the most influential current theories of language learning. Taking a chronological approach, we begun by reviewing the behaviourist

theory proposed by Skinner (1957) and then moving to Chomsky's cognitive theory of language learning (1968), followed by Krashen's theory of creative constructionist (1981), constructivist and socio-cultural theories of language learning. Although all these theories are primarily concerned with providing explanations about how languages are acquired, no single theory offers a comprehensive explanation about the whole process of second language acquisition. As Mitchell and Myles assert:

> "Theories may be embryonic and restricted in scope…A theory of L2 learning may deal only with a particular stage or phase of learning, or with the learning of some particular sub-aspect of language; or it may propose learning mechanisms which are much more general in scope" (1998, p.3).

It is important, therefore, to note that theories, in their views of how languages are learned, may be limited in scope and in conflict with each other. They may also illuminate different aspects of language skills. In order to provide a more practical account, for example, while behaviourist theory advocates learning through *stimuli* and *response* and lends itself in supporting learning vocabulary and pronunciation, it may not be so pertinent in acquiring grammar and fluency skills. On the other hand, the cognitive approach believes learning a second language happens through developing rules and experience of the target language and therefore it puts more emphasis on explicit learning of language structure and grammar. In the following sections, we provide a critical review of a number of theories and indicate areas of language skills that could be best supported from these theories.

2.2.1 Behaviourist theory

The behaviourist approach suggests that language is a habit-associated activity, which can be learned explicitly through *stimuli* and *response* (Skinner, 1957). Learners receive linguistic input from speakers and learning takes place through correct repetition and imitation. As a result, second language acquisition is developed through a set of habits that are related to the first language. These habits then clash with those needed for second language speech, and new habits will be formed.

Certain skills such as vocabulary, sounds and pronunciations may well be acquired through the use of a behaviourist approach, e.g. through the language lab and its

repetitive exercises. However, the development of fluency and structural accuracy is not easily achievable and requires considerable exposure to the foreign language and/or to explicit instruction (Milton, 2002). The main reason is that the behaviourist approach does not allow for our cognitive interpretation and mental representation of the target language to develop (Skehan, 1998). In particular, it provides no explicit description and instruction about language rules and grammar (Johnson, 1996).

2.2.2 Cognitive theory

According to the cognitive approach, language learning is a process of building up a cognitive model of the target language through knowledge and experience until learners can make use of their knowledge automatically without even being aware of doing so (Chomsky, 1968). During this process of automization, the learner organizes and restructures new information that is acquired. Through this process of restructuring the learner links new information to old information, acquiring language rules and structures in order to achieve an increasing degree of mastery in the second language (McLaughlin, 1987).

In contrast with behaviourist approach, the cognitive approach suggests that learning happens when the learner internalizes rules that can be applied to different situations rather than memorizing string of words and dialogue for specific situations (Johnson, 1996). Thus, certain areas of language skills, in particular learning language structures, rules and grammar, were emphasised in this approach for acquiring a second language (Skehan, 1998).

2.2.3 Creative constructionist theory

The creative construction position on language learning is particularly associated with Krashen (1981). Krashen suggests that language acquirers outside formal learning contexts are not usually aware of the fact that they are learning a language, but acquire the second language by understanding the message or by receiving comprehensible input. Comprehensible input can come from a variety of sources at a level on or slightly above the learner’s current level of competence. (There is a clear parallel here with Vygotsky's notion (1978) of the Zone of Proximal Development). This input contributes directly to acquisition (incidental and implicit learning) which is largely responsible for

developing comprehension and subsequent productive fluency in a second language. According to this theory, learners do not need to actually speak or write in order to acquire language. Acquisition takes place internally as learners read and hear understandable samples of the language. In other words, after a great deal of listening, speech will emerge spontaneously.

Motivation to learn also appears to be one of the most important determinants in successful language acquisition (Krashen, 1981, 1982; Trueba, 1987). Krashen suggests that language programs must be highly motivating and designed in ways that cause learners to forget that they are hearing or reading another language. It is important to note that Krashen's theory of creative constructionist is not in conflict with the Papert's constructionist theory, which asserts learning is an active process wherein learners are actively constructing mental models and knowledge of the world around them (Papert and Harel, 1991). In Krashen's view, also, the emphasis is on the language learner creating his or her own individualized knowledge. However, in Krashen's view knowledge construction can also happen subconsciously, i.e. when learners are hearing a language even when they are not actively involved in the process of listening and comprehension activities, whereas in Papert's view construction of knowledge tends to be a more active and conscious process.

The most central skills to be supported, within this approach, are listening and comprehension. In contrast with cognitive approach, Krashen's theory suggests that learning is achieved "without conscious focusing on linguistic forms" (Krashen, 1981, p.78). Therefore, there will be less focus on learning grammar, reading, and writing skills. However, learning new lexicon and vocabulary may be supported whilst receiving comprehensible input from exposure to a target language environment.

2.2.4 Constructivist theory

The constructivist approach asserts that learning is an active, creative, and socially interactive process in which learners construct new ideas based upon their current and past knowledge (Piaget, 1970; Brunner, 1990).

Typically a learner in the constructivist tradition would be required to perform tasks and solve problems in the foreign language, ensuring a high level of interaction. Learner autonomy is highly emphasised in the constructivist view. Instruction is no more than the provision of the opportunities, and the teacher's role is also that of a coach, co-learner and facilitator. Learners will acquire different areas of language skills by being actively involved in reading, writing, listening, and speaking tasks. For example, learners may be encouraged to research, read and write about a topic of their own interest and/or to be involved in collaborative activities and interactions with other learners or native speakers in order to acquire communication skills, grammar and vocabulary.

It seems that the constructivist approach can offer a reasonable grounding in learning different area of language skills. However, it is frequently argued that this approach does not provide enough support for learning language structure and grammar (Cobb, 2005). Especially as far as novice learners are concerned, explicit instruction on grammar may be required.

2.2.5 Sociocultural theory

Sociocultural theory draws heavily on the work of Vygotsky, as well as later theoreticians (see, for example, Lantolf 2000). Vygotsky (1978) claims that learning occurs at both the social and individual level. Moreover, this theory asserts that language develops through meaningful social interaction (Lantolf, 2000). Therefore, knowledge develops via the negotiation of meaning through dialogue in the target language and its many socio-cultural expressions. Successful language learning is therefore achieved through exposure to and interaction with language in authentic contexts.

Lee argues that "interactive negotiation through individual input and output modifications does not provide sufficient conditions for acquisition and mastery of a second language". Rather, language learning goes beyond 'what' the individual produces (that is input and output) and focuses on 'how' the individual interacts with others through a joint activity (for example collaborative online exchange). The process

of negotiation encompasses the “inter-relationship between two parties whose actions are influenced by their intentions, goals and learning conditions” (Lee, 2004, p.84).

Typically learners in the sociocultural inspired programme are supported through dialogue or collaboration between peers. Therefore, there is more emphasis on communication, speaking and fluency skills where learning vocabulary and lexicon play an important part (Mitchell and Myles, 1998). However, grammar and writing skills may be implicitly supported through learner’s interaction and communications with teachers, native speakers and fellow learners.

2.3 Language teaching approaches

A number of different teaching approaches have developed on the basis of the learning theories introduced above. These approaches have been used over decades for teaching second languages either through technological tools or through classroom based activities. This section aims to briefly introduce and discuss the most prevalent approaches in more detail.

It is important to note that the learning effectiveness and success of any language teaching approach is highly dependent on a number of different factors. These may include: (a) the way the approach is used and adapted by the language teacher, (b) the way the approach is received by an individual learner, and (c) the collection of learning materials and content developed on the basis of the particular language teaching approach. In the following section, while we highlight the general principles of each approach, we also indicate the main area of language skills that may be supported through the use of each approach. This overview may help in understanding the different characteristics and principles of each language teaching approach as well as their strengths in supporting different areas of language skills.

2.3.1 The grammar-translation approach

The grammar-translation approach claims that conscious control of grammar is necessary for mastery. The assumption was that language consists of written words, which may be translated into sentences in the foreign language. This approach generally considers the situation where the learner needs to manage written texts, the vocabulary

relevant to those texts and language rules, grammatically sequenced starting from easy rules to more complex rules, translating into and out of the foreign language. In the most extreme versions of this approach learners are required to read word by word, and consequently rarely focus on the message. For example, Spanish students learn that the suffix 'dad' corresponds to 'ty' in English, as in 'reality' and 'realidad'. Some of the general characteristics and principles of this approach are as follows:

- The fundamental purpose of learning a foreign language is to be able to read literature written in the target language. Literary language is considered superior to spoken language.

- An important goal is for learners to be able to translate each language into the other.

- Learners need to learn about the grammar rules and vocabulary of the target language.

- The ability to communicate in the target language is not a goal of instruction.

The weakness of this method is associated with "its narrow focus on the reading and translation of texts and its lack of a means of dealing with language where speaking and other forms of communication are required" (Milton, 2002, p.7). The grammar translation method does not develop students' awareness of the new language as it relies only on analogy with their first language. This method also "makes no attempt, explicitly or implicitly, to help learners to manage their conversation with native speakers" (Krashen, 1987, p.129). The primary skills to be developed are reading and writing. Learning vocabulary and grammar is emphasised. Little attention is given to speaking and listening, and almost none to pronunciation.

2.3.2 Audio-lingual approaches

The audio-lingual approach was inspired by the behaviourist theory of learning. (Skinner, 1957). The focus is on formal drilling and repetition. The lesson (digital or non digital) usually contains the structure and vocabulary of sample dialogues. The

learners are expected to memorize these dialogues (which are often practiced in a group), and this is followed by pattern drill on the structures taught in the dialogue until the pattern becomes automatic. Some of the general characteristics and principles of this approach are as follows:

- Language learning is a process of habit formation. The more often something is repeated, the stronger the habit and the greater the learning.

- The learning of a foreign language should be the same as the acquisition of the native language. We do not need to memorize rules in order to use our native language. The rules necessary to use the target language will be induced from examples.

- An important goal of language learning is to learn how to use the language to communicate. Speaking is considered superior to writing skills.

One drawback of this approach, as Lado (1964) points out, is that audio-lingual pattern drills take the learner's concentration away from language structure. They may think that they are learning vocabulary and grammar, but they are only repeating dialogue to make the pattern automatic. According to the audio-lingual approach, the goal is the memorization of the dialogue, not the comprehension of a message. Theoretically, conscious learning is not an explicit goal of audio-lingualism. Furthermore, this method is lacking in teaching meaning, which cannot be achieved through endless practice (Milton, 2002). Also, repetitions and dialogues are not generally formed according to learners' interests or age; these aspects are certainly of value if learning is effectively to happen (ibid).

In the audio-lingual approach, oral/aural skills receive most of the attention. The primary skills to develop are speaking and listening. Grammar is learned inductively from examples. Pronunciation skill is often acquired by learners working in language laboratories.

2.3.3 Cognitive code approach

The cognitive code approach claims that learners should develop a cognitive model of the target language grammar and structure in order to learn the second language. According to Carroll, the cognitive code assumes that "once student has a proper degree of cognitive control over the structures of a language, facility will develop automatically with the use of language in meaningful situations" (1980, p.521), or according to Krashen (1987), learning becomes acquisition. Some of the general characteristics and principles of this approach are as follows:

- Learners should be conscious of the grammatical rules of the target language.
- Learning is facilitated through attention to similarities between the target language and the native language.
- Literary language is considered superior to spoken language.

In a typical cognitive-code inspired programme, a grammatical rule will first be explained in a sequence and followed by a number of exercises, which allow the student to practice. These may, for example, include activities that require one to guess the meaning of sentences, fill-in-gap exercises, or grouping and classifying words and terminology according to their definitions. This method, like grammar-translation, fails to provide a great deal of comprehensible input, as the focus is on form and not meaning (Skehan, 1998).

The main areas of language skills to be acquired are grammatical rules and language structure. Vocabulary is taught deductively by reading and writing target language text. There are no obvious opportunities for developing speaking, pronunciation, listening and comprehension skills.

2.3.4 The 'Direct method' approach

The main goal of the direct method approach is to use a foreign language to communicate. This method has one very basic rule: no translation is allowed and instructions need to be in the target language through the use of demonstrations and

visual aids (Richards and Rodgers, 2001). If this is well established, the entire period of instruction and discussion are filled with target language use, with a variety of topics that can provide a meaningful direct method session. Some of the general characteristics and principles of this approach are as follows:

- The native language should not be used in the classroom. The teacher should demonstrate and explain not translate.

- Lessons should contain conversational activity. Learners should be encouraged to speak as much as possible.

- There may never be explicit grammar instruction. Grammar should be learnt inductively.

In the direct method approach speaking, pronunciation, listening and comprehension skills receive most of the attention. The method generally focuses on inductive teaching of grammar where all discussions, including instructions, teacher talk and classroom language, are conducted in the target language. The goal of instruction is for the learners to work out the rules of language or grammar. Teachers ask questions and the student's response is then used to provide an example of the target structure. Learning a complex grammar rule may not be easily achieved through this approach, as there is no emphasis on explicit instruction of language structures and grammar.

2.3.5 Oral and situational language approach

The origin of this approach began with the work of two British applied linguists, Palmer (1923) and Hornby (1954). They attempted to develop systematic principles and procedures that could be applied to the selection and organisation of the content of a language teaching course in order to ensure that appropriate aspects of the language are covered. One of the important aspects of this method was the role of vocabulary, which was seen as an essential component of language learning. This led to the development of principles of vocabulary control, indicating that a core of two thousands or so words occurred frequently in written texts and that a knowledge of these words would greatly assist in reading a foreign language. Palmer and colleagues produced a guide to the

English vocabulary needed for teaching English as a foreign language. Parallel to the interest in developing rational principles for vocabulary selection was a focus on the grammatical content for a language course, where they suggested the major grammatical structures of English to be taught at different levels of language class (Palmer and Blandford, 1939). Some of the general characteristics and principles of this approach are as follows:

- The target language is the language of the classroom.
- Language teaching begins with the spoken language. Material is taught orally before it is presented in written form.
- New language points are introduced and practiced situationally. Vocabulary selection procedures are followed to ensure that an essential knowledge of content is covered.
- Items of grammar are graded following the principles that simple forms should be taught before complex ones.
- Reading and writing are introduced once a sufficient lexical and grammatical basis is established.

Although all areas of language skills may be supported within the oral and situational language approach, learning vocabulary and grammatical rule receive most of the attention. There is less emphasis on communication and fluency skills.

2.3.6 The natural approach

The natural approach developed by Tracy Terrell at University of California was influenced by Krashen's theory of second language acquisition. In this approach, the goal of instruction is to provide comprehensible input for learners. Acquisition happens when people understand messages in the target language (Krashen and Terrell, 1983). Some of the general characteristics and principles of this approach are as follows:

- Emphasis is placed on students' developing communication skills and vocabulary through their receiving meaningful exposure to the target language.

- It is thought that if the teachers use language that is just in advance of students' current level of language competence, while making sure that their input is comprehensible, learning will proceed naturally.

- The students listen to the teacher using the target language from the beginning of instruction. They do not speak at first. Teachers help students to understand by being as expressive as possible and by using visual aids and pictures.

Class activities and computer support systems that are inspired by this approach often provide extra support for understanding the learning materials, for example, scaffolding learner's understanding by providing a link to a dictionary to explain unknown words in the text while reading. Krashen's creative constructionist theory (1981) is underlying this approach, where the focus of the instruction is on provision of comprehensible input and learning materials for the particular level of language learners.

In the natural approach communication skill receives most of the attention. For this reason, listening and comprehension, speaking and leaning vocabulary are emphasised. Language grammar and structure should be taught inductively.

2.3.7 Communicative approach

This approach attempts to emphasise the use of language for communication and, hence, requires learners to perform a task or solve a problem in pairs or in a group, using the target language in order to establish communicative competence (Milton, 2002). In the communicative approach, meaning is more important than language structure or rules, which may not be explicitly explained. Some of the general characteristics and principles of this approach are as follows:

- The emphasis is on the process of communication rather than just mastery of different areas of language skills.

- Learners need knowledge of language structure and words in order to convey their intended meaning appropriately and to be engaged in meaningful communication.

- The grammar and vocabulary that the students learn follow from the situational context and communication activities that the teachers pursue.

The communicative aspect may be particularly motivating for learners who are in the country of their target language and can take advantage of meaningful exposure and interaction in that language. The advantage of this method lies in its ability to provide practice in understanding and responding in the target language that may help in acquiring speaking, pronunciation and fluency skills. There is little attention in explicit teaching of language grammar.

2.3.8 Total physical response approach

Total Physical Response (TPR) approach was developed by James Asher, who theorises that "obeying commands given by an instructor that involve an overt physical response" could help in learning a language. Total physical response requires learners to respond accurately. For example, the teacher says "sit down" and the class sits down. Asher's (1977) theory of total physical response says:

> (i) "Delay speech from students until understanding of spoken language has been extensively internalized
> (ii) Achieve understanding of spoken language through utterances by the instructor in the imperative
> (iii) Expect that, at some point in the understanding of the spoken language, a student will indicate a readiness to talk" (see Krashen, 1987, p.140).

Teachers who use TPR believe in the importance of having their students enjoy their experience in learning to communicate in a foreign language. Some of the general characteristics and principles of this approach are as follows:

- Meaning in the target language can often be conveyed through actions. Learners can learn through observing actions as well as by performing the actions themselves.

- Introducing TPR activities in a class can reduce learners' stress, be motivational and encourage learning.

- The students' understanding of the target language should be developed before speaking. Also, spoken language should be emphasised over written language.

TPR lessons are not grammatically focused and the assumption is that grammar will be learned inductively, as students will be aware of correct forms during the TPR activities. The emphasis is more on listening comprehension than on speaking and writing. The novelty of the TPR method makes the class and learning experience more interesting and can easily fill an entire session with comprehensible input in the form of commands. The TPR method could result in improving listening and comprehension and encourage the active participation of learners, while enabling instructors to know when utterances are understood.

In addition to the approach used, there are also other factors that may affect the result of second language learning, for example, individual differences, attitude and motivation. Section 2.4 provides a general overview of a number of these factors.

2.4 Factors influencing second language learning

It has been widely realised that there are a number of different factors that may influence second language learning (Krashen, 1981). In particular, individual learners have certain characteristics that enable them to acquire language at different rates or through different techniques. Personal characteristics play an important role for a child or adult acquiring a second language. Learners are varied in terms of their knowledge, motivation, age, aptitude and metalinguistic awareness and many other aspects.

An implication is that it is necessary for the teacher or designer of a language learning program to provide appropriate teaching materials (Skehan, 1989). The empirical evidence also suggests that matching teaching materials to individual learners improves learning (Wesche, 1981). This section will provide an overview of a number of important factors that may influence second language learning.

2.4.1 Attitude and motivation

The role of variables like attitude and motivation has been of great interest for many researchers in recent decades. The research indicates a link between positive attitude and motivation in success of language acquisition (Gardner, 1985; Skehan, 1989).

Krashen's hypothesis indicates that attitude relates directly to acquisition. Furthermore, the 'right' attitudinal factors cause two effects: they stimulate useful input and they also encourage the acquirer to be 'open' to this input, which can help with acquisition (Krashen, 1981).

2.4.2 Intelligence

A link between intelligence and successful second language learning has been reported (Lightbown and Spada, 1993). One study in Canada indicates that intelligence may be more connected to some language skills than others (Genesee, 1976). In particular, this study suggests that intelligence is related to reading, grammar and vocabulary learning and is un-related to oral productive skills, i.e. speaking. Similar findings are reported in another study where intelligence was associated with reading, dictation, and writing skills, but not with listening comprehension and oral communication (Spolsky, 1989).

2.4.3 Personality

Personality has been proposed to have an effect on second language acquisition. Some studies argue that people who have qualities of extroversion, assertiveness, talkativeness, responsiveness, self-esteem and adventurousness may show more success in their language learning as they are more willing to take risks in trying to communicate (Oxford, 1990).

2.4.4 Aptitude

There is evidence in the literature that some people have a remarkable capacity or aptitude for language learning. These individuals have been reported to have an exceptional ability to identify and memorize new sounds; to understand how words function grammatically in sentences, to comprehend grammatical rules from language samples, and also to memorize new words. Four elements of aptitude are specified in Carrol and Sapon's study: short-term memory; the ability to form sound symbol

correspondences; grammatical sensitivity and language inferencing skills (Lightbown and Spada, 1993).

Although there have been a number of studies that explore 'aptitude' (ibid), the findings are not clear. This is largely because many of the behaviours associated with aptitude may be confused with other learner characteristics such as intelligence or personality.

2.4.5 Age

Age has also been considered as a significant factor in second language learning. It is generally agreed that there is a time in human development when the brain is at its most able to acquire a new language. This critical period ends in adolescence. Older children and adults are not able to acquire the same degree of mastery and native-like language-skill achievement that young children do (Patkowski, 1980; Johnson and Newport, 1989).

As discussed above, there are a number of factors such as attitude, motivation, intelligence, personality, aptitude and age that may influence second language learning. Exploring these factors can help not only in taking more appropriate approaches to learning, but also in the provision of suitable learning materials for learners. In addition to this, understanding individual differences can inform the design of better technological systems for language learners. The next section, before turning to explore adult learning theory and practices, explores the notions of formal, informal, and incidental learning (section 2.5). This discussion will help in understanding the different strategies that adults might undertake during their lifetime's learning.

2.5 Theories of formal, informal and incidental learning

Sections 2.2, 2.3 and 2.4 presented an overview of language learning theories, approaches and factors that may affect second language learning. This section provides an overview of formal, informal and incidental learning theories.

The notions of formal, informal and incidental learning are complex and difficult to define. One approach is to distinguish between formal, informal and incidental learning simply by looking at the circumstances in which they occur. For example, Marsick and Watkins contrast formal learning with informal and incidental learning as follows:

> "Formal learning is typically institutionally sponsored, classroom based, and highly structured. Informal learning, a category that includes incidental learning, may occur in institutions, but it is not typically classroom based or highly structured, and control of learning rests primarily in the hands of the learner. Incidental learning is defined as a byproduct of some other activity, such as task accomplishment, interpersonal interaction, sensing the organizational culture, trial and error experimentation, or even formal learning. Informal learning can be deliberately encouraged by an organization or it can take place despite an environment not highly conductive to learning. Incidental learning, on the other hand, almost always takes place although people are not always conscious of it" (Marsick and Watkins, 1990, p.12).

According to Colley et al., "formal learning is provided by an educational institution, structured in terms of learning objectives, time and support and leading to certification. Informal learning, however, take place in day-to-day life activities, related to work, family or leisure and may be intentional but in most cases it is non-intentional or incidental and random" (2002, p.2). Rogers suggests that we could draw a distinction between education and learning and extend the continuum in this way (see Figure 2.1):

> "informal learning being all that incidental learning, unstructured, unpurposeful but the most extensive and most important part of all the learning that all of us do every day of our lives…" (Rogers, 2004, p.8).

←			→
formal education	**non-formal education**	**participatory education**	**informal learning**

Figure 2-1: The formal - informal continuum

Interest in self-directed adult learners was particularly aroused by Tough's 1971 study of the learning projects of adults (Tough, 1971). Researchers in self-directed learning concentrate on the one hand on the choice of self- as opposed to other-direction by the learner, and on the other hand on the learning that may take place when a learner chooses this mode, which may involve the use of media (print, television, radio, computers), seeking out a tutor or mentor, attendance at conferences, travel or consulting and just-in-time courses, with or without the assistance of technology. According to Brockett and Hiemstra, "self-direction in learning refers to both the

external characteristics of an instructional process and the internal characteristics of the learner, where the individual assumes primary responsibility for a learning experience" (Brockett and Hiemstra, 1991, p.24).

A number of models and theories from a range of disciplines have contributed to the development of work in informal and incidental learning. In particular, many researchers, inspired by the work of Dewey and Vygotsky see learning as socially and culturally mediated (Dewey, 1938; Vygotsky, 1978). A particularly influential concept has been Lave and Wenger's concept of "situated learning", promoting the notion that learning takes place from the process of engagement in a community of practice (Lave and Wenger, 1991; Lave, 1996). This may be a classroom community, but more often is not.

A related approach is vicarious learning (Bandura, 1977), which asserts that people can benefit from observing and modelling the behaviours, attitudes and emotional reactions of other learners. 'Lurking' on Internet discussion boards is a familiar example of this sort of learning pattern (McKendree et al., 1998).

Research in discovery and experiential learning processes, growing out of Dewey's (1938) work, emphasises the experiential aspects of learning. In this view, learning results from our reflections on our experience. Garrick underlines the importance of experience: "all genuine knowledge originates in direct experience… human knowledge can in no way be separated from practice… practice is higher than theoretical knowledge. Whoever wants to know a thing has no way except by coming into contact with it, that is, by living in its environment…practice, knowledge, again practice, and again knowledge…such is the dialectical-materialist theory of the unity of knowing and doing" (Garrick, 1998, p.22).

In order to understand more about our target group, independent adult learners, and their approaches to language learning, the next section (2.6) explores adult learning theories and practices in more detail.

2.6 Adult learning theories and practices

The previous sections discussed language learning theories (2.2), approaches to teaching (2.3), factors influencing second language learning (2.4), and theories of formal, informal and incidental learning (2.5). In this section, we explore the theories and practices developed for adult learning, and aim to understand adult self-directed language learners' approaches and strategies.

Adult learning theory, or andragogy, is discussed by Smith (1996; 1999), who provides a set of assumptions about how adults learn and their distinctive characteristics:

> "1. Self-concept: As a person matures his self concept moves from one of being a dependent personality towards one of being a self-directed human being.
>
> 2. Experience: As a person matures he accumulates a growing reservoir of experience that becomes an increasing resource for learning.
>
> 3. Readiness to learn: As a person matures his readiness to learn becomes oriented increasingly to the development tasks of his social roles.
>
> 4. Orientation to learning: As a person matures his time perspective changes from one of postponed application of knowledge to immediacy of application, and accordingly his orientation toward learning shifts from one of subject-centeredness to one of problem centeredness.
>
> 5. Motivation to learn: As a person matures the motivation to learn is internal"
>
> (Smith, 1996; 1999, p.2).

One important characteristic that has arisen from Knowles' theory is the notion of "self-concepts" or self-directness of learning, which distinguishes adult learning (andragogy) from children's learning (pedagogy). Adults can "become self-directed, taking responsibility for their own learning and the direction it takes" (Fidishun, 2000, p.2).

Adult learning, from one standpoint, is seen as a continuing aspect of everyday life. This was initially articulated in the theory of lifelong learning. Lindeman (1926), in his explorations of adult and lifelong learning, asserts that:

> "Education is life: not merely preparation for an unknown kind of future living….The whole of life is learning, therefore education can have no

> ending. This new venture is called adult education not because it is confined to adults but because adulthood, maturity, defines its limits…" (see Smith, 1996, 2001, p.2).

Lindeman also further argues that adult education should be dependent on situation rather than subject, and it should be developed around the learner's needs and interests (ibid).

Adult learning has been recognised by many as an experiential, reflective, conversational, and social process (Jarvis et al., 1998; Schon, 1983; Pask, 1976; Vygotsky, 1978). Naylor identifies some of the most effective instructional techniques for adult learners, such as reflection and self-pacing. He also suggests adults are "self-directed beings who are the products of an accumulation of unique and personal experiences and whose desires to learn grow out of a need to face the tasks they encounter during the course of their development" (1985, p.2-3).

A comparison study between pedagogy and andragogy based on Knowles' assumptions was reported by Jarvis (1985). He discusses how pedagogy and andragogy differ in terms of the learner, the learner's experience, readiness to learn, and orientation to learning. This is illustrated in Table 2.1.

	Pedagogy	**Andragogy**
The learner	*Dependent.* Teacher directs what, when, and how a subject is learned and tests that it has been learned	*Moves towards independence.* *Self-directed.* Teacher encourages and nurtures this movement.
The learner's experience	*Of little worth.* Hence teaching methods are didactic.	*A rich resource for learning.* Hence teaching methods include discussion, problem-solving, and so on.
Readiness to learn	*People learn what society expects them to learn.* So that the curriculum is standardized.	*People learn what they need to know.* So that learning programmes are organised around life applications.
Orientation to learning	*Acquisition of subject matter.* Curriculum organized by subjects.	*Learning experience should be based around experiences.* Since people are performance centred in their learning.

Table 2-1: A comparison between andragogy and pedagogy (Smith, 1996; 1999, p.6)

An important point to note in the above comparison is the concept of self-directness and independence in learning that is distinguishable within adult education.

In practice, adults adopt numerous strategies for their learning, which may take place in many different situations and settings. Informal and non-formal learning are as important as formal learning, with some studies indicating that most adult learning takes place outside formal education (Tough, 1971; Livingstone, 2001, O'Malley et al., 2003). Learning is often linked with other activities as a part of everyday life and may also happen in various settings and places; at home, work, on the move, abroad, or in places of leisure (Vavoula, 2004). This is particularly true for language learning where theory can only deal with some aspects of language skills; therefore different strategies and approaches need to be adopted (Mitchell and Myles, 1998).

Language learning involves acquiring skills in different areas, such as speaking, writing, reading, and listening and comprehension. It also requires learning about language structure, phonetics, lexicon and culture. Jones (1996) provides a practical and useful taxonomy of what language learning might encompass, indicating the involvement of the following procedures:

- Formal, instructed input; use language class.
- Informal, real-text input; use real-text input (for example, novel), as long as it is 'comprehensible' to the learner (Krashen, 1981, 1985).
- Formal, controlled output; practice of language as form, concentrating on language structure and grammar.
- Informal, communicative output; practice to get the message across, concentration is less on form and accuracy.
- Learning vocabulary; lexical knowledge is fundamental to speaking, listening and reading skills (Brown and Perry, 1991; Hollander et al., 1995). A number of different strategies, such as using items in real contexts and messages, dictionary look-up, word-lists and out-loud repetition seem to be useful and effective (Carter and McCarthy, 1988).
- Learning grammar.
- Metalinguistic awareness.

In particular, learning a language cannot be isolated from the culture that embraces it (Tang, 1999). Jessner (2006) claims knowing about the language itself or metalinguistic awarness is as important as the language itself. There are a number of ways to acquire metalinguistic knowledge and cultural information, such as living in a foreign country and talking to native speakers. Metalinguistic knowledge can also be acquired through authentic language materials, such as poems, novels, dramas and songs. These open up the learner's view "to the culture and help them use the new language authentically themselves, to communicate meaning in meaningful situations rather than for demonstrating knowledge of a grammar point or a lexical item" (Melvin and Stout, 1987, p.44).

Acquiring metalinguistic knowledge and reaching proficiency level corresponds to the ability to deal with real text, people and authentic materials. It is referred to by (Belasco, 1967, p.82) as "getting on top of a plateau". Those learners who reach a plateau or relatively stable phase, will find that their language competence seldom moves ahead at an even pace. They may face spurts and slow-downs in their perceived progress. The term "fossilization" is commonly used to describe this phenomenon (Selinker, 1992). This is particularly relevant for advanced language learners who reach a phase where they are unable to attain native-like ability in the target language, for example, to acquire a native accent, or to understand culture specific expressions (Selinker and Lakshamanan, 1992; Han, 2004). In practice, in order to go beyond this phase, adult learners adopt different strategies and approaches. For example, their learning may continue, formally and systematically, in a classroom setting; or it may take place informally through social contact, migration and work (Mitchell and Myles, 1998). In addition, learning may happen unintentionally or through what Krashen (1982) refers to as "subconscious" learning, for instance by listening to music, hearing people's conversations, or watching dramas.

As discussed above, although research in the language field attempts to cover different aspects of learning and teaching, still surprisingly little is known about independent, self-directed adult learners[3]. This includes how they go about their own language

[3] By independent, self-directed language learners, we mean those learners who take active responsibility for their own learning process from identifying methods and strategies to be used up to selecting the content and learning materials (Dickinson, 1987; Jones, 1996; Abdullah, 2001)

learning, what their approaches and strategies are, what works, and what does not work for them in practice (Fallahkhair et al., 2004a). Thornton and Sharples indicate:

> "While there is an extensive literature on many aspects of language learning, especially in classroom settings, there is surprisingly little research about independent language learning and almost no research about technology issues in independent language learning" (2005, p.203).

It is important to investigate independent adult approaches and strategies. In particular, this knowledge is crucial for directing the design of effective learner-centred language learning systems, which is the focus of this project. The following discussion summarises a number of studies that have attempted, to some extent, to investigate independent self-directed language learners' approaches and use of technologies.

Oxford (1990, 1996, 2003), in her series of studies, investigated adult general strategies for second language learning, mainly in connection with formal/ class based approaches to learning. She suggests that learners might undertake six different learning strategies:

- Metacognitive strategies; for example, becoming culturally aware, gathering and organizing materials for learning.
- Affective strategies; for example, being motivated and encouraged to use a language, reducing learner anxiety.
- Social strategies; for example, co-operation with peers, using native speaker interlocutors, pen-pals.
- Memory strategies; for example, repetition, note-taking (for instance with a pocket notebook).
- Cognitive strategies; for example, contextualization of new items to aid comprehension/recall, grouping of words and concepts.
- Compensatory strategies; for example, inferring, checking, guessing, and identifying key items in a text or dialogue.

The research of Oxford et al. (1996) further investigates second language learning strategies through students' self-reported diaries and recollections. The diaries of 42 university students of Spanish were used. The students were asked to explain, in their

diaries, how they approached listening and comprehension, how they learned grammar, and how they mastered vocabulary. The results broadly suggest that learners often use memory, cognitive and metacognitive strategies for mastering listening, comprehension and vocabulary skills. These include strategies such as designing a sequential plan for learning, making a conscious effort to concentrate, writing down information, repeating, translating and using flashcards. However, strategies reported for learning grammar were sparse. Also, the results reveal that learners' motivation is an important factor in successful second language learning.

Tran (1988) investigates older learners (above 40) who were refugees in the US. The study reveals that common approaches amongst both female and male were listening to TV or radio, communicating with an English tutor, and living in an English speaking country or neighbourhood. Adegbija (2004) used observations, open-ended surveys, and interviews to investigate strategies used by 35 university students of English. A number of frequent strategies reported included reading extensively, mixing with fluent speakers, listening to English (radio, TV, debates, symposia), and referring constantly to the dictionary. However, strategies for writing were rarely reported.

Chan et al. (2002) investigates learners' views of their responsibilities and learning activities inside and outside the English classroom in order to gauge their readiness for autonomous learning. They used a questionnaire and in-depth interview methods with learners following an English programme as part of their degree/higher diploma study at university. The results suggest that learners have the main responsibility for deciding what to learn outside class. Also, learners indicate a number of activities that they tend to undertake outside language class as a part of their learning strategy. More than half of the respondents said they engaged in the following activities:

- Watching English movies (87%)
- Listening to songs in English (83%)
- Reading English notices (82%)
- Using English for the internet (81%)
- Sending e-mails (79%)
- Watching TV (79%)

- Reading books and magazines (75%)
- Noting down new words and their meanings (67.4%)
- Reading newspapers (66%)
- Talking to foreigners in English (57%)

Moreover, the study found that higher motivation did lead to higher frequency of engagement in autonomous activities outside the classroom. Motivated learners tended to be more engaged and to undertake more activities than others who were less motivated.

Thornton and Sharples (2005) study investigates Japanese language learners' patterns of technology use. They conducted six in-depth interviews with self-directed language learners. A number of patterns emerged that indicate that independent learners use technology to (a) manage time and to learn more efficiently, (b) have learning resources available when needed, (c) support foreign language use such as reading and writing, and (d) to blend learning and entertainment. Also this study suggests that materials that are at the wrong level or interest for language learners are of less use to them.

Hurd (2006) investigates the experience of distance learners of an Open University (UK) French course in order to understand learner perceptions of personality, motivation, roles, and approaches. The study combined both quantitative and qualitative methods, including questionnaires, audio-record, and one-to-one telephone interviews with learners. The results suggest that being motivated, persistent, and enthusiastic towards second language and learning materials may have a direct effect in successful distance language learning.

Few studies provide practical suggestions for the independent learner. An exception is Jones (1996), who investigates the field of adult foreign-language self-instruction. A learner-diary study of 11 months' self-instruction of Hungarian from post-beginner level was reported. In addition to this, telephone interviews of 70 learners with self-instructed experience and open-ended reports of their self-instructed learning processes were also gathered. The study reveals that lexis and listening were the main challenges, and the importance of real-message practice is highlighted. It also indicates that learners' strategies often change when they reach a certain threshold of language

competence (about 2000 words), shifting from "course book-centred to real text- and interaction-centred", and "to the ability to cope with authentic language", mainly on reaching the post-beginner level (p.5). In fact, Jones's study (1996) is the only research project we are aware of to date that develops some strategy guidelines for self-instruction learning based on the previous experiences of language learners. These include some informal strategies for learning grammar, vocabulary, reading, listening and writing skills. Some examples are:

- take a pocket-sized notebook everywhere you go
- write down any useful words or phrases you see
- memorize new words in the bus, train or on walks
- use a dictionary to find words meanings and pronunciations
- try to write letters to native-speaker friends
- try to read magazines, poems, books in the target language
- use a Walkman to practice listening

The next section (2.7) indicates the design implications that arise from the issues discussed within this section.

2.7 Design implications

The research synthesized in this chapter suggests the following issues, which have a number of implications for design of new language learning systems:

- Language learning involves acquiring various different skills

  It involves acquiring different areas of language skills, such as speaking, listening comprehension, reading, writing, grammar and lexicon. It also involves learning metalinguistic knowledge and cultural information. The implication is that a new language learning system often does not facilitate all aspects of language skills. In particular, for advanced learners, who have reached a plateau, being able to move forward, achieving a native-like fluency, is the ultimate learning goal. However, support for these people is often neglected in the implementation of language technologies (Jones, 1996). In this situation, no single teaching approaches (grammar translations, audio-lingual approach, or set

of language teaching materials) will be enough to achieve a native-like fluency. The design implication for a new learning system, therefore, is to provide support materials, and features that will assist learners to move beyond this phase of language competence. In this case, technology could play an important role that cannot otherwise be achieved through grammar books and/or dictionaries. For example, multimedia and audio/visual materials could be developed to show different situations, learning a new language item, idioms, body language and expressions. Interactive television, virtual reality, and game technologies could be developed to enable learners to immerse themselves in a target culture and language.

- No single second language learning approach fits all learners' characteristics, learning needs, and motivations

  The literature review of language learning and teaching theories discussed in this chapter demonstrates a wide variety of views and instructional approaches to second language learning. While one approach works for some learners, it may be very unsatisfying and unhelpful for others. The main reason is that learners vary in terms of their individual characteristics. Therefore, it should be noted that no single learning and teaching approach will fit all learners and their learning needs. In designing a new language learning system, personalised and adaptable features which can accommodate learners' different characteristics should be considered.

- There is a need to know more about adult approaches and strategies for learning a second language

  As discussed earlier, most literature looks at language learning within the territory of the classroom. As a result, we still know very little about independent adult approaches to second language learning. In particular, learner acceptance - the willingness of the learner to use the technology - is important. Exploring this area will help to identify opportunities for matching the capabilities of a new technological system to the real needs of adult language learners.

- Motivation is an important factor in successful language learning
  The learner must be motivated to learn a new language (Krashen, 1981). For example, learners might be motivated to learn about a particular subject; perhaps health, food, fashion, geography, or by interacting and communicating with others. The learner's motivation in designing the language learning materials, functionalities and interactions should be considered.

2.8 Conclusions

A literature survey of theories and approaches to adult learning of a second languages is presented in this chapter.

The chapter began with an outline of some of the most influential theories of language learning: behaviourist, cognitive, creative constructionist, constructivist, and socio-cultural. It continued with an overview of a number of different language teaching approaches, implementing aspects of these theories: grammar-translation, audio-lingual, cognitive code, direct method, oral and situational language, the natural, communicative and TPR approaches. Adults, through either technological developments or formal classroom activities, have used these approaches over decades for learning second languages. A discussion of factors that may influence second language learning, such as age, aptitude, attitude and motivation was also provided. Such studies assist teachers or designers in the provision of more suitable materials and tools for a group of learners (Skehan, 1989).

The chapter then moves on to an exploration of theories of formal, informal and incidental learning, continued by adult learning theories with the aim of understanding adult self-directed language learners' approaches and strategies that work in practice. A number of investigations that explore adult approaches to language learning and use of technology were presented. This overview indicates how little is known about independent and self-instructed language learners.

It appears that language learning typically involves a complex combination of instructed and self-directed approaches as well as conscious and unconscious processes. The variety of learners and their individual characteristics might explain what may or may

not work in practice for some language learners. The discussion above highlights a number of factors that have implications for the design of a new language learning support system, which are as follows:

- Language learning involves acquiring various different skills; therefore various learning materials/features should be designed to assist in learning different language skills.

- No single second language learning approach fits all learners' characteristics, learning needs, and motivations; therefore, personalised and adaptable materials/features which can accommodate different needs should be designed.

- There is a need to know more about adult approaches and strategies to learning a second language; more empirical research should be undertaken to investigate independent language learners' approaches and use of technology. This research should be used to inform the design of new learning systems.

- Motivation is an important factor in successful language learning; therefore, the designer should take into account learner motivation when designing content, functionalities, and interactions.

As the focus of this research is to take a learner centred stance, in the initial analysis phase we also further investigate the independent adult language learner's approach to and use of technology. This discussion is provided in Chapter 6, which is used to direct the design of an iTV based language learning system.

The next chapter (Chapter 3) provides an historical survey of media technologies that have been used for language learning and in some cases, where relevant, the adaptation and use of the underlying learning and teaching theories is indicated.

Chapter 3 Language learning technologies

3.1 Introduction

> "…technology can be of great assistance for helping the second language learner achieve success" (Chaves et al., 1996, p.2).

> "…technology provides tools and resources, but it is the learner who remains firmly are at the centre" (Broady, 1997, p.13).

Chaves et al. discuss how technologies could facilitate second language learning in five distinct ways:

> "First there is the option of simply helping learners to access technology, followed by the possibility of using technology to facilitate literacy tasks. Another option involves using video technologies to provide a visual context for teaching language and literacy. Technology can also be used as a tool to promote social interaction and communication in the ESL classroom. Finally, there is the possibility of using computers to teach directly…" (1996, p.2).

This chapter aims to provide a survey of technologies that have been used to facilitate second language learning. We analyse and synthesize the literature on language teaching and learning technologies with the objective of understanding how technologies have supported language learning in the past, how they reinforce different language skills, e.g. listening comprehension, speaking, writing and reading, their distinctive features and the teaching and learning strategies and approaches they embody.

First we look at different media technologies and their affordances for language learning. These include printed materials, language lab and audio and visual media, such as radio, tapes, CD, film, TV, CD-ROM and DVD (sections 3.2, 3.3, 3.4). Next, an historical review of computers for language learning is provided (section 3.5), followed by a discussion of the Internet and World Wide Web (section 3.6). Communication technologies, including email, chat-room and discussion boards, video conferencing, blogging, mobile phone and personal digital assistance (PDA) are discussed separately

in more detail (section 3.7). Finally, we provide an overview of research into virtual reality technology for language learning (section 3.8). Section 3.9 provides a more systematic critique of language learning technologies.

3.2 Printed materials

Print is the most widely used medium known for language and communications. People learning a language often use printed materials as a medium to assist learning, whether they are developed explicitly for language teaching, for example syllabus-based language teaching texts and self-instruction books, or authentic materials in the target language that are available and widely accessible for native speakers, such as newspapers, magazines, novels, poetry, children's books or advertisements.

The most common use of print is the language teaching lesson, developed by linguists and language instructors to teach different aspects of language skills, for example, to teach grammar, language structure, vocabulary and phonetics. Dictionaries, in particular, are developed in different languages and for different subject matter, and provide a rich source of information for language learners. Summer (1988) provides a detailed discussion of how dictionaries can help learners to learn words and languages. He indicates that dictionaries present a powerful analytic tool in organizing language and learning the concepts that the words express. Specialist examples include dictionaries for business, sociology, computers, medicine, and pharmaceuticals. These provide common terms and definitions relevant to the field. Picture dictionaries are also available, and provide images in addition to word definitions. An obvious example is the Oxford Picture Dictionary published by Oxford University press (see Figure 3.1).

Printed materials in the form of language learning games like crosswords are also widely used by native speakers and second language learners. Language learning games are motivational and engaging (Milton, 2002).

Figure 3-1: Oxford illustrated dictionary

Printed materials enable reading and writing of textual materials, including lexical items, grammar, and authentic text, in a flexible and accessible way. They can also provide visual aid through illustration and pictures. Even with the advent of many new technologies, print is still one of the most flexible learning media as it provides a portable, easy to read and ubiquitous source of information (Bates, 2005). Learners can carry it with them and it is available on an anytime, anywhere basis. Laurillard refers to print as the most important educational medium and asserts the advantages that it offers:

> "[Print] is the easiest medium to design (single author), to produce (established publishing mechanisms), to deliver (bookshops and libraries), to handle (light and portable), to use (random access, content, indexes)" (2002, p.94).

Printed materials can facilitate the learning of reading and writing skills. However, they do not lend themselves to explicit learning of listening and speaking skills. Although the textual equivalents of the pronunciation of characters and words are available - for example via a printed dictionary that contains the phonetic spelling for all words - a full account of listening skills might be best acquired by hearing a language rather than reading it. Printed material cannot provide this opportunity for hearing and speaking a language.

3.3 Audio based media

After printed materials, audio-based media were the second medium used to assist language learning. In this section we provide a general overview of these, including language lab, radio, tape cassettes, and CDs.

3.3.1 Language lab

The first language laboratory was established in the UK in 1961 (Philippe, 2000). These labs were based on the audiolingual and behaviourist approach. Learners were required to repeat and practice in order to learn new words, pronunciations and dialogues (Warschauer, 1996). The teaching approach in the language lab was predominantly based on repetition and practice rather than meaningful communication (Milton, 2002). Nevertheless, it was realised that more advanced language labs that could offer recording and playback functionalities could be more beneficial. The main advantage was that they enabled learners to hear their own speech and pronunciation. Lorge's research indicates the advantages of the language lab: "it provides easy, accurate, and immediate recording and playback of speech. Teachers could bring to their students pre-recorded foreign language materials, in a variety of native voices and speech patterns. Imitative practice could be recorded, judged, erased, re-recorded, to the point of learning" (1964, p.409).

One obvious disadvantage of this kind of language lab is that they do not provide a feedback mechanism for identifying a learner's problems and weaknesses in the way that a computer based lab might do (Ehsani and Knodt, 1998; Laurillard, 2002). Also, they do not provide any opportunity for practicing writing skills. This will be discussed in more detail in section 3.5.

3.3.2 Radio

The importance of using authentic materials has been widely recognised, and radio has been shown to have great potential to assist in second language learning. Radio offers the opportunity to practice listening and comprehension skills (Richmond, 1979).

The main advantage of using radio is that it delivers up-to-date authentic materials, and also enables learners to hear language in context and to 'get in tune' with different

accents and dialects (King, 1992). Wipf (1984) provides several reasons for using radio for second language learning. They are as follows:

- Radio provides a variety of regional accents and idiomatic language.
- Radio programmes can become a source of motivation and inspiration for second language learning.
- Learners can choose the programmes of their choice.
- New vocabulary and grammar can be taught in different contexts.
- The learner can get used to listening to target language pronunciations and speed.

Kitay studied the use of radio for teaching English as a second language. The advantage of radio according to Kitay is that "it allows the learner to hear multiple native English speakers talk in normal speed in a variety of accents. It also allows students to encounter new terms, expressions, and geographical locations. Radio is relatively inexpensive, highly portable and easy to obtain" (2000, p.1-2).

These factors encouraged teachers to incorporate radio materials in their teaching strategies. However, the main disadvantage is the flow of information which may be too fast, particularly for beginners. Also, as Robin points out, "[t]he audio is too fast. Or acoustically difficult. Or too heavily culturally referenced. Or has too much slang" (2007, p.109-110). Other disadvantages are associated with the lack of feedback and non-interactive state of the information delivered (Laurillard, 2002). The responsibility of the teacher as a facilitator, therefore, is to select and segment from radio materials what they think to be suitable for the particular level of their language learners - beginners, intermediate, or advanced. In this way, they can provide support with which to scaffold their students' understanding. Wood et al. defined scaffolding as "the process of supportive dialogue which directs the attention of the learner to key features of the environment, and which prompts them through successive steps of a problem" (1976, p.90). Scaffolding support could be provided in a number of different ways, for example, giving a listing of vocabulary and expressions which are heard in a programme, or transcripts of the spoken dialogues.

The problem is that the materials selected by teachers usually target a whole classroom population, and therefore pay less attention to individual needs, preferences and motivations (Milton, 2002).

3.3.3 Tape cassette

Similar to the language lab, learning through tape based language instruction was based on repetition and listening exercises, but did not involve meaningful communications (Chen, 1999). A large number of publishers developed tape based language teaching courses that aimed to formally teach different aspect of language.

The main drawback of this approach is described by Milton:

> "You cannot really communicate with a cassette. There was a tendency to practice highly formulaic language, as a result, while most foreign language use is quite unstructured and is not formulaic. They proved boring and the use of booths claustrophobic. Most of all a teaching technique based on little more than repetition is flawed, it does not improve language learning as a whole" (2002, p.17).

However, once tapes became widely available, they grew in popularity as they could provide increased flexibility, largely by enabling learners to practice listening and comprehensions skills at their own pace and even outside a language lab environment, for instance at home, work and on the move. The greatest advantage of tape cassettes was that they enabled access to the wider range of authentic materials that were available to native speakers like, songs, poetry, and music. Songs, in particular, can be highly motivational and can enhance learning (Kamel, 1997; Huy Le, 1999).

Whilst tapes afford a number of functions for practicing listening and comprehension skills, they are not so pertinent for acquiring writing, reading and speaking skills, unless help and scaffolding are available; providing audio transcriptions for songs and poems, for example, to encourage reading skills practice.

3.3.4 CDs

CDs, like tapes, appear to be simple pieces of technology, and not particularly developed for language learning, but they have the advantage of ubiquity. One difference in comparison to tape is the fact that they provide better quality sound. They

are able to record more material, which can be played using CD players or personal computers. Although, as with tape, the language teaching approach for CD is repetition and practice, CDs are a flexible medium because it is easier to move from one place to another. On tape this entails passing all points in between (Chen, 1999). Pocket sized and car CD players are particularly useful because they facilitate learning on the move.

Many publishers developed audio and comprehension exercises as a complement to text-books using tapes/cassettes and CDs. Linguaphone, for example, was developed to teach languages without classroom intervention, entirely from instruction by textbooks and audio tapes. Linguaphone teaching, which started with language lessons in print and audio tapes, was enhanced by the use of CDs.

The main advantage of using authentic tape and CDs over learning authentic materials from radio is the control that these media offer over the selection and usage of materials. Language learners are able to select authentic materials in accordance with their own individual preferences and to use them in their own time and at their own pace. In particular, foreign language songs, if supported by transcriptions and translations, can enable effective learning. Milton (2002) suggests:

> "Songs have certain natural advantages; they are highly loaded with vocabulary and structures, repetition is inbuilt, language structures are embedded in meaningful phrases and the music is thought to be an aid to memory. Repetition of these songs need not be meaningless and dull, as with drills in the language lab, but is normal practice with almost all listeners" (p.18).

3.4 Video based media

Video as an effective visual aid has been widely used in language learning. The main advantage of this medium is the way that it offers two channels of information: sound and vision. Lonergan (1984) explains the characteristics of video by comparing it with printed materials and the audio-based media for language learning. He points out that although printed materials are widely available, they provide no facility for learning how the language is spoken; audio-based media deals with spoken language. Audio-visual media offer what audio can offer plus additional visual information that shows paralinguistic aspects of language; for example, intonations, body language, how words are being spoken in different situations, and showing anger or pleasure.

Broady points out the potential of video for communicative language teaching:

> "Of all media available to us, it [video] provides the most accurate representation of language-in-use, that is, language embedded in a situation, used by a speaker whose identity we 'read' from their physical appearance, and whose communicative intent is reinforced by a whole range of visually paralinguistic features" (1997, p.1).

Videos have largely supported second language learning in two different ways: a) specifically made language teaching videos to facilitate language learning, delivered by TV broadcast, or purchased separately to be played on a VCR, or b) authentic videos like films and mainstream TV programmes (for example, the news, soap operas, and documentaries) that could be used with or without subtitles for language learning purposes. TV programmes and films are often selected by teachers and incorporated into language classes. In this section, we will provide a detailed overview of video-based media technologies, and explain their role and method of use in assisting second language learning.

3.4.1 Video-based language teaching programme

Video-based language teaching programmes are often produced by publishers and broadcasters, mainly to facilitate language learning outside the classroom and for distance learning. These types of video-based programmes provide language lessons similar to classroom instruction, where an instructor teaches each lesson from a language teaching syllabus, e.g. alphabet, numbers, vocabulary, syntax, and so on. In addition to formal instruction methods some of these video-based courses were published to teach situational learning through dialogue, a technique specifically created for language teaching purposes, illustrating the native speakers' conversations in various situations. For example, 'the greeting', where two people greet each other in the target language, or 'shopping', which details dialogue between a shop keeper and a customer.

Television was first employed to teach English as a foreign language in the nineteen-fifties (Sherrington, 1973), and since then has continued to assist in the teaching of all languages around the world. Many public broadcasters have scheduled language teaching programmes that are targeted at different levels of language learner. The BBC,

for example, has developed a number of courses to teach Spanish, French and German which are broadcast in the UK. They have also developed a number of programmes to teach English to an international market, largely for China. These programmes are: 'On We Go', 'Follow Me', 'Follow Through', 'Bid for Power', and 'Sardinia Project'. All of these broadcasts have attracted millions of Chinese learners of English. Although the videos are tailored for specific instructions and situations, they provide the opportunity for learning at a distance and in a different context.

3.4.2 Video-based authentic programmes

Video-based authentic programmes in the target language created for native speakers are often used for second language learning (Broady, 1997). In particular, target language television provides rich, varied, and up-to-date videos that are available to many language learners via satellite and cable transmission (Sherrington, 1973; Meinhof, 1998).

Authentic videos like films and target language television are frequently incorporated into classroom activities to encourage learning in context and from native speakers (Oxford, 1996). A common technique is to use sound and vision separately, for the learners to guess what is being said, to compare predictions with other students, and to answer multiple choice or quiz-based questions. These tasks may encourage learners to focus retrospectively on listening or comprehension. Also, a video can be stopped and replayed when needed, perhaps when learners are unclear about a part of speech. As MacWilliam points out:

> "…there can be very few practicing (and journal-reading) teachers with access to video who still need to be told that 'video places language in context' or who are as yet unaware of the virtues of the freeze-frame button" (see Broady, 1997, p.1.).

In this section we provide an overview of video-based authentic materials categorized into films, TV in the target language, and TV with subtitles.

3.4.2.1 Films

Film, like other video-based materials, provides an opportunity for learning in context through viewing and hearing language in different situations. For example, comedy,

drama, fiction, children's cartoons, and so on can provide a wide variety of audio-visual sources of information for language learners. Films can enhance listening and comprehension skills but they do not provide obvious opportunities for developing reading, writing and speaking skills. They can be played using a VCR, and provide more flexibility in the language learning experience. Learners have more control over their learning experience as film enables them to record, play and practice in their own time and at their own pace (Milton, 2002). Moreover, films are available in different genres and can be selected by learners in line with their own interests, so can be both motivational and engaging.

New technology such as DVD and personal video recorders like TiVo (which enables the recording of live TV programmes) are becoming widely affordable. They offer more interactive features than VCR, including digital recording, multiple languages audio tracks, subtitles, and additional footage.

3.4.2.2 TV in the target language

The potential use of video-based authentic materials that are mainly delivered via broadcast TV was recognised many years ago by Sherrington (1973). In his book, "Television and Language Skills", he argued that while television presents obvious opportunities for developing listening and comprehension skills, it may not be pertinent for developing explicit speaking and writing skills. He explained how to make use of broadcast TV, and to develop activities to support the learning of different aspects of language skills, such as listening, speaking, writing and reading.

McGovern points out the benefits of viewing TV programmes in the target language, particularly using TV's multimedia aspect:

> "The suitability of television as a medium for bringing a living language to learners is undoubted. The dynamic combination of sound and vision can bring an air of reality into the classroom. The wealth of visual information available can convey the atmosphere of another culture, can show paralinguistic aspects of communication; the techniques of television can present material to learners in ways quite beyond the resources of the language teacher" (1983, p.37).

Wright articulates a language learner's view on television:

> "With its unique combination of sound and moving pictures is seen by many students a medium that can present and contextualize the target language in a way that a book and audiotape alone are not able to do" (1994, p.10).

One disadvantage of TV broadcast compared with video or DVD is its "non-interruptable quality"; it restricts learners from replaying the information available (Broady, 1997, p.3). Broady points out that one of the problems associated with target language TV is that foreign language learners are not aware of the required background knowledge - something she refers to as "cultural knowledge" - that needs to be acquired in order to understand the programme. She discusses the notion of a situation that can be misunderstood by non-French viewers when the accompanying image does not support interpretations of the "verbal input" when watching a French News channel. She further argues: "Because it [television] conveys 'real' language used by 'real' people in 'real' situations, it is generally perceived as motivating and interesting by learners. Yet this very cultural authenticity can render it frustratingly obscure. But is this a 'real' problem?" She later mentions that "non-native viewers are not the only ones whose understanding is impaired when picture and commentary do not correspond closely: it happens to native viewers too" (Broady, 1997, p.4). One problem that non-native speakers often have is that they "lack the confidence…and assume that they need to understand every word. With such a strategy, the richness of authentic television is likely to remain buried" (Broady, 1997, p.5). For this reason, a number of researchers have attempted to develop "viewing strategies" that could be used by learners when watching authentic television. These strategies explain how to maximize comprehension of foreign TV viewing (Meinhof, 1998).

Some projects have investigated the relationship between television and first language development in children (Van Evra, 1990; Close, 2004). The main theme of these studies suggests that there will be some benefits from exposure to appropriate television programmes that have age appropriate content of new and familiar words, and where there is the possibility of interaction and adult co-viewing. On the other hand, other studies have argued that television viewing might impede child first language development. Although these studies were originally conducted on children, it can be argued that they might also be applicable to adult learners learning a second language.

According to second language learning theory (Krashen, 1987), some adult learners do acquire a second language in a similar way to their first.

3.4.2.3 TV with subtitles or closed captions

Several projects have analysed the use of TV with first language subtitles (L1 subtitling) and second language subtitles (L2 subtitling), as an aid to comprehension, retention of second language vocabulary and improving reading skills (Bean and Wilson, 1989; Spanos and Smith, 1990; Parks, 1994; Koskinen et al., 1996; Koolstra and Beentjes, 1999). One such study (de Bot et al., 1986) suggests that even a TV with an L2 audio track and L1 subtitling could lead to incidental second language learning (see Broady, 1997). Friedman (2001) argues for closed captioned[4] videos as powerful tools for improving vocabulary and reading comprehension skills for EFL learners. Bean and Wilson report the motivating influence of closed captioned television, and positive attitudes on the part of learners toward this medium (1989).

Neuman and Koskinen's (1992) study suggests that closed captioned television can be used as an effective instructional tool in learning vocabulary and concepts. Koskinen et al. studied the effect of closed captioned television on incidental vocabulary acquisition by adult EFL learners. They assessed vocabulary knowledge of viewers who watched TV with and without captions, identifying "a statistically significant difference in favour of captioned TV" and "a positive relationship between oral English language competency and vocabulary learning". The participants with a higher level of oral proficiency learned more than less proficient subjects (1996, p.368). Blosser (1988) studied the effect of closed captioned TV on students' reading and comprehension and suggested captioned TV had a positive effect on reading and comprehension skills (see Neuman and Koskinen, 1992).

Kikuchi (1997) provides an overview of 37 studies on the use of English Subtitled Movies (ESM) for EFL learners in Japan. The main benefits of ESM were:

[4] Closed captions developed to provide additional or interpretive information of the television programmes to the viewers who want to access it. They are mainly targeted for deaf and hard of hearing viewers to assist their comprehension. Although they are widely used in USA and Canada, most countries do not distinguish closed captions with subtitles.

- Movies are good for teaching authentic English. (It should be noted that this statement is rather broad as most movies are scripted, apart from some documentary type that may contain authentic language use).
- ESM facilitates learner understanding of linguistic information.
- ESM improves the overall listening comprehension of viewers.
- ESM motivates students to listen to dialogues in the movies and to learn English.
- Fully captioned videos were much more effective than partially captioned or non-captioned video.
- ESM has educational value in the EFL classroom and improves overall listening comprehension.
- Groups with English captions scored higher than groups with Japanese captions in understanding English context-bound expressions.
- ESM can be used successfully for improving learners' listening comprehension, rapid reading and vocabulary development.

Vanderplank (1988; 1990) investigated the value of subtitles in language learning. He studied European learners of English, between high-intermediate and post-proficiency level, watching nine hour-long sessions of BBC programmes with English language subtitles. Although the findings suggested that subtitled programmes may be of limited value for low-level learners, they are useful and beneficial for those at post-intermediate-level. The findings also indicated that subtitled programmes provide large amounts of comprehensible input that may encourage incidental language development.

Borras and Lafayette (1994) investigated the effect of L2 subtitles on comprehension and reading skills. They compared the performance of learners who had used video with and without subtitles. The result clearly favoured the subtitle option and concludes that "when learning from 'authentic video' in a multimedia environment, having the opportunity to see and control subtitles, as opposed to not having that opportunity, results in both better comprehension and subsequent better use of the foreign language" (see Chapelle, 2003, p.82). The most recent study conducted by Stewart and Pertusa (2004), which investigated learning while viewing target language closed-caption films, also suggests that second language captions aid immediate comprehension.

3.4.3 Interactive video delivered via CD-ROM or DVD

> "If the 1980's were the decade of the 'communicative approach' and 'video', then the 1990's are the decade of 'learner independence' and 'interactive multimedia'"(Broady, 1997, p.1).

What video delivers, as discussed in the previous section, is the way it conveys messages through two information channels, audio and visual. However, with the advance of multimedia and hypermedia technologies, we are no longer limited to these two. There are many opportunities for integration of text, still graphics, audio and video into one file, to produce an interactive video, which can be played in computer CD-ROM or DVD drives.

Before discussing how CD-ROM and DVD are used to facilitate language learning, it is crucial to understand that these media are not so different from their rival technologies: tapes and video cassettes. However, not only do they capitalise on storage and the delivery of large amounts of audio and visual material, they also provide functions which link these materials to textual content and enable the interactive access and retrieval of digital information. Thus, in this section I prefer to use the terms interactive video or interactive multimedia, as opposed to CD-ROM or DVD.

Interactive video provides multimedia presentations of information that can link and combine content in different modalities; text, image, audio and video. For example, interactive video could deliver: multiple subtitles in the first language (L1) or the second language (L2); extra materials such as programme transcripts; exercises; cultural references; and reading lists. Some publishers provide a large number of authentic video clips, coupled with a variety of tasks that derive from the video materials and explore areas of grammar, lexis, function and pronunciation. They may, for example, provide a list of words that appear in a particular video clip for learners to practice and remember.

Chavez et al. (1996) describe the general attributes of interactive video that may assist learners to develop speaking and listening skills. It offers high data storage capabilities and provides access to multiple soundtrack, images and animated graphics. Therefore, a variety of tasks and contents can be supported. For example, cultural subjects could be

shown in different modalities, and learners could be involved in different activities of reading and listening.

A DVD based entertainment/learning system was developed by Bayon (2004) and was aimed at further assisting second language learners to learn whilst watching films. The system provides dual subtitles in both L1 and L2. The author hypothesised that dual subtitles would enable learners to become more familiar with the L2 vocabulary. The prototype was evaluated through expert walkthrough and user feedback. They suggested that the system has great potential for use as a complementary learning tool, and it will enable students to learn new words and reinforce the ones that they already know with the possibility of observing how grammatically and semantically the expressions in both languages are constructed. However, students also evaluated the system informally, and suggested that although it might have great potential for both entertainment and learning, having "two subtitles displayed at the same time required a lot of concentration in order to be able to follow the text and audio track" (Baynon, 2004, p.563).

One good example of the use of CD-ROM technologies for language teaching is the electronic dictionary. The Longman Interactive English Dictionary[5] provides a collection of linked reference works, including a dictionary, a dictionary of common errors, grammar, a collection of pictures and even a small library of video clips illustrating language in context (see Figure 3.2). Other examples are: Collins EFL specific Multilevel Business Programme, GrammarRom, General Edutainment and Encarta.

[5] http://www.longman.com/dictionaries/which_dict/lied.html

Figure 3-2: Longman GrammarRom interactive CD-ROM

A study by Al-Segheyer examining the effect of still image and dynamic video annotations in aiding vocabulary acquisition yielded the conclusion that “[a] video clip is more effective in teaching unknown vocabulary words than a still picture”. He further suggests “video better builds a mental image, better creates curiosity leading to increased concentration, and embodies and advantageous combination of modalities (vivid or dynamic image, sound, and printed text)” (2001, p.202).

EuroTalk interactive DVDs were developed to teach advanced French, English, Spanish, German and Italian. Advanced French is appropriate for individual self-directed learning, and is based on an episode of *Au coeur de la loi* (At the Heart of the Law), a French television series which features a female detective and her male colleagues in Paris. The main menu of *Advanced French* indicates six choices: Video and text, dictionary, word search, activities, record your own voice, and quiz. There are no directions explaining where or how to begin the program, although the "video and text" button is prominent at the top and centre of the screen (see Figure 3.3). The most attractive aspect of this program is that “it offers exposure to authentic French”. However, it lacks the opportunity for “meaningful communication” that can be initiated online through a computer (Brinkley, 2002, p.32).

Figure 3-3: EuroTalk advanced French: main menu

Clicking on *Vidéo et texte* takes the user to the video and transcript. *Au coeur de la loi* plays within a television-like frame, with the French transcript appearing as subtitles below the television frame (see Figure 3.4).

Figure 3-4: EuroTalk advanced French: *Vidéo et texte* screenshot

3.5 Computers for language learning

The main principle behind using the computer for second language learning, as opposed to other distance learning courses, was to facilitate more effective one-to-one tutoring by "taking the weight of responsibility for learning away from the teacher and allocating it to the learner" (Hoven, 1997, p.64). It adds flexibility to the learning experience by enabling students to work at their own pace, in their own time, and in accordance to their own learning needs, interests and motivations.

There is a considerable amount of research on the use of Computer Assisted Language Learning (CALL) (Warschauer, 1996; Warschauer and Healey, 1998; Philippe, 2000; Warschauer and Kern, 2000; Chapelle, 2003). This section presents an historical review of how computers have helped in second language learning.

3.5.1 Computer assisted language learning: a historical development

Computers have been used for language learning since the 1960's. A number of researchers have provided an overview of computer developments for language learning over the last 40 years (Philippe, 2000).

Warschauer categorises the development of CALL into three distinguishable phases that he refers to as 'behavioristic CALL', 'communicative CALL', and 'integrative CALL' (Warschauer, 1996). The first phase, referred to as 'behaviorist CALL', was established in the 1960 and 70s, and had its roots in behaviorist theory, which was the dominant theory at the time. The CALL programme of this phase featured repetitive language drill and practice. Figure 3.5, illustrates the audio-lingual language lab (Philippe, 2000). The computer mainly acted as a tutor that "never grew tired or judgemental and allowed students to work at an individual pace" (Warschauer and Healey, 1998, p.1.). Early CALL programmes were designed for mainframe computers, and featured drills, grammar instruction and tests. PLATO (Programmed Logic for Automatic Teaching Operations) was a well-known computer based learning environment, which was also used for language teaching. The most interesting feature of this programme was the way that it enabled liaison between tutor and learner in the form of mainframe note files (Philippe, 2000). In this way, students could ask questions and receive feedback from their tutors.

Figure 3-5: Audio-lingual language lab (Philippe, 2000)

The next phase of CALL development started in the l980s and was based on the communicative approach to language learning. The proponents of this approach argued that the drill-and-practice programme does not provide an opportunity for real and "authentic communication", and that "computer-based activities should focus more on using forms than on the forms themselves, teach grammar implicitly rather explicitly, allow and encourage students to generate original utterances rather than just manipulate prefabricated language, use the target language exclusively and create an environment in which using the target language feels natural…, and will never try to do anything that a book can do just as well" (Warschauer, 1996, p.5).

A large number of programmes were developed using the principle of 'communicative CALL'. These mainly assist language learners either as a *tutor* or as a form of *stimulus.* Whilst the former (tutor) instructed, examined and gave feedback, the latter were more heuristic and aimed to provide an environment which stimulated students in discussion, critical thinking, writing and reading activities. A wide variety of software, which was not developed specifically for language teaching, has been recognised as beneficial for

this purpose (e.g. games like SimCity[6], Sleuth, or Where in the World is Carmen Diego) (Warschauer and Healey, 1998). Figure 3.6 illustrates the SimCity programme.

Figure 3-6: SimCity screenshot

Although communicative CALL was perceived to have advantages over behaviourist CALL, it still failed to work to its full potential, and was criticized as being ad hoc and disconnected; therefore, teaching in a more integrated manner was required. The final phase of development was a step towards 'Integrative CALL'.

> "If the mainframe was the technology of behavioristic CALL, and the PC the technology of communicative CALL, the multimedia network computer is the technology of integrative CALL" (Warschauer and Healey, 1998, p.58).

Multimedia CALL, with its capacity for provision of information in different modalities - audio, video, animation, hypertext and hypermedia, communications, whether synchronous or asynchronous - will provide new opportunities of all sorts that could enhance language learner's experience in acquiring different aspects of language skills: speaking, writing, reading, listening and comprehension.

[6] http://simcity.ea.com/

The strength of multimedia CALL is its ability to provide interactivity and flexibility in which learners can interact with learning materials in their own time, and in a non-threatening, non-judgmental way (Chapelle, 2003). The advent of the Internet and World Wide Web has particularly advanced access to information and communication across different languages and cultures. It is no longer difficult to access authentic materials like the news and foreign language radio that are available literally at the fingertips of every language learner using the Internet. Communication technologies, such as email, chat, discussion boards and video conferencing, provide an opportunity for synchronous and asynchronous interaction between learners, native speakers and teachers. An overview of integrative CALL software, also known as multimedia and hypermedia CALL, will be given in the next section.

3.5.2 Intelligent Computer Assisted Language Learning Systems (ICALL)

The concept of intelligent computer assisted language learning systems is to incorporate Artificial Intelligence (AI), Natural Language Parsing (NLP) and Machine Translation (MT) processing to automate language tutoring. ICALL programs were developed according to language learning theories, from the behaviourist, cognitive and constructivist schools. The teaching and didactic model was based on the idea that the computer is the expert tutor, and can provide instructions for learning skills including vocabulary and grammar and can provide verbal or textual feedback. The main components of ICALL systems were a knowledge base, tutoring, and an interface module. Later, in the 1990's, when individual differences and learning styles were recognised as having a huge influence on learning outcomes, adaptive ICALL software was created using a learner model, in order to give dynamic and adaptive instructions and feedback (Shahrour and Bull, 2008). Figure 3.7 illustrates the general structure of ICALL architecture.

Figure 3-7: ICALL architecture (Wenger, 1987)

Machine Translation programs which were restricted to translating word by word in the 1950s and 60s, have now become much more advanced in translating text into almost all languages (Kraif et al., 2004; Greene et al., 2004). Advances in hardware and processing power made it possible to easily acquire translation software, some of which is freely available on the Internet.

Speech recognition is another field of interest for ICALL researchers. Its potential lies in the software's ability to recognise a speaker's utterance and to provide effective feedback which aids the learner in mastering pronunciation skills (Ehsani and Knodt, 1998). Some of the advanced speech recognition software provides visual feedback as an aid to pronunciation (Anderson-Hsieh, 1994; Lambacher, 1996; Dalby and Kewley-Port, 1999).

3.5.3 The computer as a tutor

There are a number of software programs available to support the learning of grammar and vocabulary and to support listening, pronunciation, reading and writing skills. Programmes that teach grammar include packages for drill and practice (e.g. 'Advance Grammar Series' and 'English Grammar Computerised I and II'), games (e.g. 'Code Breaker' and 'High Grade Builder'), quiz and test (e.g. '50 TOEFL SWE Grammar Test'), and multimedia (e.g. 'Dynamic English' and 'Learn to Speak English Series').

Programs that teach vocabulary include drill and practice programs (e.g. ‘Synonyms’), multimedia tutorials (e.g. ‘English Vocabulary’), and games (e.g. ‘Hangman’ and ‘Scrabble’). Those that teach pronunciation mainly allow learners to record and play back their own voice and compare it to a model (e.g. ‘Sounds American’ and ‘Conversations’). Programs with similar features but with integrated multimedia include ‘Firsthand Access’ and ‘The Lost Secret’. Offerings which teach reading skills that are designed for English second language learners include ‘Reading Adventure 1’ and games like ‘HangWord’.

Programs that teach all aspects of language skill within one package are available from many publishers. They are available at different levels, from beginner to advanced, and teach grammar, vocabulary, cultural context, writing, speaking, and listening comprehension. One of the most sophisticated programs currently available is called ‘Tell Me More’. It features interactive dialogues, a word glossary, grammar instruction, and more intelligent features such as: lesson report (which gives a detailed account of the learner’s progress), personalised learning paths, speech recognition, a spoken error tracking system and phonetic animations in 3-D. Figures 3.8 and 3.9 illustrate its oral and pronunciation exercise, and the phonetic exercise (Lafford, 2004).

Figure 3-8: Oral and pronunciation exercise

Figure 3-9: Phonetics exercise

3.5.4 The computer as a tool

Computer programs that are not specifically designed for language learning could also be beneficial for learners acquiring different language skills. We mainly describe them within three categories: office tools, search tools and authoring tools.

3.5.4.1 Office tools

The computer based visual tools that facilitate writing and reading (e.g. 'Microsoft Word' and 'WordPerfect') could assist language learners in acquiring writing and reading skills. These tools enable the student to write using the keyboard and incorporate spell checking and grammar checking (Milton, 2002). Chavez et al., discuss the way that using such tools enables learners to write, edit and revise their work and stimulates their desire to do so by introducing different graphics and font and style options (1996). The desktop publishing tools that allow insertion of high quality images in a combination of different styles of text and graphics could be used to aid and motivate language learners in writing.

There are some other tools available to aid collaborative writing among learners. Some programs are designed to incorporate synchronous discussion, word processing, brainstorming and electronic mail (e.g. 'Daedalus Integrated Writing Environment', 'Aspects' and 'MacCollaborator').

There are many computer programs that help reading: obvious examples are the office tools ‘Microsoft Word’ and ‘Microsoft PowerPoint’. Internet browsers, such as ‘Microsoft Explorer’, can be used to read hypertext and hypermedia content. ‘Microsoft Office’, in particular, has extra functionality which is designed to improve accessibility and provides an audio version of submitted text. This could aid language learners in mastering listening comprehension and pronunciation skills.

3.5.4.2 Search tools

Search tools provide reference and search facilities that enable learners to search for specific materials, or even inside materials. Search engines like ‘Google’, ‘Yahoo’, and ‘AltaVista’ allow learners to search for any topic and also provide translations.

Program such as concordances also provide search functionality through files and texts in order to locate different uses of a particular word. These programs, however, are more suitable for advanced learners. The most popular concordance available is Oxford’s MicroConcord, which is a large source of words (1,000,000 words) taken from British newspapers.

3.5.4.3 Authoring tools

Authoring tools can be used by teachers or learners to design and develop language learning content that can be shared between them, and in acquiring different aspects of language skills, such as speaking, reading, writing, and listening. In addition to these, authoring tools could facilitate the application of the constructivist view of language learning, enabling individuals or groups of learners to create their own language learning content (e.g. videos, transcripts of conversations, or audio files of dialogue), and to perform collaborative tasks.

Some authoring tools, like Web Publishing tools, are not specifically developed to be used in the language learning field; however, they can provide opportunities for designing and creating HTML pages that can include materials like text, audio, and video, and can be shared among learners and teachers who are working at a distance. Examples are ‘Macromedia Dearmweaver’, ‘Front Page’, and ‘Mozilla’s Composer’.

Some video editing tools like 'Adobe Premier' enable learners to edit and create their own language learning videos, (e.g. documentaries, and conversations with native speakers), and generally allow people to reflect on their own language learning experience and to share it with others learners (Broady, 1997). The constructivist approach to learning is adopted in this way.

Other authoring tools are designed specifically for language teachers who are not expert in the use of such software and make it possible for them to create their own lessons and multimedia courseware, e.g. 'CALIS' and 'DASHER' (Chavez et al., 1996).

3.6 The Internet and the World Wide Web

The Internet can deliver all sorts of materials for language learning and also allows communication. Warschauer et al. referred to the Internet as "the fourth most important invention after language itself, writing and printing" (see Milton, 2002, p.21). The Internet and World Wide Web provide rich multimedia and hypermedia sources of information that can assist language learners to access authentic resources, and can also deliver online language learning courses (Young, 2003). The following section provides an overview of the Internet for language learning.

3.6.1 The Internet as an authentic resource for language learners

The Internet is a rich information resource that includes authentic materials of all sorts that could facilitate language learning (LeLoup and Ponterio, 2000). Lee discusses how using the Internet can enhance language learners' experience beyond the classroom walls, and points out how they may acquire 'cultural knowledge' and promote 'intercultural exchanges' via online newspapers and chat-rooms respectively (Lee, 1997; Lee, 1998).

The potential use of the Internet as a resource has been investigated by Osuna and Meskill, and it has been suggested that the "Web is a suitable tool to increase language and cultural knowledge, as well as a means to increase motivation" (1998, p.71).

The main characteristics of the Internet are described as "an informal learning environment for English as a second/foreign language; as a discursive space where

identities are formed and social relationships are negotiated, and, as a space where the intermingling of the global and the local gives rise to hybrid language varieties" (Koutsogiannis and Mitsikopoulou, 2004, p.83).

Godwin-Jones considers that "using the web as a source of real-world information is in line with another important component of contemporary language learning methodology, the use of authentic language materials" (2004, p.9).

Authentic resources, such as newspapers, magazines, radio, music, poems, novels, and so on, are at the fingertips of every language learners using the Internet. They facilitate learning in context and also help learners to improve their reading, writing, listening and comprehension skills. Learners are able, for example, to read the news headlines in their first and second languages via the Internet, in order to learn new vocabulary or to test their comprehension skills.

3.6.2 Online language learning environments

Some online language learning environments are designed to facilitate self-directed language learning. Most of these environments perform either the role of language instructor to provide a language lesson for different level learners (e.g. beginners, intermediate, advanced) or facilitate learning through authentic materials.

The online teaching approach is similar to the CALL systems which attempt to teach different aspects of language skills. However, unlike the first generation CALL environments, they incorporate multimedia and hypermedia facilities for the presentation of materials. Digital audio and video files are often included in lessons and activities to enforce listening and comprehension skills. Textual resources like reading lists are provided in the hypertext format that leads learners from one link to another, for further discussions, or to provide a word definition or glossary. A number of activities and exercises are developed for learning grammar, vocabulary, syntax, and so on, in the form of fill-in-the-gap, multiple choice questions, quizzes and games. Games like 'Scrabble' and 'Hangman' are developed for the online environment to assist in vocabulary and reading skills respectively.

A number of publishers and other institutions have designed online language learning courses, some of which are freely available, whereas others require a subscription. A number of researchers have developed guidelines for designing tasks for web based language learning environments. What is being realised is that "the task should promote use of target language, should require use of the same kinds of authentic materials used by native speakers, and require meaningful communication for the production of the end product" (Goodwin-Jones, 2004, p.10).

The BBC[7] provides language learning environments for teaching, amongst others, English, German, Italian, Spanish, and Chinese, based on themed multimedia activities. Examples of themes are: flying visit, meeting people, food and drink, places, making plans, shopping, and emergencies. Each set of activities teaches the key words relevant to the subject matter, explains a narrative of the situation textually and then shows learners a video simulation of the dialogue to indicate how the language would be spoken in that context by native speakers. The learner can also ask to view and read a transcript of the dialogue. In addition to this, the site provides an A-Z list of vocabulary together with a translation, gives a 'hands-on' guide to grammar, and assisting with practice speaking and writing. In the speaking section, the learner hears one side of a conversation, then practices the words out loud. Figure 3.10 illustrates the BBC French online course for beginners.

[7] http://www.bbc.co.uk/languages/

Figure 3-10: BBC French course for beginners

A number of online language learning environments provide authentic materials and activities. For example the BBC World Service[8] provides resources and activities to assist learners based on the daily news. This is entitled 'Learning English – Words in News', and it enables readers to read, listen to and learn vocabulary from the news. A list of key vocabulary is highlighted in the transcription, and a translation of the words is also provided. Figure 3.11, illustrates the BBC learning English service. 1-language.com[9] has a similar service that provides learning opportunities based on the news. In addition to this, it provides a gap-fill exercise and multiple choice quizzes to test reading, listening and comprehension.

The BBC World Service provides another service to assist those learning from authentic materials like radio, music and songs. English by Radio[10] enables learners to listen to a radio programme, vote, and talk about the topic. Video clips and vocabulary from the UK pop music charts[11] are also available in order to help learners to understand the video. These are combined with a brief singer's autobiography and quizzes to test the learner's listening and comprehension. Figure 3.12 illustrates the 'BBC Learn English

[8] http://www.bbc.co.uk/worldservice/learningenglish/newsenglish/
[9] http://www.1-language.com/eslnews/
[10] http://www.bbc.co.uk/worldservice/learningenglish/radio/radioprogramme/index.shtml
[11] http://www.bbc.co.uk/worldservice/learningenglish/multimedia/index.shtml

Top of the Pops service'. The principles and theory behind the development of these environments are derived from Krashen's (1982) theory about the value of 'comprehensive input'; language can be acquired without the learner knowing all of the linguistic forms in the message. So, the idea is to provide an engaging, motivational and immersive environment that enhances 'linguistic input' by making it more comprehensible to the learner.

Figure 3-11: BBC learning English - words in the News service

The BBC world language learning service is being frequently used by second language learners around the world. Currently it has approximately 1.5-2 million unique users, generating in excess of 30 million page views per month (Chapman and Scott, 2008). In particular, the service succeeded in attracting EFL learners in China who are using it as an informal learning tool for acquiring metacognitive and cultural knowledge about the English language (Young and Sim, 2003). It is also realised that the learners used the service for online community building and authentic language learning (Chapman and Scott, 2008).

Figure 3-12: BBC learning English - Top of the Pop service

3.6.2.1 Online dictionary

Online dictionaries are possibly the most common form of technology used by second language learners on a daily basis (e.g. a free Longman dictionary[12] is available online). Picture dictionaries are also available online[13]. These are split into categories (animals, fruits, kitchen, musical instrument, and so on) and give a word's definition coupled with a picture.

3.6.2.2 Online translator software

Translator software is available online, and provides instant text translation[14] in 24 languages. Although teachers may question the pedagogical principle of learning by translation, translator software could help learners to check their understanding.

3.6.2.3 A Word a Day Service

Some online language learning environments provide a 'One Word a Day'[15] service. A user can retrieve a word from the Internet or subscribe to an email service to receive

[12] http://www.ldoceonline.com/
[13] http://www.pdictionary.com/
[14] http://dictionary.reference.com/translate/text.html

‘One Word a Day’ via email. These environments have other facilities (e.g. dictionary, instant translator, and games) for self-directed language learning. Figure 3.13 illustrates the Longman’s word of the week service, and its word of the week - ‘information overload’ with a picture emphasising the meaning.

Figure 3-13: A Word a Day Service

3.7 Communication technologies

Even before the advent of computer-mediated communication (CMC), language learners around the globe were aware of the benefits of communication with peers and native speakers, and many found and communicated with foreigners as pen-friends. So, the letter was the first form of communication technology for language learners, and a number of companies established processes for finding pen-friends for second language learners.

The development of communication technologies is based on the socio-cultural learning theories (Vygotsky, 1978; Platt, 1986; Donato and McCormick, 1994; Donato, 1994; Lantlof; 2000) and the presumption that a student’s collaboration with other students and with teachers and experts is an important feature of mastering ‘communicative

[15] http://www.lambdaeducation.com/a_word_a_day.htm#Gambit - http://www.wordsmith.org/, http://dictionary.reference.com/ - http://www.longman.com/ldoce/word_wk/index.html

competence', and ultimately contributes towards acquiring a second language. The pedagogical benefits of computer-mediated communication (e.g. electronic mails, chat-rooms and discussions boards) have become one of the most discussed topics in second language learning research (Salaberry, 2001; Blake, 2000; Sengupta, 2001; Cziko and Park, 2003; Chapelle, 2003).

Kersten et al. discuss how CMC, or what they refer to as 'Electronic Negotiation Systems', could augment communication and conventional teaching, and be used effectively in the development of analytic, cognitive and linguistic skills (2002).

Chapelle points out the way in which CMC extends language learners' discussion "beyond the time, location – and even the participants – of one classroom" (2003, p.25).

Liu et al. highlight the benefits of CMC for language learning; that "unlike many individual CALL applications, CMC seems to promote meaningful human interaction that can foster the language learning process. … CMC can be an excellent medium for cultivating new social relationships within or across classrooms, resulting in collaborative, meaningful, and cross-cultural human interactions among members of a discourse community created in cyberspace" (2002, p.3).

The next section looks at a range of communication technologies - from email, to chat-rooms and discussion boards, video conferencing, blogs, mobile phones and PDAs - that have been used for learning different areas of language skill.

3.7.1 Email

One of the features of email that is most beneficial for language learners, is that it provides instant access to people all over the world. Chavez et al. explain the benefits of email:

> "Second language learners can benefit immensely from this resource by contacting other students whose native language is the one they are trying to acquire. Student are no longer restricted or confined within classroom walls. With a computer, telecommunications software, a modem, and a telephone line students can travel to remote places in the world, across time zones, and send messages more quickly than by regular mail" (Chavez et al., 1996, p.6).

The benefits of e-mail have been mentioned with respect to helping students to develop meaningful communicative and thinking skills (Kroonenberg, 1995). “E-mail allows a teacher to stress writing in a non threatening way. It provides the students with a real life and realistic form of communication; real people talking to each other. Email allows students to communicate with another student without the stress of an immediate response” (Matarazzo, 1996, p.7).

The study by Van Handle and Corl on e-mail exchanges between two intermediate level German classes suggests that it provides the opportunities to extend dialogue and encourages conversation and writing among language students (1998).

As the communication technologies are rapidly developing, language learners may now prefer to use more advanced technologies, such as instant messaging and mobile phone texting. In particular, the potential value of mobile technologies for language learning has been widely recognised (Attewell, 2002; Godwin-Jones, 2004; Chinnery, 2006): this is discussed in section 3.7.5.

3.7.2 Chat-rooms and discussion boards

Learners can now communicate and interact with one another in real-time. Such virtual chats provide opportunities for communications among native and non-native speakers (Tudini, 2003). Electronic lists or discussion groups provide a forum where people with similar interests can share resources and participate with one another in dialogue (LeLoup and Ponterio, 2000).

Chapelle argues that ‘Internet speech communities’ have freed language learners from the tension of face-to-face communication. She points out that “Learners can avail themselves of a large amount of input, participate in interactions without revealing their true identity…, [and] lurk in a discussion perhaps to benefit from the input without being pressed to produce any language” (Chapelle, 2003, p.15).

Cziko and Parkvast reviewed six programs (‘AOL Instant Messenger’, ‘Yahoo Messenger’, ‘MSN Messenger’, ‘Windows Messenger’, ‘PalTalk’ and ‘iVisit’) that enable synchronous audio (and some video) communications through the Internet. They found that “the communicative contexts created by these programs can provide second

language learners with an inexpensive means for useful audio interaction with native speakers of their second language" (2003, p.15).

Some teachers try to incorporate online chat-rooms or discussion boards in their lessons to initiate communication tasks. Learners are usually given a particular topic to review and to comment upon over a defined period. The advantages of these tools are notable because they facilitate synchronous communication among students (Kroonenberg, 1995; Matarazzo, 1996). Examples include the Let'sTalk[16] audio/video online discussion forum which enables language learners and teachers of English as a Second/Foreign Language (ESL/EFL) to participate in discussions about various topics: perhaps the 'US election', or 'how is the weather?'

A study in Taiwan investigated the potential of CMC in second language learning, and concluded that:

> "…computer mediated environment could lower students' psychological barriers to enable them to express their opinions freely and to communicate actively on the Internet and that it could also enhance their critical thinking, problem solving and communication skills through online activities …" (Young, 2003, p.447).

Despite some of the potentials outlined above, there some limitations. Firstly, there is a great danger that learners develop bad conversational skills by chatting and interacting with people whose language competence is not suitable. Secondly, it may not always be easy to get a native language partner who is willing to spend time in conversations. In addition, there is the problem of getting instruction from amateurs.

3.7.3 Video conferencing

Video conferencing software enables synchronous communication in a distance situation using visual images and sound. Video conferencing in distance learning has become widely accepted as this medium connects a dispersed community of learners and teachers, facilitates interactions between them and can be used to deliver instructions and feedback.

[16] http://duber.com/LetsTalk/

Coverdale-Jones (2000) studied student perception of the use of video conferencing for language learning, and suggests two advantages. The first one is associated with the interactivity that this medium offers and the second refers to the immediacy of communication with a real person. He concludes that this technology makes a powerful contribution to communication authenticity.

The use of video conferencing for language learning was studied by Wang, who suggests that desktop video conferencing tools are "capable of supporting oral and visual interaction in distance language education" (Wang, 2004, p.1).

A study undertaken by Bromiley investigated the use of video conferencing, linking a remote teacher and learner to recreate face to face classroom activities. The study suggested that the most commonly used activities were speech based. A survey of the attitudes of language teachers towards the use of this medium indicated that "the more experienced the teacher the more inclined they are to be unsure or negative about the value of video conferencing" (Bromiley, 1999, p.21). She concludes that video conferencing has evolved over the past few years, from lecture style, to more interactive tutor-learner communication, to the more recent learner-learner interaction.

Kinginger (1998) studied the use of video conferencing to enable learners of French in the US to converse with native speakers. She concludes that video conferencing could provide the opportunities for real utterances and access to native speakers whose language is the subject of study.

3.7.4 Blog

As communication with native speakers has been recognised as an important factor in the development of speaking, writing and reading skills, most recently the potential of blogs has also come under investigation by researchers. Blogs have been variously defined. Ward explains them as "a dynamic place that is connected by time and topic" (2004, p.1). The general online consensus is that they are "an online web-zine or diary (usually with facilities for reader comments and discussion threads) made accessible through the World Wide Web" (Answer.com).

The potential of the blog is realised as it provides opportunities to practice writing, reading and communication skills. It offers "a genuine audience, is authentically communicative, process driven, peer reviewed, provide a dis-inhibiting context and offers a completely new form with un-chartered creative potential" (Ward, 2004, p.3). A blog can offer two-way communication among groups as "it intersects e-mail, discussion forum, instant messaging and conventional electronic publishing" (Wred, 2003, p.2). It seems that it entices students to communicate through their reading and writing, which can also help in developing these areas of language skill. Reading will be more interesting when content covers a range of current and authentic topics. However, it could lead to superficial and inaccurate understanding of the content (Ward, 2004; Arena and Jefferson, 2008).

3.7.5 Mobile phones and personal digital assistants

The potential value of learning via wireless and mobile devices or m-learning has been widely realised (Sharples, 2000; Attewell, 2002; Leung and Chan, 2003; Chinnery, 2006). Mobile devices enhance learning experiences by enabling communications and learning on the move, on an 'anytime and anywhere' basis (Sharples, 2000, Hardless et al., 2001; Roschelle, 2003). For language learning in particular this realisation holds true (Chinnery, 2006). Second language learners currently are often to be found with a pocket dictionary or personal vocabulary book. As a result, several researchers have begun to investigate the potential of mobile devices for language teaching (Malliou et al., 2002; Kadyte, 2004; Godwin-Jones, 2004; Tan and Liu, 2004).

Godwin-Jones points out how mobile and wireless technologies could provide an opportunity for language and cultural learning. He describes a project to develop a wireless system called RAFT that can be used on student's field trips. Using RAFT, an individual is able to store and retrieve information regarding their field trip on a handheld mobile device and to share it with other learners. Although RAFT was not specifically designed for language learning, its developer suggested that it could be used for cultural and languages learning by learners who are on trips abroad; for instance, to conduct interviews with native speakers, and to share them with other learners (Godwin-Jones, 2004).

The AD-HOC project aims to develop a mobile language learning environment to facilitate 'learning on demand' for European travellers who need to acquire language skills in order to communicate with local people. The AD-HOC system acts as a tutor, teaching linguistic and cultural knowledge through the use of multiple media presentations (e.g. text, sound, picture and video). The language learning environment offers representations of contextualised, authentic, real life situations for different levels of competency and within different thematic fields (e.g. business travel, travelling of young people, and so on). The underpinning pedagogical principle of the AD-HOC project is self-directed learning (Malliou et al., 2002).

The M-learn project is concerned with developing a mobile learning system for young adults (16-24), to teach them aspects of literacy and numeracy, and to involve them in the development of lifelong learning (Ultralab, 2003).

The mobile language learning system, designed in Finland by Kadyte (2004) delivers lessons using sound and text to teach grammar and vocabulary. It tracks the learner's progress and integrates voice technology for user interaction.

BBC Worldwide provides an English language teaching service via mobile phones in China. Learners receive a daily text message on their mobile containing a phrase in English together with the Chinese translation. A range of topics is covered (e.g. sport, business and lifestyle, etc.). The idea behind the system is to provide an opportunity for busy learners on the move to learn authentic spoken English (BBC, 2003).

A project conducted in Taiwan developed a mobile based (PDA) interactive language learning environment for elementary school children learning English as a second language. The activities aimed to help students to learn listening, reading and writing skills. For example, a scenario to teach words related to images showing a body parts provides a word's pronunciation and spelling when the image is clicked by the user. Evaluation showed a positive response from learners and indicates that the use of mobile devices can significantly increase student motivation and interest (Tan and Liu, 2004).

The Speak My Speak project is investigating the use of SMS (Short Messaging Service) as a communication tool between adult English language learners and native English tutors. They conclude that using SMS in language learning is feasible and promising. Students did reflect on text sent and received, and were active in constructing the content of communication (Markett, 2003).

MobiLearn[17] software provides a mobile phrase book in different languages for the pocket PC. The main features of the software are to provide a list of common words and phrases, to enable learners to bookmark their required words and phrases for easy access, to hear pronunciations and to test their knowledge through a number of quizzes provided.

The INLET project (Lingua) has developed a mobile phone support system to encourage tourists to learn some Greek language at the Athens Olympic Games 2004 (Pincas, 2004). The system provides a number of facilities for learning useful Greek phrases in a just-in-time manner. Language categories judged most beneficial for tourists were developed as follows: 'basic' (e.g. greeting, numbers, basic words), 'where' (e.g. phrases for asking direction, going by bus, taxi and trains), 'when' (e.g. asking times, today, now, tomorrow), 'Olympic Sport' (games name, athletics, fencing, and so on) and 'buying' (asking price, money, expressions like expensive, cheap, and so on). Users recruited at the airport in many cases, were able to register for SMS messages containing useful phrases to be sent to their mobile phones freely and regularly. They also could request SMS translations of other languages into Greek.

Song and Fox (2005) explored the role of mobile technology in the learning of English vocabulary by adults in Hong Kong. SMS functionality was integrated into a web-based vocabulary learning platform. They evaluated the effectiveness of the system using an online testing system and an open-ended questionnaire. The findings indicated a positive attitude towards mobile learning and significant improvements in learners' vocabulary acquisitions.

[17] http://www.mobilearn.net/

The integration of speech technologies for English oral practice and assessment were researched in Taiwan. A system was developed for PDAs, consisting of four modules: speech, testing, learning portfolio and teacher management. The evaluation, conducted through system log data, questionnaire and interview, indicated that student performance on oral practice and confidence in speaking English were greatly improved. Learners indicated that they accepted the learning style provided by the hand-held devices (Yang et al., 2005).

The LOCH project developed an informal language learning environment for use outside the classroom. It aimed to assist overseas students to learn Japanese whilst they were involved in real life situations. The teacher would assign a task for the student; for instance, asking a local person for directions. Students would then use the PDA interface to write and record questions, take pictures, and report back to the teacher. Communication between students and teachers could always be established through SMS and IP phone. The evaluation findings demonstrated that students benefit from the LOCH system as it provides the opportunity to learn outside the classroom, in real life situations (Paredes et al., 2005).

Thornton and Houser (2003; 2005) also developed several projects using mobile phones teaching English at a Japanese university. One focused on providing English vocabulary at timed intervals to the mobile phones of 44 Japanese university students. They compared the learning outcomes of these people with those of other students who were using identical materials on paper or the Web. The results indicate that students receiving mobile e-mails learned more than their counterparts.

Levy and Kennedy (2005) created a similar SMS based learning system for students of Italian in Australia, sending vocabulary words and idioms, definitions, and example sentences in a scheduled pattern. Feedback and quizzes were also provided through mobile interface.

The MEldit project developed a mobile version of the adaptive language learning system (ELDIT), developed for students studying Italian and German language who were preparing for bilingualism exams. The offline accesses of learning materials were enabled via PDA interface. The advantage of MEldit was that it provided easy access to

language learning materials on the move and on an 'anytime and anywhere' basis (Trifonova, 2006).

The L-Mo (Language - Mobile) project is developing a language learning system for young children. The project aims to exploit the potential of mobile and games technologies to teach foreign languages and to make the language learning experience more fun, engaging, and effective for children (LSRI, 2006).

Ogata et al. (2006) developed a context-aware mobile language learning environment that enables learning Japanese mimicry and onomatopoeia (MIO) words, which is called JAMIOLAS (Japanese mimicry and onomatopoeia learning assisting system). The system provides learner the appropriate MIO expressions.

Mobile dictionaries and translators are also widely available. The WAP translator, available from Don Quijote[18], for example, provides Spanish to English translations. Moreover, mobile devices, including PDA and Pocket PC, could be used to assist language learners in performing reading and writing tasks, and also in developing these skills.

3.8 Virtual Reality

This section discusses two kind of virtual reality applications that may facilitate language learning. The first one is multi user virtual environments (MUVE); the second is simulated immersion.

3.8.1 Multi user virtual environments

The MUD (Multi-User Dungeon/Domain/Dimension, depending on the source) is developed to facilitate multi-player role-playing games run over computer networks, allowing groups of individuals to build virtual realities collaboratively (Bartle, 1999; Dourish, 1998). Advances in computational power and network connectivity have driven the evolution of MUD, resulting in diverse human computer interfaces such as MUVE (Multi user virtual environment) and MOO (Multi-user dungeon object oriented), which is object oriented MUD.

[18] http://www.donquijote.org/spanishlanguage/wap

Regardless of content and intended user group, all MUVEs enable multiple simultaneous participants to represent themselves through 'avatars' and to interact with digital artefacts. In this way, they can access virtual contexts (in some cases graphical and in others, text-based) and to communicate with other participants of the environment (Dede et al., 2004).

There have been a variety of proposals regarding ways to use MUVEs and MOOs for language learning (Schwienhorst, 2002). MOOs are essentially text-based virtual reality environments that enable learners to interact with other participants in a similar way to chat rooms, but through symbolic representation of objects (which may represent locations, topics and user groups) that define the "virtual environment with specific roles and conventions" (Godwin-Jones, 2004, p.10). Large numbers of MOOs are available in a variety of languages, including 'SchMOOze' for ESL which also provides an online dictionary and learning games. Typically, when a learner logs on to a MOO, they create a character with a name and description, using various computer commands. They can carry out a number of activities, such as smiling, waving and ultimately chatting with other learners. At 'SchMOOz', language learners can meet new people, get together with friends or meet up with them in especial places (e.g. parties, coffee shops, libraries and so on) and play language learning games such as 'Scrabble', 'Hangman' and 'Boggle'. Learners can travel to different places and write simple commands and descriptions. For example, they may write a description of a book or poem in the virtual library, which can also be viewed by others around the world. This functionality can provide additional motivation for learners to write (Shield et al., 1999). In another system called 'The Palace', learners are represented by 'avatars' or cartoon figures that can communicate with each other (Schwienhorst, 1998).

The NICE world program provides for multiple users and evolving virtual space, and is essentially an extended version of MOO. The user is required to wear special stereo-glasses and to use a light-weight hand-held wand for interaction. A number of users can participate simultaneously and communicate with one another (Johanson et al, 1998).

Second Life is another example of advanced MUVE, an avatar-based 3-dimensional virtual environment. In Second Life, users appear in a fantasyland as an avatar in the company of other avatars. They can explore, meet other users, socialize, participate in

individual and group activities, and create and trade items and services with one another. For language learners, Second Life provides the opportunity to interact with other people in an easily accessible and non-threatening environment (Stevens, 2006). Unlike face-to-face communication, learners are not required to take part in instant interaction, but they can think, lurk and converse according to their preferences (Stanley and Mawer, 2008).

Another example of the usefulness of Second Life is that it can be developed by language teachers to provide simulation of real life environments and language instruction. For example, the online language school, 'Avatar English'[19], is taking an innovative approach by combining Second Life with voice messengers such as Skype and other online teaching tools such as Moodle that can provide instruction in grammar, vocabularies and for other areas of language skills (Stevens, 2006). Another virtual learning academy is 'Language Lab'[20]. The British Council[21] have opened a self-access centre island for teenage language learners in the teen grid of Second Life, a space designed exclusively to be used by teenagers and approved adult educators.

Despite the advantages that these virtual learning environments could bring for communications and interactions among a community of language learners and teachers, research still need to establish the full potential that they could offer in acquiring different language skills.

3.8.2 Simulated immersion

The advanced virtual reality currently available could provide simulated immersion into virtual environments. The 'Zengo Sayu Application' is a simulated immersion type of virtual reality that is designed to teach Japanese to learners. This system requires learners to be equipped with a head mounted display, hand-held wand, and a microphone. They are immersed in a traditional Japanese room, where they see and grasp objects or listen to sentences. Each object is pronounced in response to the user's actions with the hand-held wand. The idea is to provide comprehensible input while learners are physically immersed in the environment (Rose, 1996).

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[19] http://www.avatarlanguages.com
[20] http://www.languagelab.com
[21] http://www.britishcouncil.org/learnenglish/ and http://www.teen.secondlife.com

Another programme by the Foundation for the Hellenic World provides a 3-D virtual reality space that simulates a reconstruction of an ancient Hellenic city. The user is required to wear a head mounted display and can 'fly' around the city and view ancient buildings (Roussou, 2000).

A piece of virtual reality software for teaching Arabic language, called the 'Rapid Tactical Language Training System', has been developed by the U.S Army at the University of Southern California. It uses natural language processing and speech recognition to create a fully immersive environment with an interface similar to a video game. Users are able to move through a village and to make conversation with native speakers (Godwin-Jones, 2004).

A project at MIT has developed a persistent interface that features ubiquitous display, audio, and interaction in delivering language learning materials into the living room (Intille et al., 2003). The interface is prototyped using non-invasive sensing technology to present information on nearly any surface in the room. The system is designed to help home occupants learn the vocabulary of a foreign language, which will appear randomly on different surfaces in the environment. The user is able to access the English translation by using the red laser pointer. In addition to the translation they can listen to the word's pronunciation. The main advantage of this system is its non-disruptive interface which does not interrupt ongoing activity in the environment. Figure 3.14 indicates how the system responds and provides the translations of word when the learner points out.

Figure 3-14: Learner's interaction with persistent language learning system in the living room (Intille et al., 2003)

3.9 Systematic critique of language learning technologies

Our discussion in the previous sections provides an overview of a number of different technologies for language learning. This overview indicates the great potential for technologies to assist language learning. However, there are some limitations associated with the special characteristics of each technology and the type of activity that each could afford. This section aims to provide a more systematic critique of current language learning technologies, indicating the major learning benefits and limitations of each type of language learning technology and possible areas of language skills that could be supported. This is outlined in Table 3.1.

It should be noted that this could be considered a rather simplistic view, looking at the affordances of each medium, without taking into account of the nature of specific content and application. Although it is true that technology has distinct characteristics that could support some type of use, however, it is also true that this use could always be enriched by *human ingenuity*. This holds true for simple technology, such as printed materials, as well as more advanced technology, including CDs, DVDs, intelligent computer assisted learning, virtual reality and mobile devices. For example, printed materials could support feedback and interactivity if the content is developed to support these features, possibly through questions and answers. On the other hand, while CDs and DVDs can support delivering extensive interactive content, they may only be limited to the rewind and replay type of functions if the interactivity is not developed within the content and application. In the following analysis (Table 3.1), we also attempt to indicate where the affordances of technology depend on the nature of the content and application that could be developed.

Language learning technology			Supporting areas of language skills	Limitations/ problems	Benefits
Printed materials			Reading Writing Learning new vocabulary Learning grammar Does support implicit teaching of listening comprehension, pronunciation and speaking skills	Depends on the nature of content provided, but they are generally limited in terms of provision of interactive[22] features (Laurillard, 2002, p.94) and feedback. Linear media that includes just text and images. Can be heavy to carry. Lack of face-to-face contact with a native speaker.	Provides a portable and easy to read source of information in a flexible and accessible way (Laurillard, 2002, p.94; Bates, 2005, p.69). Offers control to learners, enabling re-reading, skip, browse, go to another topic via the index or content page, and in doing so control the pace of delivery of the material (Laurillard, 2002, p.94).
Audio based media	Language lab		Listening and comprehension Pronunciation Learning new vocabulary	Depends on the nature of content provided, but they are generally limited in terms of provision of interactive features (Laurillard, 2002, p.98) and feedback.	Offers control to learners. Enables practice and repetition (replay function) in order to learn new vocabulary, pronunciation and dialogues (Warschauer, 1996, p.5).

[22] The back-and-forth dialog between the user and the medium

Language learning technology			Supporting areas of language skills	Limitations/ problems	Benefits
				Provides nothing for the visual channel to focus on. Lack of face-to-face contact with a native speaker.	
	Radio		Listening and comprehension Learning new vocabulary Pronunciation	Non-interactive[23] (Laurillard, 2002, p.98). Non-controllable. Lack of feedback. Provides nothing for the visual channel to focus on. The flow of information could be too fast or acoustically difficult to unravel (Robin, 2007, p.13). Does not provide opportunity for	Provides access to up-to-date authentic materials (King, 1992). Intrinsically motivating. Portable and easy to obtain (Kitay, 2000, p.1-2). Allows hearing variety of accents (Wipf, 1984).

[23] There is no back-and-forth dialog between the user and the medium

Language learning technology			Supporting areas of language skills	Limitations/ problems	Benefits
				one-to-one tutoring. Lack of face-to-face contact with a native speaker.	
	Tape cassette		Listening and comprehension Pronunciation Learning new vocabulary Does not support explicit teaching of writing and reading skills	Depends on the nature of content provided, but they are generally limited in terms of provision of interactive features (Chen, 1999, p.21) and feedback. Provides nothing for the visual channel to focus on. Lack of face-to-face contact with a native speaker.	Provides access to up-to-date materials, e.g. music. Provides auditory channel rather than the visual, which means it offers opportunities and access to people who cannot easily read (Bates, p.116). Allows access to selected materials in accordance to different personal preferences and interests. Offers opportunities for learning in a flexible way, for instance at home, work and on the move.
	CDs		Listening and comprehension	Provides nothing for the visual	Provides access to up-to-date

Language learning technology			Supporting areas of language skills	Limitations/ problems	Benefits
			Learning new vocabulary Pronunciation	channel to focus on. Lack of face-to-face contact with a native speaker.	authentic materials, e.g. music Allows users to select the materials in accordance with different personal preferences and interests. Offers opportunities for learning in a flexible way, for instance at home, work and on the move. In comparison to tape, provides better auditory quality and control for selecting a particular part (Bates, p.116).
Video based media	Video-based language teaching programme		Reading, writing, listening and comprehension, learning new vocabulary and grammar can be supported through specific instructional programme.	Depends on the nature of content provided, but they are generally limited in terms of provision of interactive features (Laurillard, 2002, p.103) and feedback. Lack of face-to-face contact with a	Offers two channels of information (sound and vision), that show paralinguistic aspect of language, e.g. body language, how language is used in different situations and settings (Broady, 1997).

Language learning technology			Supporting areas of language skills	Limitations/ problems	Benefits
				native speaker	Provides opportunities for distance learning in a flexible way, for instance at home. Controllable if it is being used with VCR. For example, being able to play, stop, fast-forward and rewind, enabling learners to self-pace and to reflect (Laurillard, 2002, p.104).
	Video-based authentic programmes	Films	Listening and comprehension Learning new vocabulary Does not support explicit teaching of writing, reading and speaking skills.	Depends on the nature of content provided, but they are generally limited in terms of provision of interactive features (Laurillard, 2002, p.103) and feedback. Sometimes visual information is not closely linked with verbal information, which may impair understanding (Broady, 1997). The flow of information could be too	Provides access to up-to-date materials of all kinds, showing different context and situations (Broady, 1997). Intrinsically motivating. Offers two channels of information (sound and vision), that show paralinguistic aspect of language, e.g. body language, how language is used in different situations and setting

Language learning technology			Supporting areas of language skills	Limitations/ problems	Benefits
				fast to unravel (Meinhof, 1998, p.23) Lack of face-to-face contact with a native speaker	(Broady, 1997). Provides opportunities for learning in a flexible way, for instance at home. It is a controllable medium in terms of being able to play, stop, fast-forward and rewind, enabling learners to self-pace and to reflect (Laurillard, 2002, p.104).
		TV in the target language	Listening and comprehension Learning new vocabulary Does not support explicit teaching of writing and speaking skills (Sherrington, 1973).	Non-interactive (Laurillard, 2002, p.99). Non-controllable (Laurillard, 2002, p.99). Lack of feedback. Does not provide opportunity for one-to-one tutoring. Lack of face-to-face contact with a	Provides access to up-to-date authentic materials of all kind, showing different context and situations (Sherrington, 1973; Meinhof, 1998). Intrinsically motivating. Offers two channels of information (sound and vision), that show paralinguistic aspect of language, e.g. body language, how language is used

Language learning technology			Supporting areas of language skills	Limitations/ problems	Benefits
				native speaker. Sometimes visual information is not closely linked with verbal information, which may impair understanding (Broady, 1997). The flow of information could be too fast to unravel (Meinhof, 1998, p.23).	in different situations and setting (Broady, 1997). Enables acquisition of cultural specific knowledge. Provides opportunities for learning in a flexible way, for instance at home.
		TV with subtitles or close captions	Listening and comprehension Learning new vocabulary Reading	Non-interactive (Laurillard, 2002, p.99). Non-controllable (Laurillard, 2002, p.99). Lack of feedback. Does not provide opportunity for one-to-one tutoring. Lack of face-to-face contact with a	Provides access to up-to-date authentic materials of all kinds, showing different contexts and situations (Sherrington, 1973; Meinhof, 1998). Intrinsically motivating. Offers two channels of information (sound and vision), that show paralinguistic aspect of language, e.g. body language, how language is used

Language learning technology			Supporting areas of language skills	Limitations/ problems	Benefits
				native speaker. Sometimes visual information is not closely linked with verbal information, which may impair understanding (Broady, 1997). The flow of information could be too fast to unravel (Meinhof, 1998, p.23).	in different situations and setting. Provides opportunities for learning in a flexible way, for instance at home.
		Interactive video delivered via CD-ROM or DVD	Listening and comprehension Learning new vocabulary Reading, writing, speaking and grammar learning can be supported through specific instructional programme.	Depends on specific application and content, but some general limitations are: Lack of face-to-face contact with a native speaker. Sometimes visual information is not closely linked with verbal information, which may impair understanding (Broady, 1997).	Provides access to up-to-date materials of all kinds, showing different contexts and situations. Offers two channels of information (sound and vision), that show paralinguistic aspect of language, e.g. body language, how language is used in different situations and settings (Broady, 1997). Provides opportunities for learning in

Language learning technology			Supporting areas of language skills	Limitations/ problems	Benefits
					a flexible way, for instance at home. Interactive (Laurillard, 2002, p.104). It is a controllable medium in terms of being able to play, stop, fast-forward and rewind, enabling learners to self-pace and to reflect (Laurillard, 2002, p.104). Enables storage and delivery of large amounts of audio and visual materials. Provides multimedia presentations of information that can link and combine text, audio and video. It can be delivered through a PC.
Computers for language learning	Intelligent computer assisted		Different applications can be developed to support listening and comprehension, learning	Depends on specific application and content, but some general limitations are:	Interactive (Chapelle, 2003). Provides feedback.

Language learning technology			Supporting areas of language skills	Limitations/ problems	Benefits
	language learning system		new vocabulary, learning grammar, pronunciation, reading, writing and speaking skills.	Usually not very intelligent, e.g. one-to-one instruction and feedback cannot be provided in a way similar to human tutor. Lack of face-to-face contact with a native speaker.	Provides opportunities for one-to-one tutoring. Offers opportunities for learning in a flexible way, for instance enabling learners to work at their own pace and in their own time.
	The computer as a tutor		Different applications can be developed to support listening and comprehension, learning new vocabulary, learning grammar, pronunciation, reading, writing and speaking skills.	Depends on specific application and content, but some general limitations are: Usually not very intelligent, e.g. one-to-one instruction and feedback cannot be provided in a way similar to human tutor. Lack of face-to-face contact with a native speaker.	Interactive (Chapelle, 2003). Provides feedback. Provides opportunities for one-to-one tutoring. Offers opportunities for learning in a flexible way, e.g. enabling learners to work at their own pace and in their own time.
	The computer as a tool	Office tools	Reading Writing	Depends on specific application and content, but some general limitations are:	Interactive (Chapelle, 2003). Offers opportunities for learning in a

Language learning technology			Supporting areas of language skills	Limitations/ problems	Benefits
			Learning new vocabulary Learning grammar Pronunciation skills	Not explicitly developed to support acquiring different areas of language skills. Learners need to acquire knowledge/training on how to use these tools for language learning. Lack of face-to-face contact with a native speaker.	flexible way, e.g. enabling learners to work at their own pace and in their own time.
		Search tool	Reading Learning new vocabulary	Not explicitly developed to support acquiring different areas of language skills. Learners need to acquire knowledge/training on how to use these tools for language learning. Lack of face-to-face contact with a native speaker.	Interactive (Chapelle, 2003). Offers opportunities for learning in a flexible way, e.g. enabling learners to work at their own pace and in their own time.
		Authoring	Different applications can be	Depends on specific application and	Interactive (Chapelle, 2003).

Language learning technology			Supporting areas of language skills	Limitations/ problems	Benefits
		tool	developed to support listening and comprehension, learning new vocabulary, learning grammar, pronunciation, reading, writing and speaking skills.	content, but some general limitations are: Not explicitly developed to support acquiring different areas of language skills. Learners and teachers need to acquire knowledge/training on how to use these tools for language learning and teaching.	Offers opportunities for learning in a flexible way, e.g. enabling learners to work at their own pace and in their own time.
The Internet and World Wide Web	The Internet as an authentic resource for language learners		Reading Learning new vocabulary Listening and comprehension Pronunciation	Not explicitly developed to support acquiring different areas of language skills. Depends on the authentic material used. For example, they can be difficult to understand for particular language learners, especially when there is no scaffolding support available.	Provides access to up-to-date authentic materials. Enables acquiring cultural specific knowledge (Lee, 1997). Interactive (Godwin-Jones, 2004).

Language learning technology			Supporting areas of language skills	Limitations/ problems	Benefits
				Low/bad quality materials are also accessible.	
	Online language learning environment		Different applications can be developed to support listening and comprehension, pronunciation, learning new vocabulary, learning grammar, reading, writing and speaking skills.	Depends on specific application and content. Rich possibility, but a possible limitations are: Lack of face-to-face contact with a native speaker. One-to-one instruction and feedback cannot be provided in a way similar to human tutor.	Provides hypermedia and multimedia facilities for the presentations of learning materials. Interactive (Godwin-Jones, 2004). Provides feedback. Provides opportunities for one-to-one tutoring. Provides instant access to check unknown terms. Offers opportunities for learning in a flexible way, for instance enabling learners to work at their own pace and in their own time.
Communication technologies	E-mail		Communication skill	Requires native language speaker or language teacher to spend time in	Interactive (Godwin-Jones, 2004).

Language learning technology			Supporting areas of language skills	Limitations/ problems	Benefits
			Learning new vocabulary Writing	conversations and instructions “Teaching by amateurs”	Provides opportunities for communications and interactions between learners and with native speakers (Chavez et al., 1996, p.6). Encourages conversation and writing among learners (Van Handle, 1998).
	Chat-rooms and discussion boards		Communication skill Learning new vocabulary Writing	Requires native language speaker or language teacher to spend time in conversations and instructions. “Teaching by amateurs”	Interactive (Godwin-Jones, 2004). Provides opportunities for instant communications and interactions between learners and with native speakers (Tudini, 2003).
	Video conferencing		Communication skill Learning new vocabulary Listening and comprehension	Requires native language speaker or language teacher to spend time in conversations and instructions. Bad quality of sound and video can impair understanding. Freezing image can impair	Interactive (Coverdale-Jones, 2000). Provides facilities for synchronous communications in a distance using video and sound (Bates, p.187).

Language learning technology			Supporting areas of language skills	Limitations/ problems	Benefits
				engagement. “Teaching by amateurs”	
	Blog		Communication skill Learning new vocabulary Writing	Requires native language speaker or language teacher to spend time in conversations and instructions (Arena and Jefferson, 2008). “Teaching by amateurs”	Provides access to up-to-date authentic materials. Interactive (Ward, 2004, p.3)
	Mobile phone and personal digital assistants		Different applications can be developed to support listening and comprehension, learning new vocabulary, learning grammar, pronunciation, reading, writing and speaking skills.	Depends on specific application and content, but some general limitations associated with the physical characteristics of mobile devices, include: limited memory for storage of learning materials, limited memory in use, limited display capability associated with screen size, text size, and limited input and interactions possibilities. Bad quality of sound and video can	Interactive (Chinnery, 2006). Provides opportunities for communications and interactions between learners and with native speakers (Godwin-Jones, 2004). Offers opportunities for learning in a flexible way, for instance enabling learners to work at their own pace, in their own time, and on the move.

Language learning technology			Supporting areas of language skills	Limitations/ problems	Benefits
				impair understanding. Requires native language speaker or language teacher to spend time in conversations and instructions.	
Virtual reality	Multi user virtual environments (MUVE) Simulated immersion	MOO Second Life	Different applications can be developed to support communication skill, listening and comprehension, pronunciation, learning new vocabulary, learning grammar, reading, writing and speaking skills.	Depends on specific application and content, but some general limitations are: Learners and teachers need to acquire knowledge/training on how to use these tools for language learning. Requires native language speaker or language teacher to spend time in conversations and instructions. "Teaching by amateurs"	Interactive (Godwin-Jones, 2004). Provides opportunities for communications and interactions between learners and with native speakers (Rose, 1996). Enables learners to immerse themselves into a target language environment (Intille et al., 2003).

Table 3-1: Systematic critiques of language learning technologies

3.10 Conclusions

The historical development of language learning technologies has been presented in this chapter. One point that arises from the literature is that often these technologies have shown advantages for some aspect of second language learning, and they have evolved over the years through new theoretical and technological developments. The review indicates that not only could these technologies support learners in conjunction with formal classes, they could also be used as stand-alone media, supporting informal, incidental and lifelong learning. The information and communication technologies especially provoked by development of the Internet and WWW, and more recently by the developments in wireless and mobile technology, could provide a vast opportunity for supporting second language learning.

These technologies provide the advantage of learning in a flexible way. They put learners in charge of their own learning experience; when they want to learn, where they want to learn, how they want to learn, and more importantly, to learn in accordance with their own individual preferences and needs.

Technologies improve access to rich sources of information, and enable communication. Therefore, learners are more capable of learning while interacting and communicating not only with each other, but also with their mentors and teachers. These collaborations will enhance the chances of speaking, writing, and hearing the target language in a way that has not been possible before. Moreover, technologies could provide the opportunities for learners who would have liked to be exposed to a target language and culture.

However, it is evident that each technology supports some uses and hampers others. In other words, they are different in terms of their affordances for supporting learning. For example, while audio labs support listening and comprehension practices, they offer no profound support for writing and reading skills. This realisation is also true for new technologies, including iTV and mobile devices.

The literature review of language learning technologies also indicates that video based media have great potential to support language learning. In particular, authentic

materials that are available in different contexts could be very motivational for learners. Television has been recognised as an excellent medium for supporting language learning, providing information in multiple modalities and bringing to life the target language and culture. Exposure to the target language can help in learning about culture, paralinguistic and metalinguistic aspects of language, especially for those who are living abroad. Moreover, TV is generally perceived as a good medium for supporting listening and comprehension skills (Sherrington, 1973; Meinhof, 1998). Many pieces of research have demonstrated the advantage of second language subtitles for developing the lexicon and improving listening, comprehension, spelling and reading skills (Bean and Wilson, 1989; Spanos and Smith, 1990; Parks, 1994; Koskinen et al., 1996; Koolstra and Beentjes, 1999; Friedman, 2001). However, these studies have not explored the characteristics and attributes of the lexical items learned from television viewing. Therefore, more research has to be done in this direction in order to establish the characteristics and nature of those language items which are generally perceived to be difficult for learners. Chapter 9 of this thesis reports the study to identify criteria for selection of language learning items/objects from authentic TV programmes.

The next chapter provides a state of the art survey of iTV technology, describing how iTV is currently being developed, its technological advancement, and its capability to deliver digital and educational content. This will help in matching the capabilities of this technology to adult second language learners' needs, preferences and requirements.

Chapter 4 Interactive television technologies and applications

4.1 Introduction

Interactive television (iTV) offers new ways of using the television set. Interactivity is a term that is used to refer to different types of iTV services that enable users to make choices, access extra information, and take action. Some types of interactivity allow users to interact with the content of the broadcast stream, for example via a 'voting' function, while others allow communications, and access to extra information, including email, electronic programme guides, the Internet on television, games and video-on-demand (Gawlinski, 2003). Currently, interactive applications range from pure entertainment, to edutainment[24], educational, information and communications services.

The development of iTV applications has been influenced by the convergence of a wide range of technologies, from hardware, (e.g. set-top-boxes and transmission platforms) to software, middleware and operating systems. ITV is currently delivered by different digital platforms: digital terrestrial, digital satellite, digital cable, IPTV and digital subscriber line (DSL). Each of these platforms has its own architecture, specifications, limitations and strengths for delivering digital content to viewers. A number of software companies and organisations have developed their own middleware and infrastructures for the delivery of iTV content and applications, including MicrosoftTV, OpenTV, Liberate, MediaHighway, and Multimedia Home Platform (MHP).

This chapter aims to provide a review of iTV technology, platforms and standards (sections 4.2, 4.3 and 4.4). It reviews a number of iTV applications that are currently prominent in this medium to demonstrate how iTV is currently being used, its technological advancement, and its capability for delivering digital content (section 4.5). This will help to indicate how iTV could be deployed as an educational technology, and how a future language learning service could be developed. The term 't-learning', or learning through the television, will be introduced and the potential and existing uses of iTV in supporting learning outlined (section 4.6). The United Kingdom

[24] The act of learning through a medium that both educates and entertains.

is the most well-developed iTV market in the world (Gawlinski, 2003). Therefore, most of the materials covered in this chapter will concern the development of iTV applications and infrastructures in the UK.

4.2 ITV transmission platforms

The main iTV platforms are; digital terrestrial, digital satellite, digital cable, IPTV and digital subscriber line (DSL). Before we discuss these platforms in more detail, it is important to understand how digital transmission works. In a digital system, all kinds of content (video, audio, text, and interactive applications) will be coded and combined together as one long binary format data stream delivered via digital transmission. Digital, as opposed to analogue transmission, is more robust and can deliver more information in a given bandwidth (Gawlinski, 2003). The digital data can also be compressed to improve capacity. Detailed discussions about encoding and multiplexing processes are outside the scope of this chapter. Briefly, however, the encoding process performs digitisation and compression of audio, video and data, and scrambling to allow only authorised use of the system. Multiplexing then combines the output from a number of encoders together into a single digital stream that can be transmitted.

The most popular video compression standard with broadcaster and platform operators is MPEG-2 (acronym for Moving Picture Expert Group) (Gawlinski, 2003). This group has defined a number of compression standard formats (MPEG-1, MPEG-2, MPEG-4). Of these, the MPEG-2 format became the standard for digital video compression that is now accepted in 190 countries worldwide (O'Driscoll, 2000). The following section provides a more detailed overview of the technical architecture of each of the digital transmission platforms.

4.2.1 Digital cable technology

Digital cable technology delivers iTV service via fibre-optic or co-axial cable. At the cable operator side (head-end), streams of data from broadcasters are combined and transferred to consumers in a particular region (see Figure 4.1). The cable companies have several head-ends, one for each region. When the signal arrives at the street level it is sent down a co-axial cable. A network made up of optical fibres and co-axial cables is known as a hybrid fibre co-axial (HFC), and is used in the UK for digital cable

transmission. The cable platforms have the advantage of a high bandwidth return path as well as a high bandwidth broadcast channel. Cable modems are used to establish two-way high speed communications, which are between ten and 100 times faster than with normal telephone modems (Gawlinski, 2003). A satellite shown in the Figure 4.1 indicates that the broadcast stream, which are available via other satellite networks (e.g. BBC's satellite), can also be multiplexed and delivered via the cable provider's head-end to a consumer.

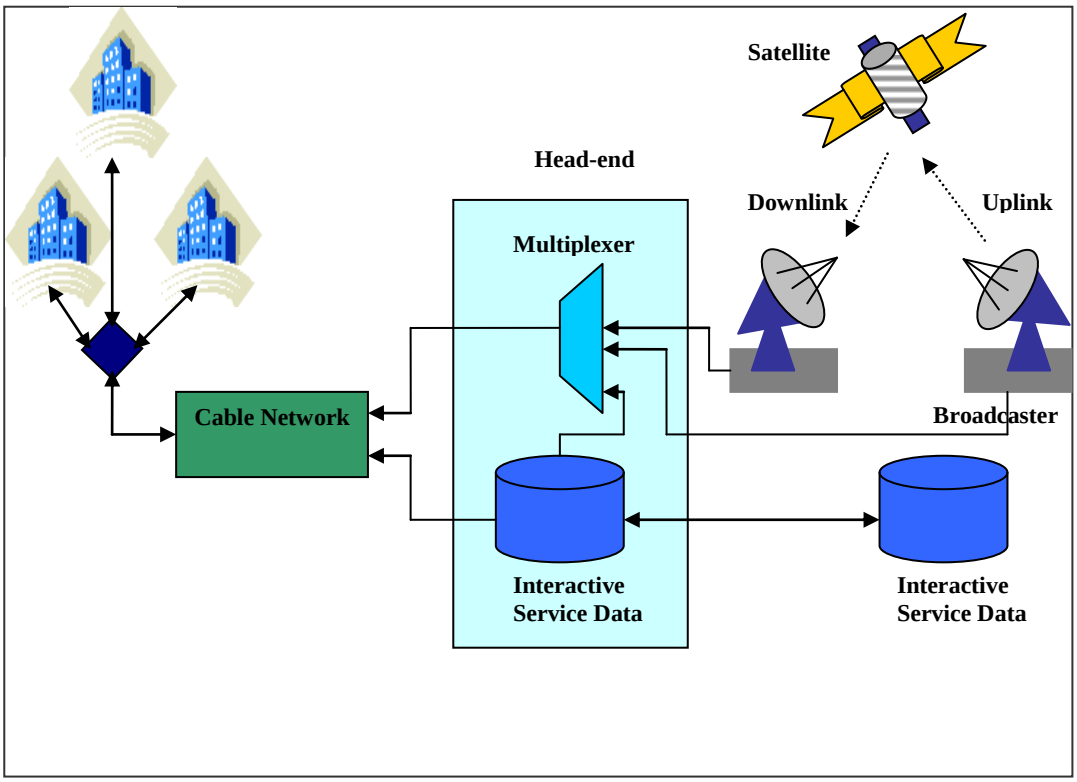


Figure 4-1: The digital cable transmission platform

The main disadvantage of digital cable technology is that it only reaches customers who have cable in their street. Cable penetration is generally high, particularly in the USA, but lower in European countries. The UK has reasonable cable penetration to around 50% of homes. The main cable iTV providers in the UK are NTL and Telewest, which merged in 2005 (now Virgin Media). Both have deployed Liberate middleware (Broadbandbananas, 2004) for delivering iTV applications, content and services.

4.2.2 Digital satellite technology

Digital satellite platform operators broadcast their signals from transmitters sited about 38,000 km (23,000 miles) up in a geostationary orbit, that can send their signals to large parts of the Earth's surface (e.g. the whole of Europe with parts of the Middle East). The digital signal will be received through directional antennae; satellite dishes. The curved surface of the satellite dish receives and concentrates the radio waves before passing it through coaxial cable to the set-top-box (Gawlinski, 2003).

The digital channels and interactive services are combined together before being transmitted using powerful transmitter antennae sitting on the ground, known as uplinks. This operation will be carried out at the satellite provider's site which is also referred to as the head-end. Once the signal is received at the satellite, it will be amplified and transmitted back to earth using a transponder maintained by the satellite providers (see Figure 4.2). Two satellites shown in the Figure 4.2 indicate that the broadcast streams that are available via other satellite networks (e.g. BBC's satellite), can also be multiplexed and delivered via a satellite provider's head-end to a consumer.

The main advantage of satellite platforms is the lack of dependence on a physical cable connection. Disadvantages of satellite platforms are:

- Extra cost associated with the radio bandwidth and the uplink operation
- Digital and analogue signals suffer interference, e.g. due to bad weather conditions
- The absence of a two-way communications channel between customers and providers

The connection between the consumer's set-top-box and the platform providers can be established via telephone modem. However, communication is relatively slow as a telephone modem uses lower bandwidth than cable modem.

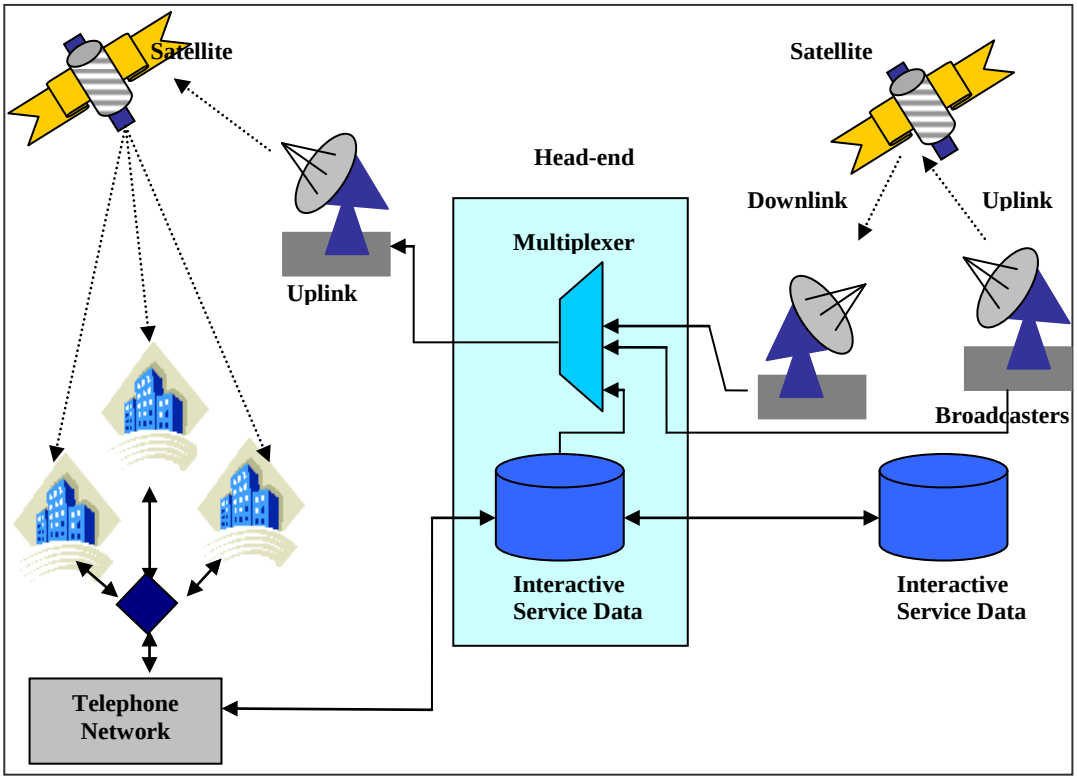


Figure 4-2: The digital satellite transmission platform

The main satellite operator in the UK for iTV services is BSkyB which uses the telephone modem to connect the viewer's set-top-box to the head-end. BSkyB deployed the OpenTV middleware architecture for its platform and set-top-boxes (Sky+ set-top-box).

4.2.3 Digital terrestrial technology

Digital terrestrial television (DTT) delivers digital signals using ground-based transmitters. The interactive services are delivered through a carousel system, which transmits data repeatedly on a loop. When the viewer requests interactive services, they have to wait until the data from the carousel is received and presented. In order to minimise the time viewers have to wait to receive content, broadcasters send the 'in demand data' more often on the carousel, e.g. news headlines. Unlike cable platforms, there are no inherent two-way communication channels (see Figure 4.3). Therefore, to establish two-way communications, set-top-boxes need be connected to the phone network in a similar way to digital satellite platforms (Gawlinski, 2003).

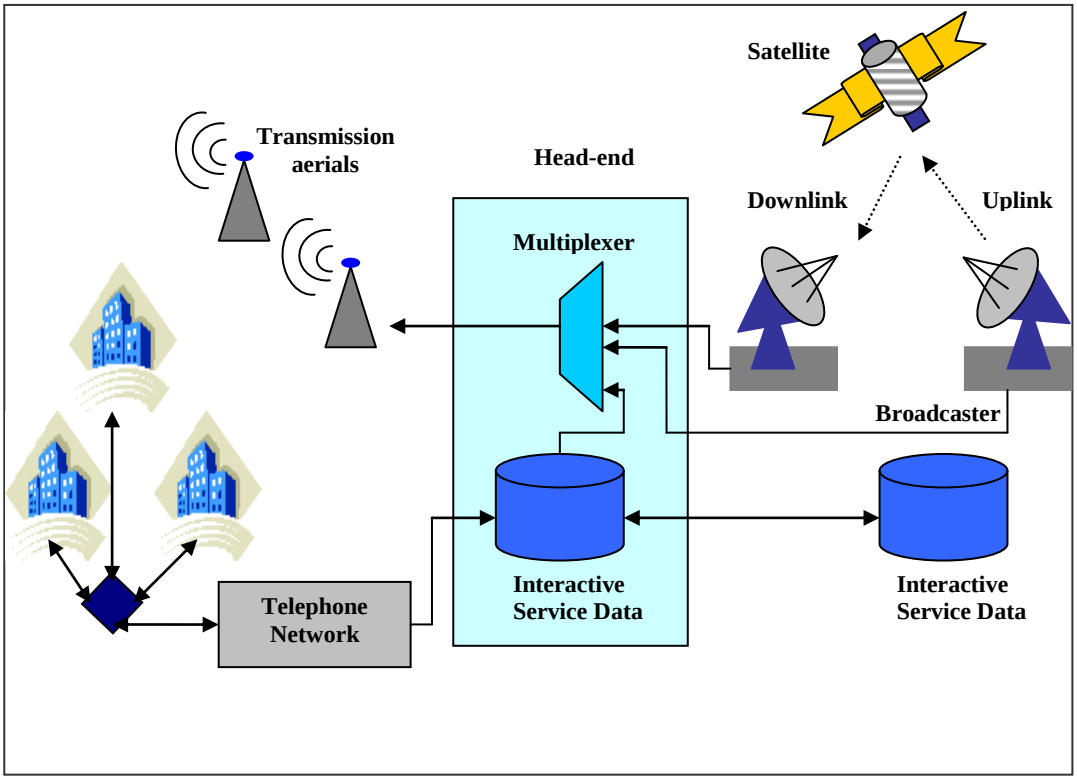


Figure 4-3: The digital terrestrial transmission platform

The main disadvantage is that digital terrestrial has less bandwidth available in its spectrum for data, which means that it can handle fewer television channels and interactive services than satellite or cable platforms. At present, the digital terrestrial provider in the UK is called Freeview. It requires viewers to purchase a DTT set-top-box, and delivers about 30 channels, with some basic interactivity, similar to a teletext service. The MHEG-5 middleware engine has been deployed in the development of the digital terrestrial environment in the UK.

4.2.4 Digital subscriber line

Digital subscriber line (DSL) is another technology for delivering iTV services to the consumer's home. The DSL allows data to be transferred at high speeds over the same copper cables used for the phone connection. The bandwidth is sufficient to provide television channels and interactive services to viewers through the return path (see Figure 4.4). VideoNetwork's HomeChoice service in the UK uses DSL technology. The main disadvantages of DSL relate to its availability (only within reach of appropriate exchanges), and its distance from the main telephone network exchange, which can affect the connection (Gawlinski, 2003).

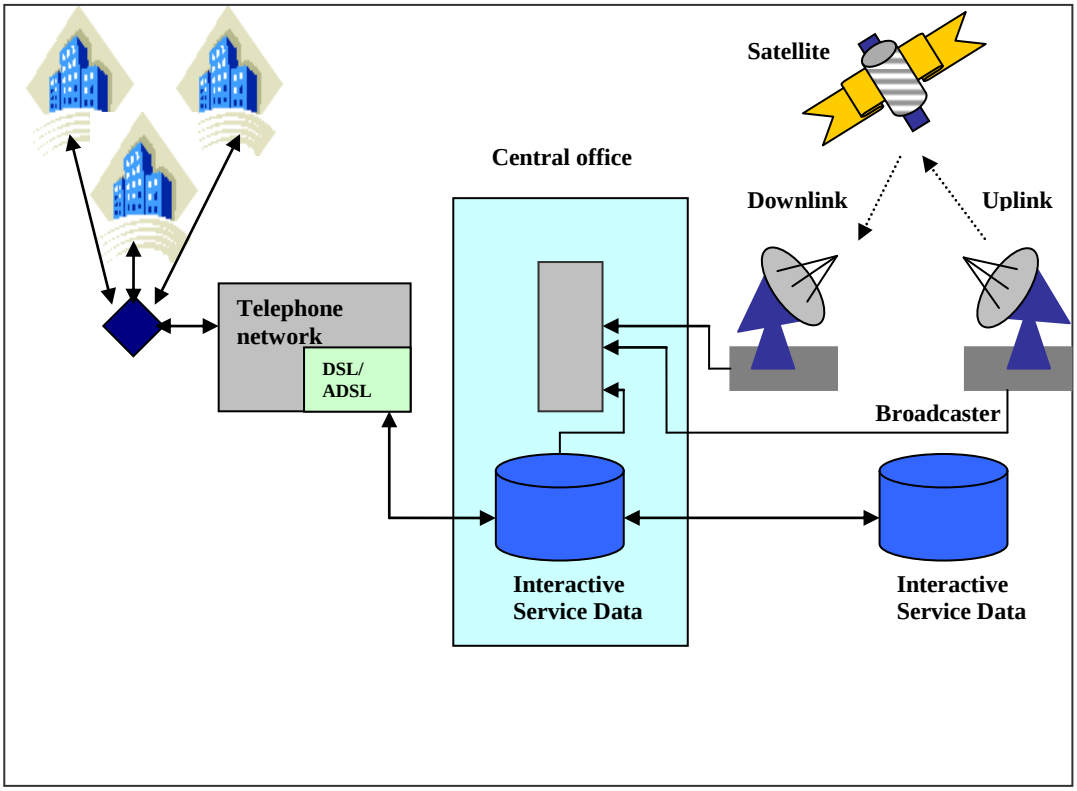


Figure 4-4: The digital subscriber line platform

4.2.5 IPTV architecture

IPTV is a method of delivering broadcast television and on-demand rich media content using an Internet Protocol or IP network as the medium. Higher-speed DSL technologies, such as ADSL (Asymmetric Digital Subscriber Line) and VDSL (Very High Data Rate Digital Subscriber Line) are capable of delivering higher broadband data rates using existing phone lines (see Table 4.1). IPTV is a competitive alternative to cable, satellite, terrestrial and DSL platforms that deliver all channels simultaneously to the subscriber's home. IPTV only delivers those channels which are being viewed by the subscriber, and it offers an unlimited number of channels that are combined with a two-way interactive capability. Users are able to decide what they want to watch and when they want to watch it. Figure 4.5 illustrates a generic IPTV architecture. Multicast delivery can be used to provide a single stream to multiple clients simultaneously. Unicast delivery can also be employed to provide services to a single client for applications such as Video On Demand (VOD).

	ADSL	ADSL2	ADSL2+	VDSL
Downstream Data RATE - Central Office (CO) to Customer Premises Equipment (CPE)	Up to 8 Mbps	Up to 12 Mbps	Up to 24 Mbps	Up to 52 Mbps
Upstream Data Rate - CPE to CO	Up to 640 Kbps	Up to 1 Mbps	Up to 2 Mbps	Up to 6 Mbps
Distance	Up to 18,000 ft	Up to 12,000 ft	Up to 9000 ft	Up to 1000 ft

Table 4-1: ADSL, ADSL2, ADSL2+ and VDSL bandwidth for delivering IPTV (Intellon, 2005)

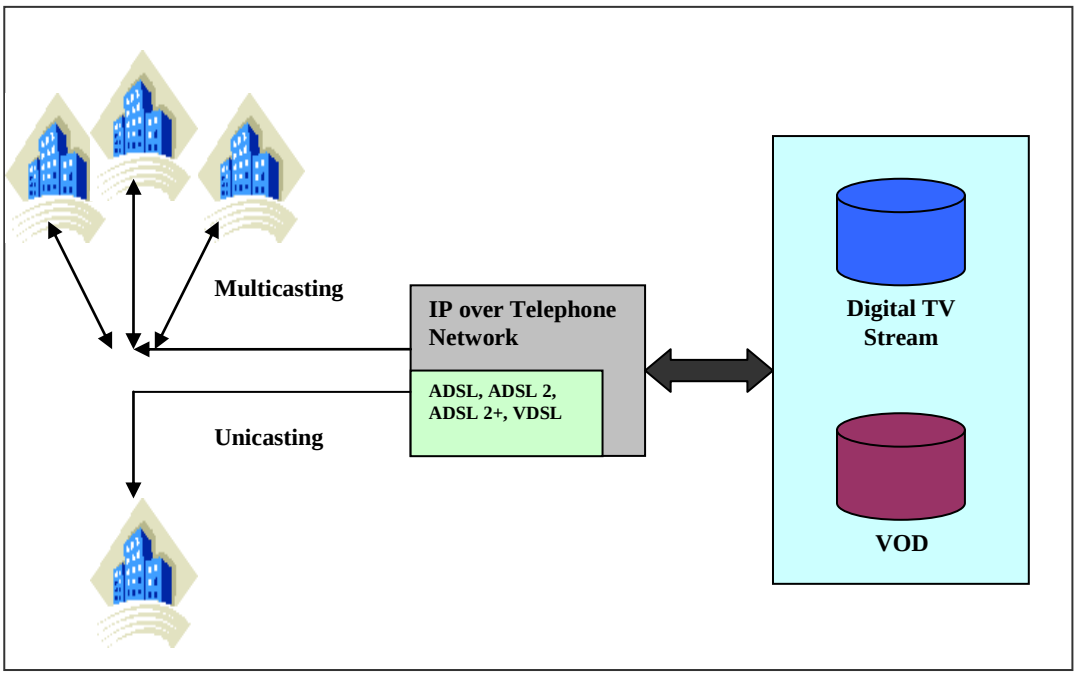


Figure 4-5: IPTV generic architecture

In particular, IPTV enables the delivery of video, voice and data over a single network. This integration allows consumers to subscribe to a single service that provides television, telephone and online services to the home or office over one connection from one service provider. The Microsoft TV IPTV Edition also provides an integrated platform developed specifically to deliver broadcast-quality video and TV services over broadband networks (Microsoft TV, 2005). In the UK, 'Video Networks Home Choice' provides the IPTV service around the London area that includes telephone, digital TV and radio channels, VOD, web space, and broadband Internet.

4.3 ITV set-top-boxes: hardware and software architecture

There are many set-top-boxes available for each digital platform in the market. Their main functionality is to unscramble the digital video and data stream and to provide control functionality for viewing and navigating through digital and interactive contents and television channels. The more sophisticated ones provide extra functionality for communication (through a plugged in modem); have larger memory capacity for recording several hours of television programmes; and allow parental control over television viewing. For example, TiVo and Sky+ set-top-boxes, with their extra storage capacity, can record television programmes for later use.

Remote controls for different set-top-boxes have a varying look and feel, but typically they have 'Fast Text' buttons (red, green, blue and yellow) and arrow keys (up, down, left, right), a text button (to activate teletext), volume control, numbered/character keys to set channel or text, and a power button to turn the box on or off. Some set-top-boxes (e.g. Sky+) also provide an infrared keyboard device, similar to a computer, to provide more functional buttons for interaction and communication, e.g. sending email and SMS through the box. In the UK, satellite and cable providers have designed their own functional set-top-boxes and remote controls. So, unlike computers, interaction devices do not look and feel the same on different platforms. Moreover, the software (the middleware and operating systems) deployed for each platform is different. This inconsistency has caused a wide range of problems for developers and broadcasters as new application or content developments need to be tested on a range of platforms and set-top-boxes. The following section provides a typical hardware and software architecture of set-top-boxes and also introduces some of the available middleware.

4.3.1 Set-top-box hardware architecture

The hardware architecture of the set-top-box is similar to a computer, consisting of CPU, memory, graphic processor, and extra components for demodulation and demultiplexing; that is, unpacking and interpreting received signals. Figure 4.6 illustrates the general hardware architecture of set-top-boxes. Table 4.2 explains the function of the individual hardware components.

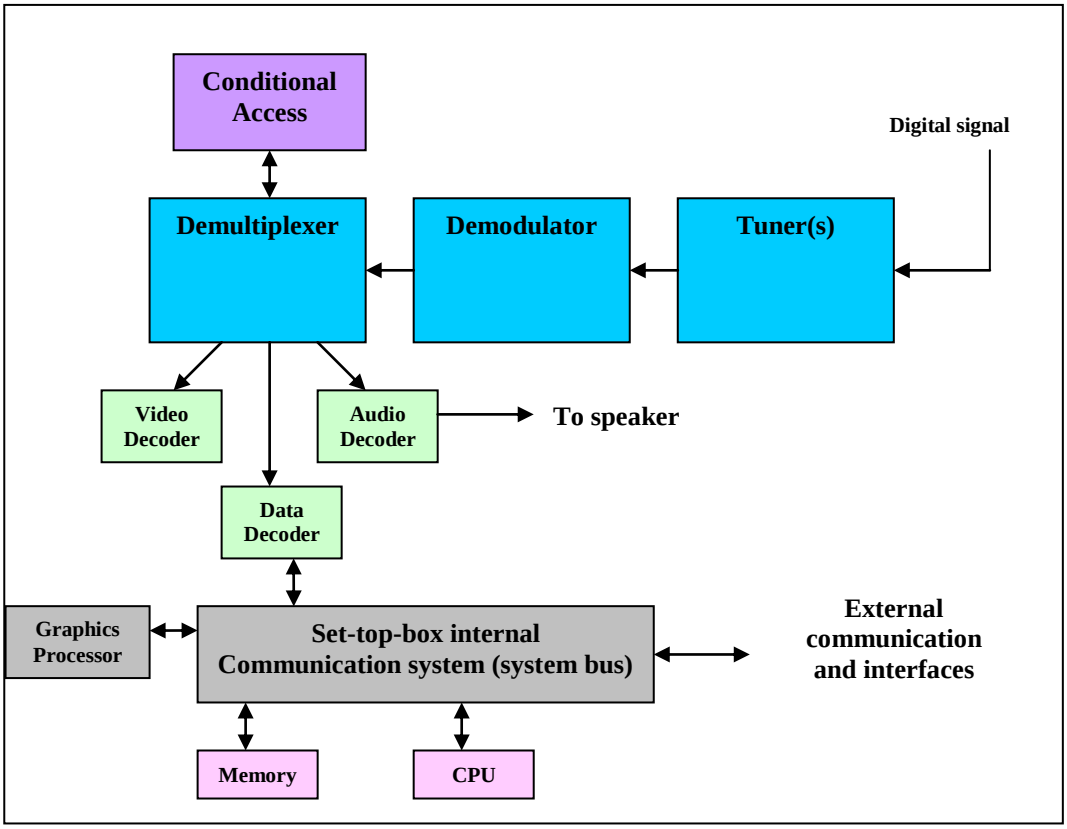


Figure 4-6: The hardware architecture of the set-top-box (Gawlinski, 2003)

Set-top-box hardware component	**Description**
Tuner	The tuner receives the digital signal and isolates the radio frequency that carries the channel from a range of frequencies.
Demodulator	The tuner then sends the signal that contains digital information into the demodulator to convert it into a digital data stream. The result is a string of ones and zeros that is unpacked from the radio wave.
Demultiplexer	The demultiplexer is responsible for interpreting the unpacked radio wave into different parts: • information on the video picture • information about the audio signal • data about programme schedule • interactive service data
Conditional access	The conditional access component checks on authorisation; whether the service is paid for and the television is eligible to receive it. Mainly it compares the programme or service against a list of services that set is allowed to access.
Video and audio decoder	The video and audio data will be sent to the video and audio cards respectively to be converted into the signal that can be understood by a display and speakers.

Set-top-box hardware component	Description	
CPU and memory	The CPU performs the required processing of the interactive services. It works in conjunction with memory and the graphic processor. Like computers, the set-top-box has both RAM (Random Access Memory) and ROM (Read Only Memory). RAM is used as a temporary storage area, whereas ROM keeps hold of information even when the set-top-box is off.	
External communication and interface (smart card, modem)	Smart card	The smart card reader contains information about channels and interactive services that the viewer has paid for (i.e. pay-per-view channels or pay-per-use interactive services). Conditional access then decides whether a viewer is allowed to use the service. Advanced smart cards can be used for spending (e.g. shopping or on interactive services like pay-per-view in the UK's BSkyB boxes), in a similar way to credits cards.
	Modem	The modem establishes two way communications between set-top-boxes and the outside world. Standard modems use the telephone line and have speeds up to 56kbps. ADSL modems have higher data-transfer rates and can provide up to 1.5 Mbps. The Sky digital platform uses a modem for providing some interactive services and communicating back and forth to the server.
	Interfaces	Some set-top-boxes have additional interfaces which are used for connection and communication with other devices. A typical interface available is RS-232, which enables connection to devices like printers, USB interfaces, which can be used for a wide range of devices, Bluetooth to establish communication wirelessly with other Bluetooth enabled devices, Firewire (IEEE 1394) and Base-T (Ethernet) are also available.

Table 4-2: Set-top-box hardware description

4.3.2 Set-top-box software architecture

Set-top-box software is composed of three key components: operating system, middleware and applications. Figure 4.7 illustrates the software architecture of the set-top-box. Table 4.3 explains the function of the individual software components in more detail.

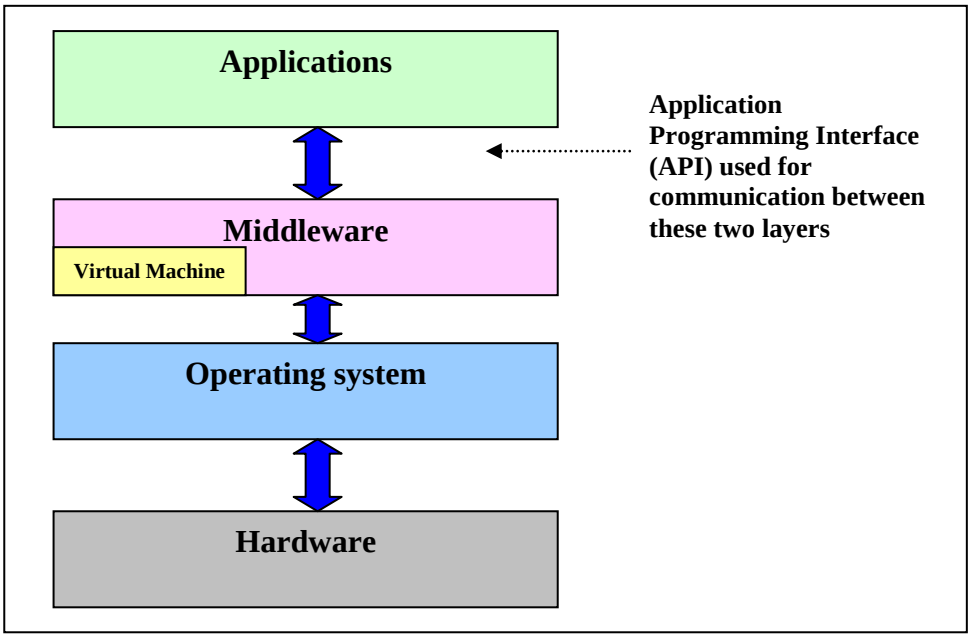


Figure 4-7: The software architecture of a set-top-box (Gawlinski, 2003)

Set-top-box software component	**Description**
The operating system	The first, or foundation, layer of the set-top-box is the operating system and its functionality is similar to computer's operating system, e.g. Windows XP. The only difference is that set-top-box operating systems do not provide a user interface that allows interaction with and control of the box. Operating systems are generally responsible for controlling and managing hardware (CPU, memory) and communication between the software and hardware components of the set-top-boxes. There is a wide range of available set-top-box operating systems (e.g. Windows CE, Linux, pSOS and VxWorks).
Middleware	The development of interactive services is directly influenced by middleware choices. Middleware is a piece of software that establishes communications between the operating system and applications. Its function is to provide a unified command control and programming tool that frees the developer from

Set-top-box software component	Description
	the need to understand each and every operating systems and hardware component. There are a range of middleware on the market, e.g. OpenTV[25], MediaHighway[26], MicrosoftTV[27], MHP[28], PowerTV[29], TV Navigator[30], CableWare[31] and Netgem[32]. Middleware provides APIs that can be used by developers for the implementation of interactive services, e.g. EPG, email, and enhanced television. Some middleware uses APIs that are based on specific programming languages, e.g. C++ or Java, where others provide special application development tool kits for which developers require extra training. There have been calls from around the globe for the standardization of middleware. Multimedia Home Platform (MHP) is becoming the European standard for deployment of iTV applications. As the development of iTV applications requires a great deal of expertise in software and hardware infrastructure, a number of authoring tools have been developed to aid and accelerate the design and development process. One such tool, which supports the production of iTV applications and content for OpenTV, Liberate and MHP middleware, is Modelstream,[33] developed in Ireland for European and USA iTV infrastructures.
Virtual machine	The virtual machine is the engine similar to middleware that allows execution of a programme written in a higher level language. Some middleware contains a virtual machine component that allows the execution of well known programming language like Java. Virtual machines are: • Java virtual machine developed by Sun Microsystems used for MHP standards. • HTML and JavaScript engines supported via Liberate TVNavigator middleware. • MHEG-5 engines developed by an organisation set up by the International Standard Organisation (ISO) called Multimedia Hypermedia Expert Group. Currently, the digital terrestrial environment in the UK has MHEG-5 presentation engines. • WML presentation engines similar to HTML language but

[25] OpenTV (www.openTV.com) and is used in Sky Digital set-top-boxes in the UK
[26] MediaHighway and is used in some digital terrestrial set-top-boxes
[27] Microsoft (www.microsoft.com/tv) is used in Portugal TVCabo network
[28] MHP is European standard for middleware based on Java (www.mhp.org)
[29] PowerTV(www.powerTV.com)
[30] TV Navigator is developed by Liberate (www.liberate.com) and is used in the UK cables platforms: NTL and Telewest
[31] Worldgate (www.wgate.com)
[32] Netgem (www.netgem.com)
[33] The Modelstream production tool is developed by Irish company emuse (http://www.emuse-tech.com/index_flashContent.html)

Set-top-box software component	Description
	originally designed for mobile phones. The digital satellite providers BSkyB in the UK has a WML engine running in the OpenTV middleware.
Applications	Application are software programs that can be designed and executed for different types of middleware, which in the iTV field are referred to as interactive applications. There are a number of interactive applications developed for provision of electronic programme guides, digital teletext service, walled gardens, shopping, banking, etc. that will be looked at in more detail in the next section.

Table 4-3: The set-top-box software description

4.4 Need for standardisation

As discussed in the previous section, middleware infrastructures have been developed by a number of different companies. These include; MicrosoftTV, OpenTV, Liberate, MediaHighway, PowerTV, WebTV for Microsoft's TVPAK Platform, MediaHighway, Liberate eNavigator, and PlanetWeb. The problem is that an iTV application developed for one cannot be executed on another. Therefore, iTV applications have to be rebuilt and tested separately for different middleware and set-top-boxes. This lack of standardisation is labour intensive and costly. As a result of this inconsistency, a number of organisations have decided to develop standards (DVB-MHP, DASE, ATVEF and the ATV Forum, MPEG-4, TV Anytime Forum). However, they are still under development and none are globally adopted. Table 4.4 provides a general overview of existing standards.

Organisations	Description
DVB-MHP	The world digital video broadcasting organisation developed the standard for middleware called MHP (Multimedia Home Platform) that defines specifications and API for developing interactive applications that would work across different platforms and set-top-boxes. MHP provides an open and feely available specification based on the Java programming language, and is often referred to as middleware itself. Although the MHP standard aims to provide interpretability, it still does not solve the general problem of migration and integration of hardware and software that are currently deployed. For example, a wide range of set-top-boxes do not meet MHP hardware requirements (Gawlinski, 2003). Some of the MHP compliant

Organisations	Description
	middleware engines on the market are: OpenTV, Liberate, and Canel+.
MPEG-4	The Multimedia Hyper Media Expert Group (MPEG) has defined a number of video compression standards, including MPEG-1, MPEG-2, MPEG-21, MPEG-7. MPEG-2 became the standard for video compression used by digital platform operators and broadcasters. However, the next version of the standard, MPEG-4, has great functionality for creating multimedia and interactive video applications. The MPEG-4 compression has a number of advantages: a) an interactive content (video, audio, animation, text) and application can be embedded in one single MPEG-4 file that can be run across different platforms, b) it works well across a range of bandwidths; even a narrow bandwidth of 56 kbps could deliver fully interactive applications, c) extra audio and video content could be recorded. Recently the BBC has used this standard to create an experimental interactive news programme that offers a multi-screen presentation of the news programme to enable viewer to choose and select the content and footage they want to watch (Marryman, 2004).
DASE	The Advance Television Committee (ATSC) in the US developed standards called the Digital Television Applications Software Environment (DASE). DASE is very similar to MHP and uses HTML and JavaScript for interface design and a Java virtual machine for development of more complex applications. As these two standards are not specifically designed to be interoperable, there are unfortunately some differences between them.
ATVEF and ATV forum	The Advance Television Enhancement Forum (ATEF), ATV, was established in the USA. ATVEF defined a set of formats and mechanisms (using HTML and JavaScript) for delivering iTV applications. ATVEF allows synchronisation of interactive content and video streams, and allows them to be delivered as a broadcast stream.
TV Anytime Forum[34]	The TV Anytime forum provides a standard for segmenting and describing a television programme by its metadata. They have developed a set of taxonomies, or metadata schemas. The idea is that the set-top-box and personal video recorder (PVR) use the metadata to record and create personalised interactive content from the available programmes (e.g. to capture all of the footage available on one specific news headline across different channels). The metadata schema provides elements for rights management.

Table 4-4: Organisations' attempts toward standardisation

[34] http://www.tv-anytime.org/

4.5 ITV applications and content

ITV applications and content allow for a number of different kinds of service and interaction. However, there is no generally agreed framework for categorising the different types of interactivity available. Gawlinski (2003), for example, identified seven distinct types of interactive service:

- Electronic programme guides (EPGs)
- Teletext-style services
- Walled gardens
- Internet on television
- Enhanced television
- Video-on-demand (VOD)
- Personal video recorders

Masthoff and Pemberton (2005) took a different approach and looked at how interactivity has been provided through different iTV applications and content. Three broad types of interactivity were identified:

- Distribution interactivity

  Distribution interactivity provides functions which allow interaction with the programme rather than the programme content; for example the EPG that allows one to search for and access specific TV programmes.

- Intra-programme interactivity

  Services in this category allow the viewer to interact with the content of the broadcast stream and are also known as ‘enhanced television’. In this case the viewer can watch the broadcast stream whilst interacting with the programme. For example, accessing supplementary information about a programme or taking action such as voting.

- Extra-programme interactivity

  Services in this category facilitate some other activities that are not relevant to either the programme or the content. For example, the use of communication facilities, including email and chat, purchasing goods, playing games and banking.

In the following discussions, we use the Masthoff and Pemberton (2005) model and provide a number of examples of iTV applications that are currently in existence. Many of the screen shots provided here are taken from the broadbandbananas[35] website.

4.5.1 Applications of distribution interactivity

One example of the distributed type of interactivity is the electronic programme guide. EPGs direct viewers to what is on the television and enable them to navigate through a vast number of available channels. Typical functions of advanced EPGs are to:

a) Display the current channel, 'now and next' programmes
b) Allow viewers to select a particular channel to view
c) Enable viewers to add a particular channel to their bookmark or favourite lists
d) Put a reminder on a programme to alert the viewer when a selected programme is about to be shown
e) Provide a search facility that allows viewers to find a programme with a particular time, date or subject
f) Provide a programme guide in advance (typically a week)

Some EPG's provide more information about a programme, such as a synopsis and cast list for a movie. The BSkyB digital satellite platform provides an advanced EPG that displays programme listing in a grid format (see Figure 4.8). Viewers are able to select a listing by genre and set reminders for programmes. While watching television, the viewer can use the 'now and next' button to see what is currently showing.

[35] http://www.broadbandbananas.com/

Figure 4-8: The BSkyB digital electronic programme guide (EPG)

4.5.2 Applications of intra-programme interactivity

Intra-programme interactivity, also known as ‘enhanced television’, broadly enables two types of interactivity: information interactivity, allowing viewers to access supplementary information, and participation interactivity, for example enabling viewer to vote and change the narrative of a reality show, to watch a sport event from different camera angles, or to answer questions in a quiz show. This section provides some examples of applications of intra-programme interactivity. For more examples see Appendix B.

One interesting enhanced iTV application which offered a new experience from watching a TV quiz show was “Test the Nation - The National IQ Test” developed by the BBC in the UK (see Figure 4.9). Sky digital and digital terrestrial viewers were able to participate in the quiz. Viewers played along with other participants in the studio, answering each question presented using one of the four corresponding colour keys on their remote controls. The unique feature of this application is that, unlike many interactive play-along shows, this one was broadcast live. The viewer’s participation

was synchronised with the studio. After completing all questions, the interactive application automatically totaled up the viewer's correct answers and presented them on the screen.

Figure 4-9: "Test the Nation - The National IQ Test" interactive application

There is a wide range of services that allow viewers to watch a sports event; maybe from different camera angles; to chose and watch a particular video or audio stream from a number of available options; or to bet or gamble on the outcome. The BBC Wimbledon interactive service features multiple video feeds from various courts, enables SMS chat on a variety of subjects, and provides an archive of messages that can be viewed using the up and down keys on the remote control (see Figure 4.10). The interactive service also allows viewers to access match highlights and interviews after the event finishes.

Figure 4-10: The BBC Wimbledon interactive services

Another interactive sport application, developed for the 2002 World Cup, allows the viewer to access additional audio tracks, commentary and match highlights. The viewer can also submit short SMS comments using their mobile phone. Figure 4.11 illustrates the example of the England vs. Slovakia game.

Interactive advertisement is another example of intra-programme interactivity. The application developed for the Peugeot 407 campaign on the BSkyB platform enabled viewers to go to the interactive service and to select from a series of videos specially made for the 'virtual showroom'(see Figure 4.12). A specification for the Peugeot 407 was provided using video footage and text. Additionally, the application allowed viewers to request a brochure or a test drive.

Figure 4-11: The BBC World Cup on Sky digital platform

Figure 4-12: The Peugeot interactive advertisement

4.5.3 Applications of extra-programme interactivity

Some applications of this category include teletext-style services, iTV portal, Internet on the television, games, video-on-demand and communications services. For more examples see Appendix B.

4.5.3.1 Teletext-style services

Digital iTV technology offers an interactive teletext service that is similar to the analogue version but provides extra information. Digital teletext offers richer graphic displays and an additional range of services, including email and mobile text messaging. The teletext service is usually activated by pressing the button marked 'TEXT' on the remote control. Some teletext services aim not to interrupt television viewing, either by showing the interactive screen as a transparent overlay on top of the programme (see Figure 4.14, the BBC teletext service) or by displaying the television picture in the corner of the interactive page. Figure 4.13 illustrates the BSkyB digital teletext service, which offers a wider range of information and services, including email and betting.

Figure 4-13: BSkyB digital teletext service

Figure 4.14 illustrates the BBCi interactive teletext service activated by pressing the red button from the BBC channels. It provides up-to-date information about such things as news and sport headlines, weather forecasts, and finance.

Figure 4-14: BBCi interactive teletext service

4.5.3.2 ITV portal

ITV portals known as “walled gardens” are environments created by platform providers (e.g. BSkyB), which offer a wide variety of interactive content and applications developed for commerce and communications. Each function of the interactive application is designed specifically for an iTV platform and takes commercial revenue for the platform providers. ITV portals are usually accessed by pressing a labelled button such as ‘Interactive’ or ‘Services’. Once the user has entered they can navigate around the available services using the controls on their remote. For example, in the UK, BSkyB (Skyactive), has created a “walled garden” offering services such as shopping, travel, banking, games, and communication facilities.

A number of companies have invested in providing television based commerce services (t-commerce) through a provider’s portal. For example, Dominos pizza has commerce

applications, allowing the viewer to browse and order pizzas with their remote control (see Figure 4.15).

Figure 4-15: The Dominos pizza interactive t-commerce service

4.5.3.3 Internet on Television

The Internet on television service enables viewers to break through the service provider's walled garden and surf the World Wide Web. However, it is difficult to display and to interact with the web pages that are not generally designed for television display and resolution (Gawlinski, 2003).

4.5.3.4 Video-on-demand (VOD)

Video-on-demand provides the facility to choose and order a programme or movie to watch. This service requires two way connection between users and platform providers.

4.5.3.5 Communications via iTV

Communications via iTV technology are established by way of a return path to the service providers. A number of applications, developed by platform providers, facilitate communication by television based email, chat/discussion boards, and SMS.

For example, the Skyactive service allows viewers to participate in discussion and chats about the news. The service provides a television window in the top-right of the screen, and enables viewers to continue watching the news whilst discussing it with others (see Figure 4.16).

Figure 4-16: Sky active news chat service

BSkyB also allows viewers to send SMS messages to mobile phones using the Sky active walled garden.

4.5.3.6 Games

There are a number of sport based games available for football, golf, cricket, volleyball, and more. BSkyB launched a football game during the World Cup which allows players to practice their shooting skills (see Figure 4.17). The game allows players to take free kicks and penalties, to set the direction and elevation, the amount of spin and the power with which they want to kick the ball.

Figure 4-17: BSkyB interactive football game

4.6 Discussion

Section 4.5 presents a number of examples of iTV applications. The functionality of iTV technology and its application indicates its vast potential for supporting learning. In particular, iTV has the potential to support lifelong learning which could take place "in a wide variety of contexts and locations in which informal and non-formal learning will be as important as formal learning" (Bates, 2004, p.137). The support this technology provides for informal learning in the form of so-called 'edutainment' (which corresponds to the educational and entertainment aspects of the iTV medium) has been continuously recognised. Studies into iTV learning suggest that the Government should consider TV learning opportunities as part of their e-learning strategy (Bates, 2003). According to the European Commission Report (1999), the provision of educational applications via iTV has the potential to reach millions of people at a time and place that is suitable for them. It has also been suggested that "iTV's added value to learning does not only reside to its technological features, but also in the fact that it is still TV. In other words, the high penetration and acceptance of TV have already established a potential market for iTV's acceptance" (Lytras, 2002, p.6). Learning from television, t-learning, has become a new approach in the field of e-learning.

The concept of ‘t-learning’ and ‘edutainment’ will be further established through a number of projects described in this section. Briefly, however, there are a number of frequently established functions which could enhance the experience of learning from the television. These are associated with the provision of information and communication facilities. Examples are the provision of extra learning materials and of communication and participation mechanisms that extend a viewer’s interaction and knowledge about a particular aspect of the broadcast programme. Heppell (2002) suggests five key-words that should be understood as essential precursors to enhancing viewers’ engagement, and most importantly in enabling learning from the television:

- “Symmetry”: this is similar to a communication model in which the bandwidth from provider to user is the same as from user to provider. The balance is symmetrical and harmonious.
- “Participation”: a succession from passive through interactive, to participative.
- “Redundancy”: multiple media that could add value in different dimensions.
- “Annotation”: the process or act of furnishing commentary or explanatory notes.
- **“**Capabilities”: the media aptitude and capabilities that are evolving successively.

Some of Heppell’s keywords can be seen in existing iTV applications. For example, the first, and most well developed interactive educational application, (Walking with Beasts) was made by the BBC (see Figure 4.18). This interactive documentary enabled viewers to choose the original narration and to jump to other video segments. A number of video clips, animated and textual information were available, explaining the life of mammals. The interactive application was available during the live broadcast and the viewers were only enabled to change stream during this time. There were four parallel video streams and additional audio streams available in conjunction with the programme. The viewer could navigate through the content using the coloured key buttons on the remote control (red for main feature, green for facts, yellow for evidence and blue to look at the making of the programme).

Figure 4-18: The BBC's "Walking with Beasts" interactive documentary

Another t-learning application developed by the BBC is "BBC Bitesize". The application is delivered via multiple platforms (iTV and mobile phones), and enables young adults (aged 12-16) to practice and revise for their GCSE (secondary school) exams. The service covers subjects, including Maths, Chemistry, Biology, English, and Geography. It offers a number of multiple choice questions and gives feedback on the user's answer. The BBC's initial aim was to offer location based, temporal and curricular flexibility for learners (LSDA, 2003).

The use of three dimensional modelling, iTV with audio and video feedback, was also proposed to support t-learning for areas such as the medical sciences, automobile design, and astronomy. The original project proposed a set-up involving formal delivery of instruction by teachers and the facilitation of communications between teachers and students, the "higher degree of interactivity between the students and the instructor making the learning process much more satisfying, thus resulting in greater acceptance because of active participation of viewers" (Gupta and Huttemann, 2003, p.112).

The eLearning Place (TeLP) project that explores the potential of iTV for learning with a disadvantage group indicates its potential in the lifelong learning context. This project

has created a learning environment in which courses can be published simultaneously to iTV and the Internet, offering learners a personalised account, and interaction with others through chat and message boards (Russell et al., 2004).

Again, the VEMiTV project was established with the same aim, to examine the potential of iTV for learning. The learning environment was developed as a complement, and not a substitute, to formal classes, teaching history and maths to children. The learning environment was delivered on a Microsoft TV platform at the TVCabo Company in Portugal. Children could record parts of the information being broadcast into their personal storage on a set-top-box, and access it later. Chat and discussion board facilities were also provided. The initial evaluation reported that the users valued the application, and especially those functions that allowed for some level of 'participations' and promoted 'community based service' and 'personalised interaction'. The potential of t-learning as a valuable medium supporting informal learning was also recognised (Damasio and Quico, 2004, p.82).

The BBCi Hull project developed an interactive learning video application, through the Kingston digital subscriber line (DSL) and IPTV, which initially provided infrastructure and support for young local people wanting to make their own video material. This project concentrated on two video learning initiatives: CITZN-H and SOS Teacher. The CITZN-H is concerned with issues affecting young people, such as conflict, homelessness, money, and voting, mainly for enhancing citizenship education. These films were then made available to the public via the BBC portal on the Kingston video-on-demand platform. The SOS Teacher project provides live advice to local GCSE students who are close to their exams. Over three weeks, students were able to phone, email or SMS their revision questions to a panel of expert subject teachers. The teachers' answers were provided using iTV and subsequently archived for VOD access at any time. They report strong evidence of success in the motivation and increased involvement of students (Richards, 2005).

The KickstartTV[36] project also examined the potential of iTV for learning, and is currently available on Telewest, Freeview and on the Web (Taylor et al., 2006). The

[36] http://www.kickstarttv.co.uk/

system offers a number of activities and quizzes for learning different skills, including literacy, numeracy and job skills.

Other research aims to address personalisation and user modelling solutions for iTV applications (Aroyo et al., 2007; Hsu et al., 2007; Masthoff and Pemberton, 2005). The integration of current e-learning standards, such as LOM and SCORM with TV-anytime is currently being investigated in order to ensure content reusability, personalisation and interoperability between t-learning and e-learning applications (Lopes-Nores et al., 2005).

4.7 Conclusions

ITV technology is rapidly developing, and is influenced by a wide range of technological advancement, including transmission platform, set-top-boxes and software. This chapter provides an overview of a number of iTV applications that have enhanced television viewing, enabling viewers to interact, make choices, and participate in communications. This overview indicates the learning potential of iTV technology.

ITV can support both formal and informal second language learning. For example, formal learning can be supported in a way similar to the old concept of the language class on TV. More interactivity, however, could be provided to enhance the learning experience, for example through conversations, by a return path, with the language teacher. Extra supplementary information such as exercises and notes could also be provided. Such a scenario of using iTV for language learning is also proposed by Underwood (2002). Informal and collaborative learning could be supported with the use of broadcast materials, games and communication facilities. The availability of extra information could enhance situational and just-in-time learning about a new language, area of knowledge or concept. In this project, we also intend to develop a scenario for an iTV based language learning system, taking into account not only the affordances of the technology, but the expressed attitude and motivations of adult language learners. The next chapter (Chapter 5) discusses the overall user centred design methodology, socio-cognitive engineering, adopted in this research, while Chapter 6 presents the investigation into adult language learners' attitudes, approaches, and motivations for second language learning that direct the development process.

Chapter 5 Research methodology

5.1 Introduction

While Chapters 2, 3 and 4 reviewed language learning theories, language learning technologies, and iTV technologies and applications, this chapter outlines the overall research methodology used in this project.

A number of media technologies that seemed to have potential for assisting in language learning, including paper-based, language laboratories, radio, audio tapes, television programs, CD-ROMS, the Internet and most recently mobile technologies, were discussed in Chapters 3. Each emergent technology has shown some potential for language learning. Some of these technologies have fulfilled their promise, while others are now regarded as partial or complete failures (Salaberry, 2001). The reasons for the failure of a technology are varied. For instance, their pedagogical effectiveness may be questionable (Salaberry, 2001) or there has been a tendency by developers to show too much of their novel features (Warschauer and Healey, 1998). We concentrate here not on teaching but on approaches to learning. In particular, we are concerned with 'learner acceptance', i.e. the willingness of the learner to use the technology as part of their learning strategy. While 'captive learners', such as children in school, may have to accept their teacher's choice of technologies, this is not the case for independent adult learners, who are free to select their own learning methods and technologies.

Learners' views are rarely sought when language learning software is being designed. Even projects that explicitly adopt a learner centred stance often limit the involvement of individual learners to the evaluation phase of the development process (Soloway et al., 1996). For instance, of the 135 software-related articles that have appeared in the journal Language Learning and Technology over the past ten years (from July 1997 to June 2007), only thirteen include user consultation, consisting for the most part of evaluation of software in prototype or final state. Only four articles report attempts to solicit user views as part of the early requirements elicitation process.[37] Where independent adults are the learners, issues of acceptability and 'fit' into everyday life

[37] Outside the language software community, Bailey and Nunan (1996) report examples of diary based and other studies that do have this learner-centred focus.

become critical. These sorts of issues are best explored as part of the early requirements gathering stage in a user-centred design process.

The research programme reported comes within the field of educational technology, and initially aimed to investigate the language learning potential of iTV, to use the facilities available with this medium to design and develop a usable, desirable and useful language learning environment that could assist an independent adult in learning a second language. The research takes into account not only the capabilities of the technological platform and theories of language learning but also the views and reported behaviour of learners with regard to this technology. The methodology is based on socio-cognitive engineering (Sharples et al., 2002a) and will be further explained within this chapter.

We first begin with an introduction to the educational technology research field; followed by a discussion of user centred design and socio-cognitive engineering methodologies. Finally, the detailed methodology for this research, adapted from socio-cognitive engineering, from the analysis stage to the design of the TAMALLE environment and its evaluation, will be discussed.

5.2 Educational technology research

The field of educational technology research is interdisciplinary, pulling two fields of research together, education and technology. Therefore, researchers in this field are required to have a broader view of several research methodologies from different disciplines, which can be applied at different stages or phases of their project. These disciplines include psychology, education, technology, art and design, and humanities. Joy (2004) analyses the variety of this interdisciplinary field and points out:

> "PhD theses in educational technology cover a wide variety of areas. One might consist of a novel technology which can be applied to the education process, and whose interest is principally technical. Another might focus on the novel use of a standard technology in an educational situation, and the interest becomes pedagogic rather than technical. Most theses probably lie somewhere between the two" (p.1056).

As the research program described here is concerned with the design of a new technological support system for language learning via iTV technology, a design

oriented methodology was therefore adopted that could put equal emphasis on learners, pedagogies and technology for supporting it. The design methodology that involves the end users throughout the process of system development, from the requirements gathering stage through design, implementation and evaluation, is known as the human centred design methodology, also referred to as User Centred Design (UCD).

5.3 User centred design

User centred design has become the standard for the design and development of useful and usable interactive products with a user focus. ISO 13407, the standard defined to provide guidance on UCD design process, describes this methodology as "a multi-disciplinary activity, which incorporates human factors and ergonomics knowledge and techniques with the objective of the enhancing effectiveness and productivity, improving human working conditions, and counteracting the possible adverse effect of use on human health, safety and performances." The four iterative activities that need to be carried out during the design processes are: "understand and specify the context of use, specify the user and organisational requirements, produce design solutions and evaluate designs against requirements" (Usability Net, 2003, p.1).

The dialectical version of UCD adopted in this research, called socio-cognitive engineering, was proposed by Sharples and colleagues for designing human-centred technology (see Figure 5.1). Sharples et al. suggest that "usability is a necessary but not sufficient condition for the design of good human-centred technology. Technology should also be useful, elegant and desirable (people should want to use it, rather than being compelled to do so as a condition of their learning or work)" (Sharples et al., 2002a, p.1).

5.4 Socio-cognitive engineering

Socio-cognitive engineering aims to involve potential users by incorporating their knowledge into the design process. Figure 5.1 illustrates the process of the socio-cognitive engineering methodology, which has a number of interrelated stages that should be carried out, from a field study to object-oriented design and evaluation. Mainly through field studies, or user studies, the researcher attempts to understand more about the potential users and their knowledge, for instance how they think, work, learn

and communicate (this borrows methods from the social-science field; interviews, ethnography, focus groups, and so on). The results from the field studies will then be combined with the theory of use to build a task model. The task model then bridges a cycle of iterative design and provides a set of principles in the form of requirements that could be used to inform the design of the artefact in the form of a software environment. For the development stage, a technology oriented methodology will be adopted, e.g. object oriented and soft system methodologies. Finally, the criteria conceived from the requirements will be used to evaluate the design of the artefact, usually in terms of its usability, usefulness, desirability, elegance, and acceptance by its intended user groups.

Figure 5-1: The Socio-cognitive engineering methodology (Sharples et al., 2002a)

The learner centred design process using socio-cognitive engineering is presented mainly in two-stages: the activity analysis stage and the design stage.

- Stage 1 concerns building a framework that sets constraints on the design by analysing how people work and interact with current tools and technologies.
- Stage 2 concerns the design of the new technology.

For the first stage, it is necessary to investigate how activities are performed by users, theories of use, and an investigation of how technology is being used and its cognitive,

pedagogic and social implications. The results of the first stage lead into a task model which describes "the activity system that may include the main actors with their tools and resources, their physical, social and cultural context, external representations such as notes and diagrams, the rules and conventions that influence the activity, the distribution of labour, and the terminology and patterns of discourse." (Sharples et al., 2002b, p.222). For the second stage, a task model will be used in specifying a design concept, design space, system specification, implementing, testing and deploying the system.

A modified version of socio-cognitive methodology is used in this research. Figure 5.2 is a diagrammatical representation that has been adapted from Sharples et al. (2002b). As depicted in the Figure 5.2, the second stage of system design was simplified: instead of going through the cyclic development of design concept, design space, system specification, implementation and testing, the development process was carried out through one cycle. In addition to this, a scenario-based methodology (Taylor and Evans 2005, Carroll, 2000) was used to conceptualise the design space and to infer a list of requirements.

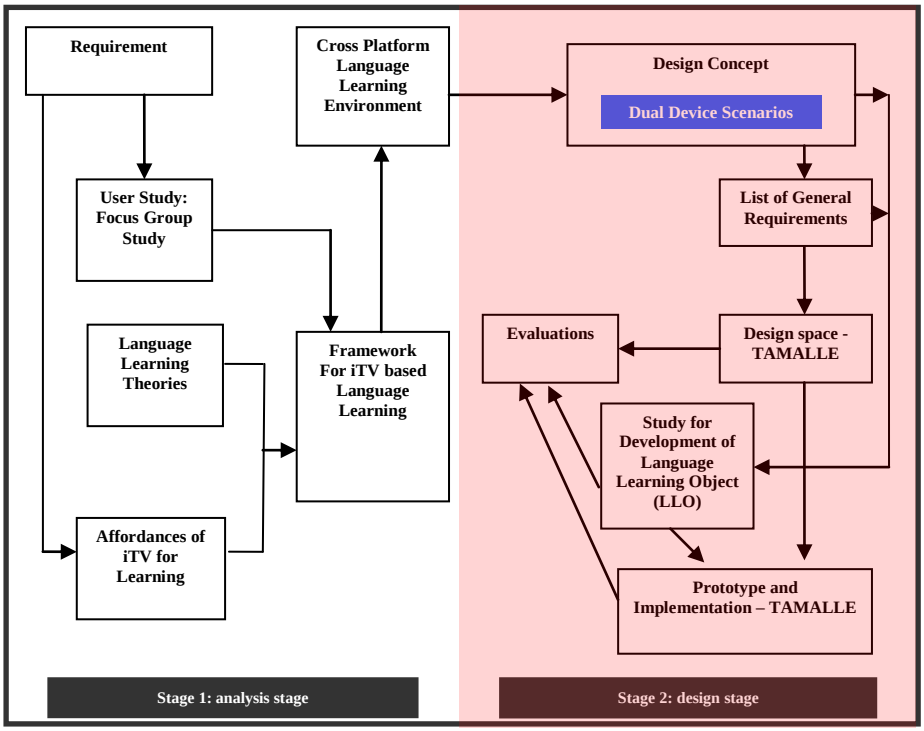


Figure 5-2: The research methodology

The two stage process of analysis and design is summarised as follows:

- Stage 1 concerns building a framework of iTV based language learning. This framework corresponds to the task model of socio-cognitive engineering, and suggests that mapping current language learning theories onto learners' expressed attitudes to a) their language learning and b) interactive television can provide a sound pedagogical framework for iTV based language learning services (Pemberton et al., 2004).

- Stage 2 concerns the design of a new language learning environment. The framework of iTV based language learning proposed from the analysis stage informs the design stage of the project and suggests learning through two media, iTV and mobile phone. A scenario based technique was used to conceptualise the system design (Taylor and Evans 2005, Carroll, 2000). These scenarios were subsequently translated into a list of requirements. On the basis of the proposed requirements, a Television and Mobile Assisted Language Learning Environment (TAMALLE) system was developed and evaluated by advanced learners of English as a foreign language. The remainder of this chapter will present each stage of the development process in more detail.

5.5 Analysis stage: user study

As discussed in Chapter 2, there is a need to know more about independent adult approaches and strategies before undertaking any development. The focus group technique is used to discover how adults go about their language learning, their learning approaches, what techniques and technologies they found useful and what problems and obstacles they encountered.

Focus groups are a useful method for exploring people's opinions, experiences, wishes, and concerns. They can help in obtaining several perspectives about the same topic, and because they are group discussions they enable the researcher to gain insights into people's shared understandings (Krueger and Casey, 2000). They are also a good technique for eliciting user requirements and can help to investigate "user needs and feelings both before interface design and long after implementation" (Nielsen, 1997,

p.1). The focus group technique has been used in many different design projects, including participatory design studies (Oosterholt et al., 1996, Iacucci et al., 2002, Go et al., 2003), for design of a novel product (Salvador, 1998), and for developing mobile learning systems (Goodman et al., 2004).

Gibbs analyses the potential value of focus groups over other qualitative research methods and indicates:

> "The main purpose of focus group research is to draw upon respondents' attitudes, feelings, beliefs, experiences and reactions in a way which would not be feasible using other methods, for example observation, one-to-one interviewing, or questionnaire surveys. These attitudes, feelings and beliefs may be partially independent of a group or its social setting, but are more likely to be revealed via the social gathering and the interaction which being in a focus group entails. Compared to individual interviews, which aim to obtain individual attitudes, beliefs and feelings, focus groups elicit a multiplicity of views and emotional processes within a group context" (1997, p.2).

Moreover, focus groups are useful when exploring a new topic that is difficult for an individual participant to articulate. They may be unable to immediately express their feelings, but as they hear others speaking, they identify the degree of relevance to their own situation and become more explicit about their own views (Morgan and Krueger, 1993).

As the nature of this project is exploratory in its own right, focus groups were used for gathering learner requirements. Using this method also helped in identifying the most common and useful approaches amongst our language learners. New ideas and insights emerged through group discussions. This was very useful as it enabled our participants to ask questions of each other, as well as to re-evaluate and reconsider their own experiences and approaches. This would not have been possible with a one-to-one enquiry method (Morgan and Krueger, 1993). However, as with other research methods, there were some limitations. In particular, focus groups are limited in terms of their ability to generalise findings, mainly because of the small numbers of people participating.

5.6 Design stage: processes from user studies to design of the artefact

Moving to the design stage, we have applied the scenario-based design technique. Although scenarios have been criticised as a design tool on the grounds that they are one-dimensional, nonscientific and underdeveloped (Nielsen, 2002), they are a well-established tool in user-centred design, embodying user requirements and early design concepts (Carroll, 2000). Using scenarios can help achieve the goal of creating truly useful and usable products by encouraging designers "to explore the larger design space of many possible design challenges, to review the technical feasibility and likely payoffs of the different approaches and only then begin considering the normal design issues" (Twidale and Cheverst, 2000). This is particularly important for this project which aims to design an application for relatively novel activities that need to be embedded in complex social contexts.

Researchers designing for ubiquitous technologies such as mobile phones and interactive television have frequently taken a scenario-building approach. For instance, scenarios have been used for conceptualising learning applications in mobile devices (Roibas and Sanchez, 2002; Sharples, 2000) and interactive television (Bates, 2003; Luckin and du Boulay, 2001), including language learning (Pemberton, 2002; Underwood, 2002, Fallahkhair et al., 2004b).

The approach we use is close to Taylor and Evans (2005). A scenario technique was used to embody the design concept. Two scenarios were developed to indicate learners' activities, interactions and use of environment while learning a language from the combination of two media technologies, iTV and mobile phone. These scenarios have been translated into a number of general requirements and used to contextualise the design space and for prototyping and implementations. Chapter 7 discusses the process of requirements elicitation and provides a detailed description and rationale for a set of general requirements.

Based on the requirements proposed, a prototype system of a cross platform informal language learning environment using iTV and mobile phones (TAMALLE) was developed. At this stage of the project the technical feasibility for a cross platform

design and architecture was also investigated (Fallahkhair, 2004). Chapter 8 provides a full account of discussions on TAMALLE design and implementations.

5.7 Design stage: methodology for development of language learning objects

One of the requirements that emerged was to scaffold learner's understanding of an authentic TV programme. TAMALLE supports advanced learners of English as a Foreign Language (EFL) in their television viewing, as just one element in their language learning activities. The system provides support, in the form of captions and other on-screen displays, for comprehension of specific linguistic and cultural items for viewers as they watch English language programmes.

The study was designed to elicit criteria for selection of those language items, which we refer to as language learning objects (LLOs), whose annotation or explanation could best enhance the advanced EFL learner's understanding of television programmes in the target language. It also aimed to discover how second language learners currently use TV for language learning and how they perceive different television genres.

Three different TV genres were selected: a popular UK soap opera (EastEnders), a news broadcast and a lifestyle programme (Relocation, Relocation, Relocation). Ten minutes of each programme were chosen, digitised and subsequently transcribed prior to the session. A questionnaire method was used. The first part of the questionnaire was concerned with collecting the learner's background information, such as age, nationality, gender, and their background and experience of English understanding and production. This was followed by more questions regarding the use of TV for language learning, including how watching TV in English impacts on the learner's language skills, what are the features, if any, that make TV a useful language medium and what are the drawbacks of TV for language learning. Then ten minutes of each programme genre were shown. After each programme, a transcript of the programme was provided. Participants were asked to go through the programme transcript and highlight any parts of the sound track that they were unclear about while watching the programme. They could highlight as many as they wanted. This was followed by further questions to identify different categories of LLOs that the learners found difficult and problematic

while watching the programme, e.g. slang, phrasal verbs, culturally specific items, and so on.

Chapter 9 provides a full discussion of this study. The results help towards development of guidelines for selection of and provision of LLOs for the TV programmes. On the basis of the results we developed the LLOs for the News, EastEnders and Relocation, Relocation, Relocation that were used within TAMALLE application and its evaluations.

5.8 Evaluation methodology

Multiple methods, combining observations, questionnaire and card sorting, were used for the TAMALLE evaluations. Prior to learner evaluation of TAMALLE, an expert evaluation was conducted using the cognitive walkthrough technique (Wharton et al., 1994) in order to minimize the chances of possible interaction design issues, such as positioning, poor wording choice, and inadequate feedback (Pemberton and Griffiths, 2003).

The learners' evaluation sessions were held with a number of advanced EFL learners in Brighton University's domestic technology lab. Data were gathered in different dimensions to test the usability of the software itself, the usefulness of the features provided, its desirability, and its overall acceptance. The main aim was to determine TAMALLE's usefulness and desirability and to ascertain how further improvements might be made in the future. We also asked questions regarding the usefulness of different television genres used with the TAMALLE system, and how useful TAMALLE might be in supporting a range of language skills, including spelling, fluency in writing, speaking, and more.

For the usability evaluations we adapted the ISO Metrics questionnaire (Gediga et al., 2000). Usability is defined in ISO 9241 part 11 as "the extent to which a product can be used by specified users to achieve goals with effectiveness, efficiency, and satisfaction in a specified context of use." Those terms are defined as: "Effectiveness: how well the user achieves the goals they set out to achieve using the system. Efficiency: the resource consumed in order to achieve their goal. Satisfaction: how the user feels about their use

of the system" (Navalkar, p.1). To assess the usefulness of its features we used feature rating methods, while to evaluate desirability we used product reaction cards developed at Microsoft (Benedek and Miner, 2002), and for overall acceptability we used a questionnaire. Chapter 10 of this thesis explains the multi-faceted dimensions of the TAMALLE evaluations in full detail.

5.9 Conclusions

This chapter outlines the research methodology used in this project. Using a modified form of the socio-cognitive engineering approach (Sharples et al., 2002a), a range of learner centred design activities was carried out and a system was developed to provide a cross platform support for adult language learners. The focus group technique was used to study adult language learners' strategies, motivations and use of technologies for learning.

For the design stage, a number of scenarios were developed and subsequently translated into a list of general requirements. The TAMALLE system has been developed based on those proposed requirements. The study was designed to investigate the development of LLOs from authentic TV programmes that could enhance EFL learner's comprehension of a programme. Finally, a combination of observations, questionnaires and card sorting was used for evaluating usability, overall acceptance, usefulness, and desirability of the TAMALLE system with advanced EFL learners.

The next chapter, Chapter 6, provides a full account of the focus group studies. This is followed by Chapter 7, which discusses the process of shaping requirements.

Chapter 6 User study: language learners reflect on techniques, approaches and technologies

6.1 Introduction

Chapter 5 provided a general overview of the research methodology used in this project. This chapter reports the focus group studies that we have conducted to elicit learner requirements. We investigated the approaches that a number of independent adult learners adopted towards their language learning and their attitudes towards a range of language technologies, including television and mobile devices. The aim was to understand their motivations, the methods they find useful and the problems they encounter. This should help us identify opportunities for matching the capabilities of interactive TV to the real needs of adult language learners.

6.2 Method

We used a focus group approach, with a total of 21 participants spread over three groups. Participants were recruited amongst the staff and student population of the Brighton University, using notice boards and a staff email list. An interest in languages was mentioned as a prerequisite for participation. The sample is therefore essentially a self-selecting group. The fact that participants work/study in a formal learning environment may also have had an effect on their attitudes, perhaps making them more likely to take up classes (free for staff and students) than others outside this environment. Each group met for one hour and participants received a £5 voucher. A short questionnaire was used to gather information about personal details, language learning experience and prior exposure to technologies.

6.3 Participants

Participants, ten female and eleven male, were of varied ages, nationalities and language backgrounds. Ten were 21 to 30 years old, four 31 to 50, and seven were over 50. As at this stage, the aim was to develop a potential of TV in learning any second language, we recruited participants from different nationalities, interested in various languages. Fourteen were English; the others were Turkish (1), Chinese (3), Iranian (2) and Lebanese (1). Participants had reached different levels of foreign language

competence, from a professed complete inability to learn any foreign language up to degree level and beyond. Most were interested in learning European languages. Five of the participants knew three or more foreign languages, with the range including Icelandic, Thai, Chinese, Japanese, Arabic, Farsi and Urdu. All participants indicated that they were frequent users of computers.

6.4 Data analysis

Each focus group was run by the same facilitator and began with participants briefly introducing themselves, explaining their motivation for learning a language, their approach to language learning and any problems experienced. Participants were also asked about a range of information and communication technologies that might be used for language learning, including interactive television. The discussions were recorded on video and subsequently transcribed (resulting in over 20 pages of text per focus group).

To analyse the data, three independent researchers (myself and my supervisors) went through the transcriptions and pulled out the participant's views and concerns about the following themes that we were originally interested in capturing:

- Learners' characteristics
- Approaches to learning a second language
- Problem and obstacles faced at present or in the past
- Technologies used
- Approach to teaching
- Motivations for learning
- Opportunities for learning
- Intervention - future ideas

Each theme was numerically coded (1-8). Then we went through the transcriptions and categorised each sentence of text accordingly. When the coding of all transcriptions was finished, for each theme, all of the selected sentences were pulled together and presented in a table format. We then began to discuss and harmonise the ideas that emerged. The above coding also helped in synthesizing our findings and in the

identification of participants' quotations on a particular theme. Therefore, our findings uncover learners' approaches, motivations, obstacles and controversies, and use of technology for second language learning, which are presented in section 6.5.

Moreover, these themes provide a useful insight into eliciting requirements, by grounding them in the scenario development process. In particular, in this project in order to envision a new scenario of iTV based language learning, we attempt to include them into a scenario template that also incorporates concerns regarding the learning affordances of iTV technology and language learning theories. By doing this, learners' views will be at the heart of the requirements elicitation and development phases (Taylor and Evans, 2005). A detailed analysis and discussion of requirement elicitation process using the result of this study is presented in Chapter 7.

6.5 Results

6.5.1 Motivations and opportunities for learning

Participants volunteered a wide range of reasons for studying a language. For some, learning a specific language was a necessity, as they were living and/or working in a foreign country, or intending to do so. Some wanted to communicate with foreigners, as part of their business dealings or while on holiday. Some had wanted (or been obliged) to study for a qualification for its own sake. Others had family reasons: a Dutch husband, a Bolivian wife and German grandchildren were mentioned. Other reasons related to personal development. Several participants simply said they liked languages and were permanent language learners. The challenge of learning a difficult language was mentioned. Opportunity, in the form of free slots in the diary or particularly convenient location, motivated some learners. One went to class *"because it is just on the third floor every Thursday"* while another found a class that matched his schedule *"because it was [on] my free Wednesday night"*.

Demotivating factors also emerged. Several participants mentioned the fact that bad experiences with learning a language at school had a negative effect. One participant said he *"had a bad experience at school and [didn't] feel confident enough to start again"*. UK participants felt they suffered what they saw as a *"typically British"*

reluctance to take risks in their language practice, for fear of failure and humiliation, particularly in pronunciation and spoken language production generally (Hilleson, 1996).

6.5.2 Approach to language learning and teaching

Fourteen of the 21 participants were currently attending a language class and all had had some experience of formal, class-based learning at some point in their lives. Participants mentioned that going to a regular class was important to retain motivation, *"If there wasn't a class there I would not have bothered"*. Positive motivating factors included the routine of attending, the structured classroom approach and the goal setting that occurs in a class. The teacher's role was important, there is *"somebody telling you things quicker"* and *"somebody giving you feedback"*. Peers were also important, *"other learners in class can support you", and you "feel guilty [if you do not go, do the exercises]"*. However, it was also noted that a class had the disadvantage of inflexibility. Learners cannot go at their own speed or repeat things when they want to. Rigid structure was perceived as problem by some, *"[in class they] say to people do this, do that it does very much take the pleasure out of things"*. Participants tended to use a combination of methods. With one exception, all participants attending a formal class used other complementary methods. Seven participants were currently learning a language without attending classes at all. Some mentioned the difficulties caused by having no fixed time slot for study. *"I have got a book [but I haven't] even read it for two months"*.

Participants were asked in the pre-session questionnaire to rank different approaches they have used from a number of proposed approaches, including learning by textbooks, formal classes, using radio, TV, online courses, computer software and more. Figure 6.1 illustrates the results. As illustrated, the most used approaches were language learning textbooks (90%) and using video and DVD (62%).

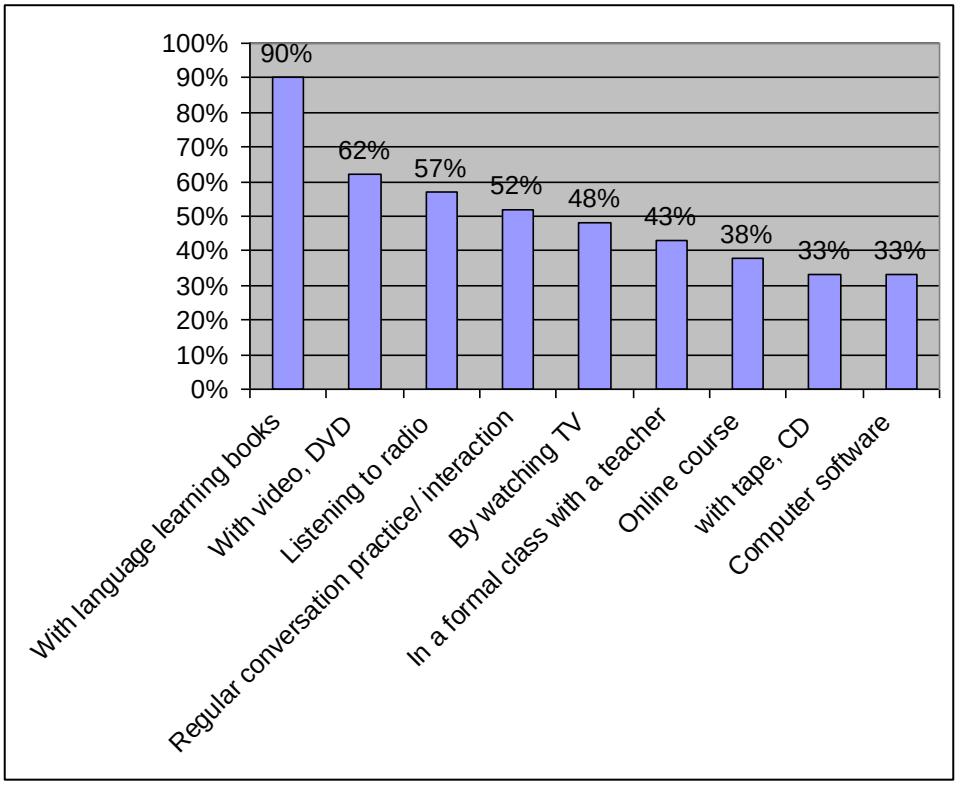


Figure 6-1: Approaches to language learning

Most participants had lived in a foreign country while learning its language. They were sure that immersion helped language learning, *"the languages that I have learned fastest [were] when I was living in a country, and it was all around you"*, *"You just let it come subconsciously; eventually you surprise yourself"*. Some try to recreate elements of immersion at home, for instance listening to a foreign language radio station or labelling domestic objects in the foreign language. They reported attempts at immersion in some of the formal classes they attended, with learners only allowed to speak the target language inside the classroom. Some participants thought this helped, *"your brain becomes in tune"*. Reading novels, watching films and listening to the radio were also mentioned as ways of getting the brain (or ear) to 'tune in'. All participants expressed a preference for native speaker teachers for the same reason of habituation.

The notion of learning in context was raised by several participants. Participants also recognised the importance of learning about the target culture as well as the language. One native Arabic speaker, for instance, mentioned that he had found it very useful to

watch Coronation Street (a popular UK soap opera) in order to become familiar with English language and culture.

A related theme was the use of authentic material versus material produced explicitly for language learning. Many participants mentioned using a combination of both, regarding the learner's stage of proficiency as a key factor. For beginners, a structured approach, using a book or a course, possibly computer based, was seen as most effective, with authentic material such as films reserved for those with some expertise. An existing local website that provided simplified versions of authentic material was highly praised. Some participants had used target language material intended for small children, such as books and TV programmes, because they tend to use relatively simple repetitive structures. Children were also perceived as speaking more clearly than adults, making their speech easier to understand. However, not everybody agreed, on the grounds that children's material could be quite boring.

Participants stressed the importance of engagement and the use of enjoyable activities. Some had fond memories of games that had been used in their language learning, such as a French version of Scrabble, or a game involving sticking labels on people's backs, *"you are having fun because it is labelled as a game, and you are learning much more"*. Others stressed the importance of conversations with native speakers outside the classroom, *"I never learned by sitting at home and learning by books. I just told myself I have to have English friends. With some guys we were going to pubs and making conversation and talking with people. I learned this way"*. The ability to hold a conversation with a native speaker was seen as a key goal for learners.

6.5.3 Obstacles and problems

A recurring debate in all three focus groups was the role of formal grammatical metaknowledge. Some felt that the need to be able to handle grammatical concepts had been at the root of their slow progress or failure as language learners and would have liked to be able to proceed without it, *"in the past it [grammar] has really stopped me learning a language"*. Others were adamant that a learner in a non-immersive situation could not go far without grammar. One participant suggested that there might be two types of people: people who flourish best in a *"pattern matching"* regime, essentially

learning to combine language *"chunks"*, and those who prefer to be made aware of the rules of grammar. Several participants mentioned a correlation between a taste for mathematics and a liking for explicit grammatical knowledge. Many participants commented on the lack of formal grammar teaching in UK schools and judged this to have had a negative effect on foreign language learning.

A major obstacle to practicing the target language was the fear of risk taking, as mentioned above, *"in school they always correct you, they always want you to be doing the right thing"*. Participants recognised that in a real world situation complete correctness might be less important than communicative competence. They stressed the role of fellow learners here, *"they are at the same level … so you feel that you can talk to them much better, you are not too scared of making mistakes"*.

Many participants mentioned difficulties in remembering languages that they had learned but did not practice, *"I did a bit of Swedish but I have forgotten a lot of it"* and *"since [taking the classes] I have forgotten much of it*". Memory for specific items of vocabulary is also a problem, *"I am getting to the age where it is very difficult to remember things unless I keep practicing"* and *"I tried to memorise something last night, I think of it this morning, it is gone"*. Some participants noted that knowledge of other foreign languages helped with remembering vocabulary, although this could also cause interference problems. However, they had developed many solutions to the memory problem. One participant who had worked as a taxi driver and had an extensive knowledge of the local road network had developed his own version of location-based mnemonics, *"I associate Spanish vocabulary with street names"*. In addition to mnemonics, participants created their own pocket-sized vocabulary books and bilingual flashcards to memorise vocabulary. They stressed the importance of using their new words '*for real'* and of repeated practice, *"whenever I … learn a new word, I try to use it straight after, [then for] days and days after"*. Another noted the importance of "*practicing [vocabulary], taking up words that you know in one context and making up sentences using [them]"*.

6.5.4 Technologies used

Participants in all three groups were asked about the use they made, specifically for language learning, of a range of media and technologies. Figure 6.2 illustrates the range of technologies used by our participants for language learning. Again, similar to findings presented in Figure 6.1, which indicates different approaches to learning, books and video tapes scored the highest (71%) by our participants. More than half of our participants selected radio (62%), TV in target language (62%) and TV with subtitles (52%) as a useful technology for second language learning.

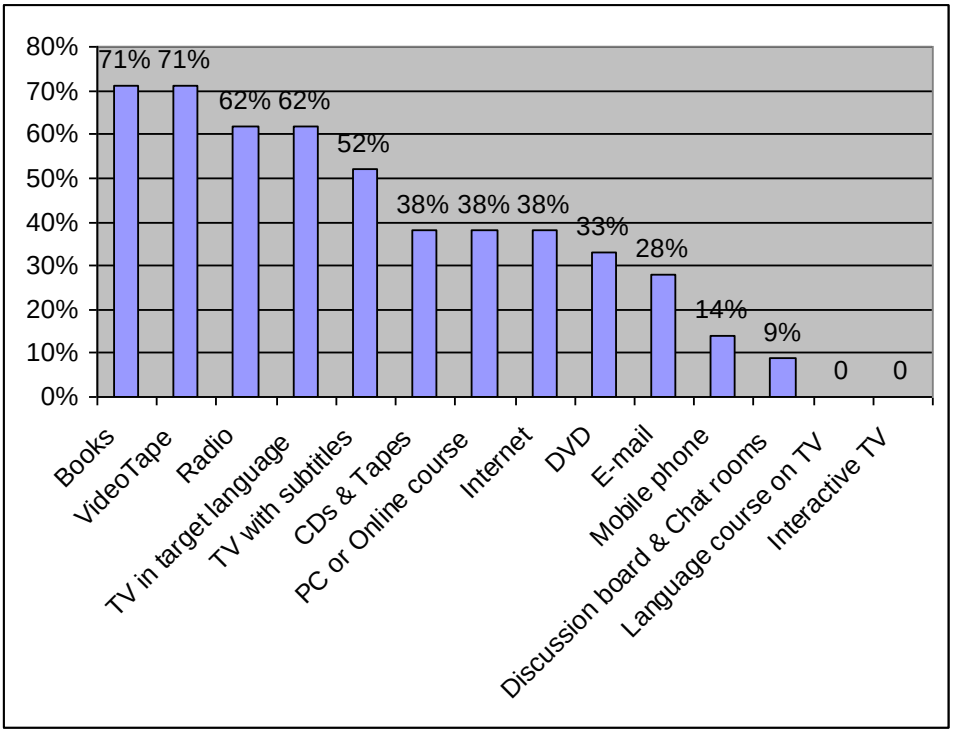


Figure 6-2: Technology used for language learning

6.5.4.1 Books

Fifteen of the 21 participants had used language textbooks. In addition to conventional texts, some participants were particularly keen to mention monolingual picture books in the target language, *"a picture-based dictionary - for each object in a picture you get a name for that object"*, and a *"[book with just] pictures of people doing things with German underneath it, that starts you on simple words and takes you a little bit further. No English in it at all"*.

6.5.4.2 Audio - based media and technologies

CDs, Tapes. Eight participants had used CDs to assist language learning, with four using them frequently. Thirteen participants had used audiotapes, with three frequent users. The main advantage of using audio materials for the participants was that they were able to listen while doing something else. Tapes and CD's enabled participants to learn on the move, e.g. *"walking in and out [of work], lots of opportunities to listen"* or *"driving in a car"*. Car-based learning made participants feel able to practice speaking aloud, *"I can talk to myself in a car … it is not embarrassing"*. They liked the fact that tapes and CD's allowed the learner to *"[listen] over and over again"*, and that some provided *"clean audio"* as well as *"recording in context"*, i.e. complete with authentic ambient sound. A problem with authentic audio was that it might be very difficult to distinguish subtleties of pronunciation, such as intonation in Chinese. Language learning tapes and CDs often accompany textbooks, and participants found it useful to read the text first and then listen, or to consult the book while listening (though this could be difficult while on the move). The linear nature of tapes made them *"very rigid"* in use, however.

Radio. Thirteen participants had used radio to assist language learning, with five using it often. They liked the authentic material delivered by radio, but noted that speech could be quite fast. Not everyone saw this as a problem, *"it doesn't matter not understanding it; slowly your ear begins to pick things up"*. It was also recognised that listening to the radio was good practice for the range of voices and accents learners were likely to meet in real conversations with native speakers. Politicians were mentioned as easier to follow as they speak very slowly and deliberately. Participants felt that the information flow of radio was more intensive than that of TV, which they saw as more leisurely due to its blend of sound and image. A problem was that "you cannot rewind it".

Language lab. Nine participants had used a language lab, with two having used one often. They like the fact that a lab allows learners to listen to themselves speaking.

6.5.4.3 Video - based media and technologies

Language courses on television. Like conventional language classes, TV language courses adhere to a set schedule. However, participants felt they might be less attractive

than live classes, *"it is like going to class without having the incentive of all those people to talk to"*. As with classes, there was the possibility of falling behind, *"If you missed the programme, that was it, you were left behind"*. Participants were not impressed with the quality of broadcast material, which was labelled *"really badly acted, ridiculous situations"* and *"artificial"*. Some had bad memories of videos being used for *"babysitting*" a class of uninterested teenagers while their teacher had a rest. They also associated television strongly with entertainment, *"We had this ... channel in Iran for learning Arabic. When I have seen it I said no, I am not going to watch that, I would like to watch football"*.

Television in target language. Thirteen participants had used target language television for language learning, with five using it often. As with radio, they appreciated its authentic material. Speech could still be fast, with background noise, but they liked the context provided by the visual information. TV was perceived as more like entertainment than learning, *"[you are] not required to go through the action of watching class in TV…you can actually sit back and relax"*. Soap operas in particular were valued for the insight they offered into the target culture, as well as for language learning opportunities. One problem the participants found with TV was that it was normally shared with others, who might not be interested in language learning. One participant did imagine a scenario where a family might want to learn a language together, for instance if they are going on a holiday. However, most participants were sceptical about getting their children involved. Some mentioned that TV might be good for learning listening, but not for learning other skills like reading, writing and speaking.

Television with subtitles. Eleven participants had used TV with subtitles to assist language learning, with three using it often. Subtitles for a foreign language programme could be provided either in the known language or in the target language. One advantage of target language subtitling was the fact that it anchored speech in written form, making it possible for the learner to find unknown terms to be looked up in a dictionary. However, participants felt they might be tempted to follow the (easier to process) subtitles than attend to the sound track, *"[I say] I am not going to look at the subtitles, I'm just gonna listen and before I know it, I'm reading the subtitles"*. The feeling was that the scaffolding provided by subtitles should be removed as soon as

feasible. The non-UK participants made extensive use of the closed captions (aimed at deaf viewers) to support their learning of English. However, speed was a problem, "*subtitles … I found that really difficult for me because I couldn't go that fast"*.

Film. Several participants took the opportunity to watch films in the target language. The issues are essentially those of TV, with the extra attraction of being able to consume cultural artifacts in their original language.

Videotape. Fifteen participants had used videotapes to assist language learning, with five using them often. Video was seen as a valuable tool, as learners could rewind scenes and record TV programmes that would otherwise be missed. Video was seen as giving more flexibility and control than broadcast TV (Beyth-Marom and Saporta, 2002; Broady, 1997).

DVD. Seven participants had watched DVDs to practice language skills, with five using them often for this purpose. The DVD was valued for its flexibility, its extra material, such as subtitles and extra audio channels, and the user control it affords. For instance, when watching a film one could check the meaning of the language in a scene via subtitles and then turn them off to test one's understanding. DVDs offer a rich source of interactive content, giving features such as up to eight different audio tracks and multiple subtitling possibilities. Target language subtitling can be particularly effective (Godwin-Jones, 2003; Koolstra and Beentjes, 1999).

6.5.4.4 Computer

PC or On-line course. Eight participants had used a variety of software products, including online language courses, to assist their learning, with two using them often. One problem with such courses was perceived to be the lack of feedback on speaking, *"the trouble is that you will never be able to pronounce it … you have to prove it yourself"*. Spell checkers were seen as useful when learning to write in a foreign language. Several participants had used an electronic dictionary for language learning. Although no participants had used computer technologies such as PDA's to write notes as they learned, this was mentioned as desirable (none of our participants owned a PDA).

Internet. Eighteen participants, a surprisingly high proportion, had used the Internet to assist language learning. This may in part be due to ease of access afforded by the University location. They reported that the Internet provided easy access to authentic material, such as newspapers in the target language. Search engines made it easy to find authentic material on topics of interest, with some search engines even providing the option to translate pages of interest. There was a lack of enthusiasm about visiting specially created language learning websites, apart from one local site mentioned above. Carrying out authentic information retrieval activities was seen as more attractive and effective.

6.5.4.5 Communication technologies

E-mail, Discussion boards, Chat rooms. Six participants had used e-mail for language learning, with three using it often. Two had used discussion boards or chat rooms for language learning.

Mobile phone. Three participants had used mobile phones for language learning, with two using it often. These participants were mainly used SMS services for vocabulary learning.

6.5.4.6 Interactive TV

None of the participants had used interactive TV for language learning.

6.5.5 Intervention and future ideas

A large number of desirable attributes for learning environments emerged, some of them contradictory. For instance, while participants appreciated the routine of the language classroom, having to attend classes imposed an inflexible schedule on busy people. It was clear that no single approach would be likely to satisfy all requirements, and participants recognised this, with the majority of those who attended a formal class also using complementary methods. However, a number of themes emerged.

6.5.5.1 Authentic materials

Participants were enthusiastic about authentic materials of all kinds, including reading novels and watching films. Learning about foreign language culture was as important as

learning about the language. Participants appreciated the fact that the authentic material delivered by television was itself engaging. Television in particular was perceived as more like entertainment than learning.

6.5.5.2 Learning in context

Learning in different contexts was established as an important factor. A particular problem was the difficulty of applying a language item learned in one context to a different one. A solution used by some was the use of a combination of media, with one providing context for the other: for instance, watching the news on television and then reading the same news stories in a newspaper. Foreign language television was seen as a valuable medium here. Although speech might be perceived as fast, with background noise sometimes obscuring the speech soundtrack, participants liked the context provided by the visual information, which made it easier to determine what was being said, *"I just watch TV in French, I don't understand everything, but especially with soap operas, there is so much gesture"*. This success in understanding also makes the experience rewarding even if the language is hard to unravel.

6.5.5.3 Scaffolding

Participants used current facilities such as subtitling and closed captions to scaffold their learning. One advantage of target language subtitling was the fact that it anchored speech in written form, making it possible for the learner to find unknown terms to be looked up in a dictionary. The non-UK participants made extensive use of English language closed captions (aimed at deaf viewers) to support their learning of English. However, speed was a problem. The DVD, providing functionality similar to iTV, was familiar and was valued for its flexibility, its extra material, such as subtitles and extra audio channels, and the user control it affords.

The potential of scaffolding learners' understanding and comprehension could be exploited. For example, difficult language items might be accompanied by an on-screen explanation, perhaps linked to the viewer's language profile. A vocabulary service or dictionary could also be made available. Moreover, extra information about a programme could be provided in order to scaffold learner's overall understanding of a programme, for example a synopsis of drama episode, news headlines, etc.

It is important to note that although our participants were from different nationalities and learning different languages, the characteristics of the scaffolding support they were required to learn from an authentic television programme was the same. Participants wanted to get scaffolding support in the target language they were learning, supporting their comprehension and learning of new language items while watching the target language programme.

6.5.5.4 Usage patterns of (i) TV

None of the participants had used interactive TV for language learning, nor were they particularly impressed with the current state of iTV technology and services. Usability was perceived as a problem, *"the remote control is just not usable…by the time you figure out what button to press you miss the content"*. This was a particular problem for the less motivated viewer, "*if a semi-interested adult decides to use their spare time [to learn a language via TV] and they can't find out what they want to know about getting started, they might just get up and say Poof, forget about it"*. Participants were anxious about missing part of the TV programme, while looking up additional information, *"if information is available during a programme, it is a complete waste of time, because you miss a programme when it has background information"*. Screen design was also seen as a problem, with text sometimes occluding the picture or banishing it into a small window. One problem the participants identified for learning with television of any form was that it was normally shared with others, who might well not be interested in language learning.

6.5.5.5 Sociability

Several participants mentioned the fact that they tended to watch in company. One problem the participants identified for learning with television of any form was that it is normally located in the heart of living space and is being shared among households, who might not have any concern in learning, *"my two boys would rather watch the Simpsons or something all the time. There is a big fight for the TV"*. Manipulating the interactive services in a shared living room was seen as intrusive and unfair to other viewers, making participants unwilling to impose aspects such as subtitles or second language labels on other viewers. One visionary concept offered by a participant was to avoid disturbing the viewing of others in the room by projecting these enhancements onto an augmented reality display, perhaps on a visor or spectacles (Intille et al., 2003).

6.5.5.6 Learning on the move

Participants liked being able to fit learning into odd moments of their day, for instance when travelling. Several listened to language tapes or CD-ROMs when driving, or tuned the car radio to a foreign language station. The fact that the mobile phone could be used on the move was attractive to these participants, who particularly liked the potential of SMS for language learning. One participant had used a Chinese service that sent subscribers text messages with new English words or constructions to learn (see also BBC, 2003). However, there was a distinct generation gap where mobiles were concerned. Younger participants were enthusiastic, but the over 50's were distinctly cool. *"I don't use a mobile phone, and I wouldn't use it to learn about a language ... I think it is a terrible idea".* This participant particularly disliked the miniaturised interface of the mobile phone.

The sum of these comments shifted the focus of the project, changing the central concept from one based entirely on interactive television to one based on two complementary devices, iTV and the mobile phone.

6.6 Implications

The focus group results played a key role in directing the overall development strategy and influenced some major decisions. One such decision concerned the appropriateness of iTV based services for formal learning. Many scenarios for iTV learning have concentrated on formal learning, i.e. where the viewer is explicitly focused on learning as an end in itself, possibly even in the context of a curriculum or class (Bates, 2003; Luckin and du Boulay, 2001). Our focus group results indicate that language learners do not perceive (i) TV as a medium for formal learning, but as a form of entertainment that may have the side effect of incidental learning. Even our most fanatical language learners were not keen to watch TV programmes specifically made for the language student. In addition, they were aware of the tensions that imposing specifically educational material might have on their fellow-viewers. However, the up-to-date authentic material broadcast on TV was very attractive to them and they perceived it as bringing many valuable learning opportunities. Hence, rather than creating interactive TV programmes specifically for language learning, our strategy should be to add interactive enhancements to existing, engaging, programmes, supporting informal rather

than formal learning, via programmes the viewer might watch spontaneously even without language learning opportunities.

Second was a decision on the provision of support for viewers. Our participants appreciated any support that helped them obtain more from their foreign language viewing. In particular multimedia presentation of material, with media complementing each other and providing context, was seen to facilitate understanding: subtitles made it easier to follow rapid speech, gestures and other graphical information expressed extra-linguistic meaning, a visual setting anchored the meaning of spoken language and so on. ITV could scaffold understanding even further, by providing a selection of levels of support in appropriate complementary media, either through the television screen or via a separate device such as the mobile phone.

Thirdly, the general enthusiasm amongst younger participants for learning on the move suggested the incorporation of the mobile phone. This proposed use of phones has the advantage of not imposing educational material on other viewers, and of giving the learner the opportunity for asynchronous engagement with the programme, after, while or even before it is broadcast. The separation of functions that occurs when using the phone to display support material also answers the fears of those participants who were worried about the speed of synchronised subtitles and the problem of missing the programme itself when attempting to access interactive material. Using the mobile phone alone would make it difficult to deliver engaging and authentic material, mainly because of the technological limitations currently associated with the technology, pointing again to a dual device solution. However, there was a clear generation gap, and the mobile phone was not embraced by older participants.

6.7 Conclusions

In this chapter we have presented a small-scale study of adult language learners. The results described here are useful beyond a single project, for other developers of services for independent learners. Uncovering pre-existing learner beliefs, attitudes and behaviours should be an essential part of a user centred approach to the design of software for learning. The high cost of iTV development also provides a strong financial incentive to draw on potential users throughout, not only in pre-design

research but also through prototyping and evaluation. Given the paucity of learner-centric studies of independent adult language learners, we hope the results from the study will also be of interest to other language learning researchers beyond the educational software development community. We all need to find out why and how independent learners learn if the lifelong learning agenda is going to be successful.

The results suggest a broad direction for our work on the use of new technologies for language learning using a cross platform approach (iTV and mobile phone), taking advantage of the best aspects of each medium, rather than concentrating on a single technology. The results also suggest that we should support informal learning from authentic television programmes and enhance the learning experience by scaffolding.

The next stage was to incorporate the result of the focus group studies into the framework of iTV based language learning, and to embody the design concept in a scenario. These discussions are presented in Chapter 7.

Chapter 7 Shaping requirements: from theoretical framework to artefact design

7.1 Introduction

In Chapter 6 we discussed the focus group studies that were carried out to investigate the approaches that a number of independent adult language learners adopted towards their language learning and their attitudes towards a range of technologies including iTV and mobile phones. This chapter provides a discussion of the process of shaping requirements. We first discuss a framework for iTV based language learning that is proposed to direct the design (section 7.2). The process of shaping requirements is then discussed in section 7.3. Finally, we provide a detailed description and rationale for a set of general requirements using the Volere shell (Robertson and Robertson, 2006) in section 7.4.

7.2 A framework for iTV based language learning

Our discussions in previous chapters have established the potential of iTV for supporting language learning. However, in order to succeed, we believe that iTV learning services should be based on a sound pedagogical framework and be derived from learners' needs, interests and motivations (Pemberton et al., 2004; Masthoff and Pemberton, 2003; Underwood, 2002; Luckin and du Boulay, 2001). The initial brief for this project was to design a technological support system for language learning using the facilities of interactive television. We assumed that for language learning programmes to be effective, they must be designed within certain constraints. These would include at least: (a) a sound pedagogical framework based on a viable learning theory, (b) a consideration of the learning affordances of the technology used and (c) the expressed attitudes and preferences of learners, derived from a user study (Fallahkhair et al., 2004a). This is sketched in Figure 7.1.

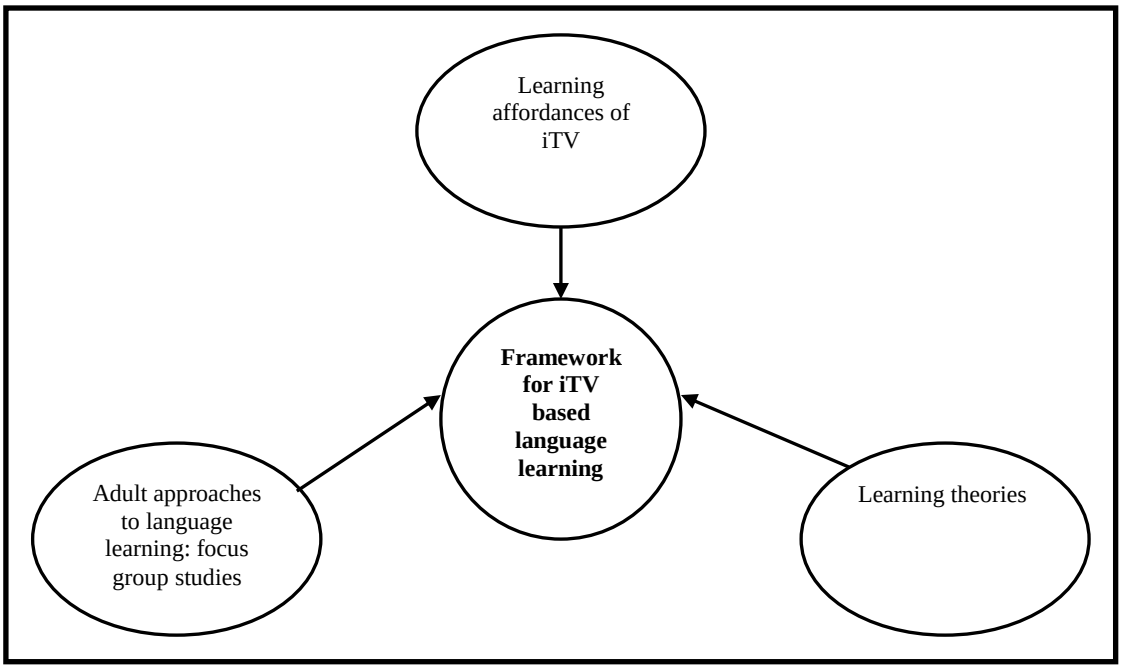


Figure 7-1: A framework for iTV based language learning

It should be noted that above framework illustrates three possible elements that influence the development of iTV based language learning in this project. Two elements of this framework, the user study and theory of use, are components of the socio-cognitive engineering methodology (Sharples et al., 2002a). However, we believe that for iTV technology to be effectively designed it is also important to bear in mind the affordances of this technology and the functionalities that it could offer to support language learning. In this section, we provide a discussion of this framework and its components in more detail.

7.2.1 Adult approaches to language learning: focus group studies

Taking a learner centred design approach, a number of focus group studies were conducted to elicit learners' attitudes and approaches to learning (Fallahkhair et al., 2004a). A full account of the results is discussed in Chapter 6. In brief, the focus group studies indicate that our participants did not perceive iTV as a medium for formal learning. They did not want to watch 'language learning' programmes, but rather mainstream programmes, which they would consume as a form of entertainment that might have the side effect of learning, i.e. they took an informal/incidental learning approach. Some of the most important themes that emerged were:

- Authentic materials: learners were enthusiastic about learning from authentic materials. They appreciated the fact that these materials are engaging.

- Learning in context: learners appreciated the advantage of learning in context, with different media complementing one another, each providing the context for the other. Foreign language television was seen as a beneficial medium, showing the use of language in different contexts and situations, and as spoken by native speakers.

- Scaffolding: learners used a number of different strategies to scaffold their understanding. In particular, they liked the idea of target language subtitling. The potential of iTV for scaffolding learners' comprehension could be exploited. For example, difficult language items might be accompanied by an on-screen explanation to support learner's comprehension of a programme. A vocabulary service or dictionary could also be made available. Moreover, extra information about a programme could aid more general language understanding, for example a synopsis of drama episode, news headlines, etc.

- Sociability: participants indicated that they watch TV in company. The problem of imposing educational materials on fellow viewers who might not be interested in language learning was a big concern. However, incorporating iTV with a mobile phone that could be used by individual in a more personalised and non-intrusive way was mentioned.

- Learning on the move: participants liked to be able to learn on the move, especially when travelling. The fact that the mobile phone could be used on the move was attractive.

The results of the focus group studies changed the direction of the project, supporting a cross platform approach via not only iTV but also mobile phone. In the next section, we discuss the second input to our framework, the learning affordances of iTV technology.

7.2.2 Learning affordances of iTV

Before we start with a discussion of language learning theories and their integration with iTV applications, we should clearly indicate what the learning affordances of iTV technology are. In other words it is important to take into account the capabilities of iTV, i.e. domestic television, augmented by new interactive facilities. It is worth considering television itself before looking at interactivity.

Television is one of the most familiar and popular media technologies. Over 98% of households in the EU and North America have access to television and for many the TV set is the focal point of the household. People of all educational levels, ages and social classes are already familiar with television and use it comfortably. Conventional TV is a known and trusted technology (Reeves and Naas, 1996), so delivering learning in this way does not involve the introduction of strange or intrusive equipment or the need for the learner to move to a special environment.

Of course the easy familiarity of TV may bring its own problems. Television is perceived as a leisure, rather than a work, technology, so any learning services need to be designed with this in mind. As one teenage respondent quoted in (Ling and Thrane, 2002) eloquently puts it, “I don’t watch TV to, like, learn.” People have a tendency to do other things - ironing, chatting, reading, eating - while viewing, (Gauntlett and Hill, 1999). They often view in company (Masthoff and Pemberton, 2003) and they may be subject to interruptions of varying frequency and significance.

TV has long been co-opted for educational ends, both formally, with syllabus-linked programmes and informally, via the informative documentaries and quiz programmes broadcast every day. In the case of language learning, conventional television is *already* a powerful learning environment. Broadcast TV material in the target language is frequently integrated into formal classroom activities. Television offers a rich multimedia experience, where learners can immerse themselves in authentic materials from the target language and culture. This material may well be engaging in itself, with up-to-date ever-changing content displaying a range of speakers and contexts. Many television shows constitute important cultural events in their own right, providing a common reference for people sharing or aspiring to share a culture. In its non-

interactive state, it clearly affords watching, reading and listening, making it an excellent medium for learners to practice comprehension skills and also to acquire background cultural knowledge. Comprehension of spoken material is strongly supported. Sherrington (1973), exploring the potential of conventional television for language teaching, notes that a number of listening skills can easily be practised via television, including recognising and understanding:

- Segmental and suprasegmental features
- Vocabulary items, short phrases and longer segments of speech
- Syntactic structures
- Varieties of speech, such as registers and dialects
- Discourse patterns
- Pragmatically determined features

(Pemberton, 2002)

Digital television adds a new dimension to learning from the TV by multiplying available channels (Meinhof, 1998; Moores, 1996). However, this is an increase in the quantity of available material rather than a change in the type of affordance provided by the medium.

Digital interactive television (iTV) offers genuinely new ways of using the television set. Interactivity is a contested term, with some commentators favouring a loose definition that would include video-on-demand and phone-ins, and others adopting a strict definition that admits only ‘enhanced’ television applications, i.e. those that offer more on the screen than a single broadcast stream, typically accessed via the TV handset (Gawlinski, 2003). Interactivity adds a new dimension to learning from television. With interactivity, viewers could select from alternative audio and video streams, make their own choice amongst subtitling options, view supplementary information on-screen, and use communications tools such as chat and email.

As discussed in Chapter 3, while television presents obvious opportunities for developing listening and comprehension skills, it may not be pertinent for developing speaking and writing skills (Sherington, 1973). The learning affordances of iTV lie in

supporting listening and comprehension, reading and spelling skills, learning new language item and learning from up-to-date and authentic content (Bean and Wilson, 1989; Spanos and Smith, 1990; Parks, 1994; Koskinen et al., 1996; Koolstra and Beentjes, 1999; Friedman, 2001).

Next, we discuss the final input to our framework: language learning theories.

7.2.3 Learning theories

Chapter 2 of this thesis discusses a number of theories and approaches to language learning, including behaviourist, cognitive, constructionist, constructivist and socio-cultural. This section provides a summary of these learning theories and possible iTV and mobile phone applications that could be developed to facilitate language learning.

The *behaviourist* approach advocates learning through repetition, drill and practice. As discussed in Chapter 2, through this approach learning new language items (e.g. vocabulary, idiomatic expressions) can be supported. Both iTV and mobile phone technologies could provide facilities to enable learners to learn new language items and to practice them. For example, a system can be developed to recommend a list of vocabulary with explanations and/or dictionary provided to enable learners to learn and practice unknown terms.

The *cognitive* approach advocates learning through building up an explicit cognitive model of the target language. Learning language structure and grammar are seen as the most important elements of acquiring a language in this view (Milton, 2002). For example, a video-based lecture or grammar note to provide instructions on language rules could be delivered via iTV and mobile applications.

The *creative constructionist* approach requires support for comprehensible input. Television, as a source of authentic second language material, seems an excellent medium for this approach. Motivation can be maintained via the provision of the high quality material already available from conventional TV. Interactive services could then improve the comprehensibility of language input by providing scaffolding for understanding of language items according to learners' motivation, interest and knowledge levels. Comprehensible input provided in the form of subtitles that anchor

speech in a written form. We can provide a language learning version of subtitles that provides extra language support, which may help learners to understand more from their viewing, for example by annotating new words with explanations, labelling objects in a scene and so on. Learners' language intake will be therefore optimal while they are watching the TV programme or when "acquisition" takes place (Krashen, 1989). However, this comprehensible input should come at a level matching or slightly above the learner's current level of competence (Krashen, 1981; 1982). To achieve this we have to find out what language items are perceived to be difficult for learners, and also to study the nature and characteristics of these language items that can provides comprehensible input and scaffolds learners' understanding. Chapter 9 describes a study for developing criteria for selecting these language items and their explanations, together forming Language Learning Objects (LLOs). Without this knowledge, automating the generation of these LLOs from the authentic TV programme would be impossible. Another option is to develop these LLOs manually, for example to ask language teachers or experts to take responsibility for annotating, in accordance with learner's different levels and interests. However, this task could be labour intensive and time consuming.

We can also support personalized scaffolding by providing support in appropriate complementary media such as the mobile phone. The general enthusiasm for learning on the move expressed in our focus groups suggested the incorporation of the mobile phone. This combination of mobile phone with iTV has the advantage of not imposing language items on other viewers, and of giving the learner the opportunity for asynchronous engagement with the programme, after, while or even before it is broadcast (Fallahkhair et al., 2004b).

The *creative constructionist* approach can also be supported by allowing learners to create their own learning space, a concept that comes close to the constructionist vision of active learners creating their own knowledge model, e.g. 'My language learning', that can also be accessed on an anytime or anywhere basis. This facility enables them to be in charge of their own learning experience. An iTV system could provide extra language learning materials, such as a list of vocabulary related to the TV programme or a summary or synopsis of what was happening in the show that could be retrieved and saved prior, during or after the show time from the iTV or other media

technologies, such as Internet and mobile phones. Mobile phones are particularly valuable here because they have the advantage of ubiquity, and enable learning individually (Naismith et al., 2005).

The *constructivist* approach, as discussed in Chapter 2, can be supported through problem solving activities. For example, through role playing activities learners can practice speaking and communication skills. In this view, the discovery and experiential aspect of learning can also be supported through language learning games. Games may be highly motivational and can encourage learners to be engaged in other forms of activities and learn subconsciously or incidentally as a result of their interaction. Games are one of the most successful iTV applications (Gawlinski, 2003). Interactive language learning games could be provided in the form of a quiz to examine a learner's comprehension of a particular TV programme. The quiz questions can determine the learner's understanding of speech or dialogue, a word's meaning and their insight into what has happened in a show. These types of games can also stimulate viewers to participate and learn as a result of their participation, via rewards such as promotion to another level of the game or access to additional programme content, e.g. to entitle learners to watch a back stage show, or extra documentaries about the characters in a show. These types of games are not only motivational but also support incidental and informal learning.

There are other types of games that are usually played in groups either in the same location or through networks, which promote conversation between players. These types of games, which are known as voice-over-IP games, enable players to communicate with others who are playing at the same time. The players are equipped with microphone and headphone or they can use mobile devices as mean for communications. They can comment on each others' performance or guide each other through hazards (Halloran et al., 2004). Their conversations can be in the target language, which they all intend to learn. ITV language learning games could provide their own 'call to action' to stimulate viewers to go and play after a show, e.g. play the Harry Potter game after the Harry Potter movie, and facilitate voice-over-IP conversation, which allows learners with a similar interest to communicate with each other. Learners can play similar games on a mobile phone individually or with others in the network.

The *socio-cultural* approach indicates the value of collaborative learning. This approach can be supported if we facilitate social interaction and communications with other learners or with native speakers. We can provide a service that facilitates these kinds of interactions via iTV or mobile phone, for example enabling viewers to participate in discussion boards and/or chat-rooms after the show, or allowing them to send and receive text messages to/from mobile phones. Research has showed that the authenticity of computer-mediated communication (such as email or chat) made the communication seem more 'real' to learners, increased their motivation and resulted in a high level of learners' satisfaction and perceived improvement (Greenfield, 2003). Chat provides valuable opportunities for the negotiation of meaning similar to that provided in oral interaction (Tudini, 2003). The fact of having viewed a programme, whether a news bulletin or a football match, can provide a rich common ground for such interactions (Quico, 2003).

7.3 Processes of shaping requirements

The framework of iTV based language learning pulled together different elements: focus group studies, learning affordances of iTV and language learning theories. As discussed in section 7.2, each of these elements produces rich knowledge that could enable us to envision a number of different activities and features with the potential to be developed through a number of different technological support tools for language learning. For example, looking at the learning theories (discussed in section 7.2.3), different kinds of technological support tool could be developed. One team could take the socio-cultural approach to language learning and develop a collaborative tool that could support learner's interactions and communications via iTV and mobile devices. Different area of language skills could be supported, for example through development of language learning games. Looking at the affordances of iTV, another team could decide to develop tools and content to support reading and spelling skills, while another might focus on supporting listening and comprehension skills. Implementing a single system that could fulfil all the attributes and ideas driven from the learning theories, affordances of iTV and user studies could not realistically be achieved.

In order to direct the development process in this project and to test some of the ideas derived from the framework, we decided to explore the potential of *scaffolding* elicited

in the focus group studies and to develop the system that could support learning informally via iTV and mobile phones. As discussed in section 7.2, the scaffolding function is clearly aligned with what is referred to in Krashen's theory of language learning as the "creative constructionist" approach (Krashen, 1981; 1982). On the other hand, the learning affordances of iTV also indicate its strength in supporting listening and comprehension skills and in learning new language items, which could also be further enhanced through the scaffolding functions. In directing the design and development, we tried to include these concerns, supporting cross platform learning via iTV and mobile phone, enabling learning from authentic and engaging TV programmes that show different contexts and situations, providing extra scaffolding support to enable learners to understand a programme better and to get more from their television viewing in an unobtrusive way. In this process, learners may be enabled to practice and improve their listening and comprehension skills as well as learning a new language item (e.g. vocabulary, idiomatic expressions).

As discussed in Chapter 6, the characteristics of scaffolding support while learning from a foreign television programme were perceived to be similar across different languages in our user study. Our participants liked to obtain scaffolding support for difficult language items with their explanation in the target language, to use a dictionary and also to learn new language items that were used in a programme. Therefore, in the scenario development, we tried to demonstrate this functionality, indicating the *generic* characteristic of the scaffolding support, through two languages: English and French.

The next phase was to conceptualise the system via scenarios and to elicit a list of general requirements from the proposed scenarios that direct the design and development process. The process of requirements elicitation is depicted in Figure 7.2, which shows the link between the framework, scenarios and requirements.

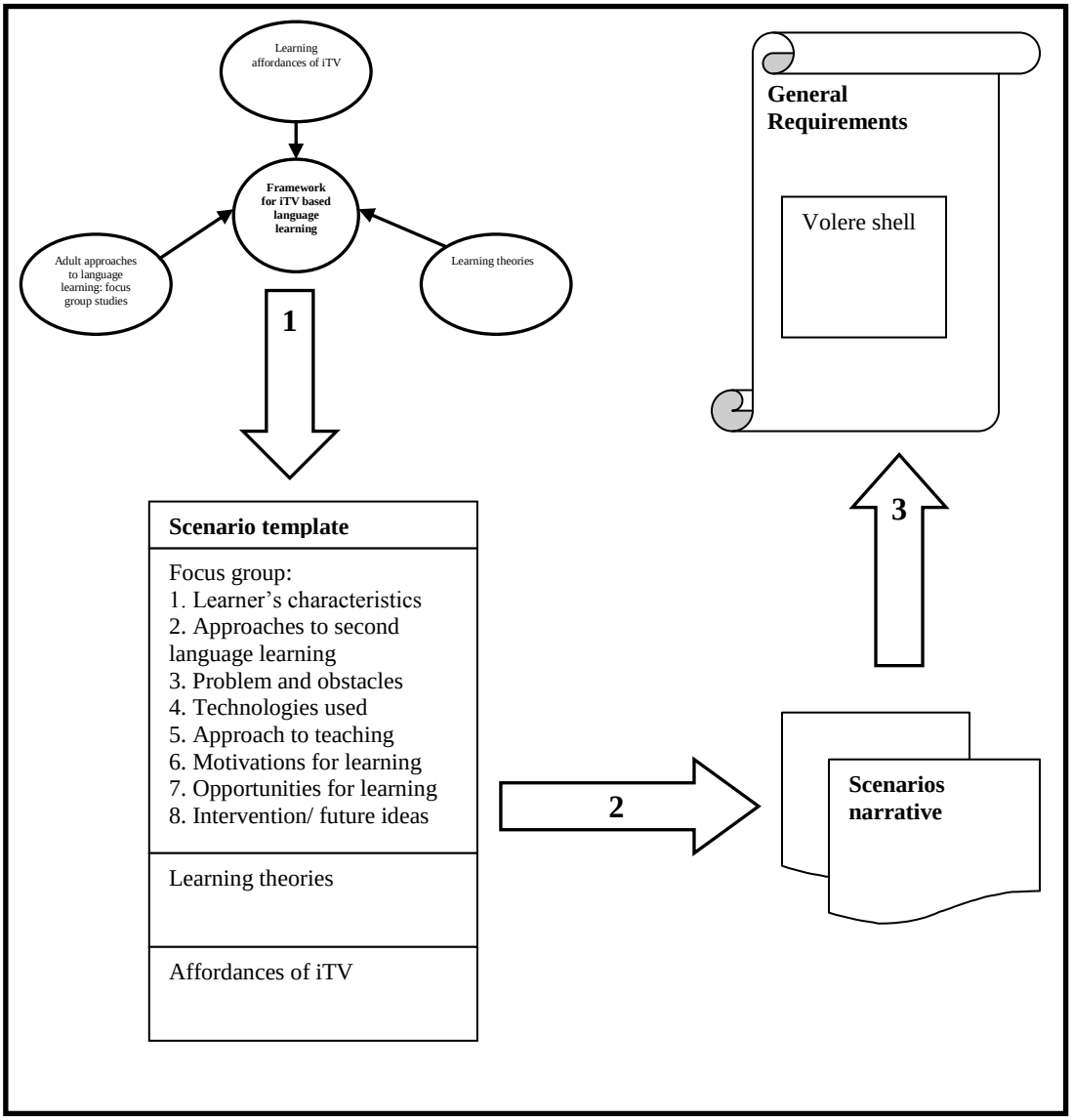


Figure 7-2: The requirements development process: the relationship between framework, scenarios and requirements

This process had the following phases:

- Phase 1: Development of a scenario template: different elements of the framework have been included in a template to provide evidence of the reasoning that led to the development of scenarios. Figure 7.2 illustrates the scenario template, which includes eight themes of the focus group studies (learner's characteristics, approaches to second language learning, problems and obstacles, technologies used, approach to teaching, motivations for learning, opportunities for learning and intervention), learning theories, and learning affordances of iTV.

In scenario development the focus group had the important spin-off effect of allowing us to create rounded personas, by grounding them in the characteristics of some of the individuals we talked to, e.g. medical students learning English. This should give more realism to the scenario and add to its capacity for generating design concepts (Nielsen, 2002).

- Phase 2: Development of scenario narrative: on the basis of the template a scenario narrative was envisioned, describing the learners and the activities that could be provided to support their language learning via iTV and mobile phone. The scenario development encouraged the design to be both imaginative and realistic. It is also a practical technique for the preparation of a detailed grounding, which is important when envisioning a novel set of activities designed into a new system. Also, building scenarios helped in assessing the technical feasibility of cross platform development (described in Chapter 8).

- Phase 3: Development of requirements from the scenarios: common activities and functions that are supported from the scenarios are abstracted out and presented as general requirements that direct the design and development of the language learning environment. Each requirement is put in the Volere shell (Robertson and Robertson, 2006) in order to provide a detailed description and a rationale for its drivers. Figure 7.3 illustrates the Volere shell used to document requirements.

Figure 7-3: The Volere shell used to document requirements (Robertson and Robertson, 2006)

In order to provide a practical account and reasoning for the development of scenarios and requirements, we provide the following examples, explaining the three phase processes that carried out. Section 7.3.1 provides the description of two scenarios in the template. On the basis of these two templates, two scenario narratives were envisioned as described in section 7.3.2. The process of eliciting requirements, together with a list of general requirements that emerged from our proposed scenarios, is discussed in section 7.3.3. Finally, we provide a detailed rationale for each requirement using the Volere shell, discussed in section 7.4.

7.3.1 Phase 1: Development of scenario template

This section provides two scenarios with a detailed description of their elements presented in the scenario template. This is outlined in Table 7.1 and 7.2.

Scenario template Scenario (I) Source	Aspect	Details
Focus groups	1. Learner characteristics	- A university lecturer interested in learning different languages, in particular French; age 48 - A university student undertaking French language; age 21
	2. Approaches to second language learning	Using combination of methods, formal and informal. For example, attending language class or using media technologies, such as listening to radio, reading novels, watching television programmes (news, soap opera, etc.) and listening to songs.
	3. Problems and obstacles	- Reading a full subtitled programme and listening at the same time to programme's sound track - Understanding difficult vocabulary and regional language items that usually appear in an authentic television programme
	4. Technologies used	Books (novels, magazine), TV (soap opera, news), subtitled TV, Radio, CDs, mobile phone.
	5. Approach to teaching	- Learning new language items (e.g. vocabulary) - Focusing on developing listening and comprehension skills
	6. Motivations for learning	- Learning informally while doing enjoyable activities, e.g. watching favourite TV programmes - Watching and understanding French dramas and news - Learning new language items - Learning from authentic TV programmes that show different contexts and situations
	7. Opportunities for learning	- Travelling or living in a foreign country - Getting qualifications - Accessing authentic materials, e.g. magazine, TV, radios, novels, music, etc. - While sharing the TV in a household, still being able to learn on an individual basis via mobile phone - Learning on the move
	8. Intervention/future ideas	- Authentic materials: support learning from authentic materials - Learning in context: support learning in the context of TV programmes - Scaffolding: support learning a new language item,

Scenario template Scenario (I) Source	Aspect	Details
		scaffold difficult language items with explanations that could be accessed during, before and after a programme show time, scaffold overall understanding (summary), provide dictionary - Usage patterns of (i) TV: people usually share TV among household - Sociability: Support learners in an unobtrusive fashion - Learning on the move: support learning individually via mobile phone while sharing television
Learning theory	The creative constructionist theory (Krashen; 1981; 1982)	- Provide "comprehensible input" by scaffolding, e.g. scaffold difficult language items that are slightly above the current level of learner's competence with explanations, scaffold overall understanding through programme summary and dictionary. - Enable learners to construct their own individualised knowledge (language items) for later practices.
Affordances of iTV		- Television is mainly seen as "leisure" rather than "learning" (Ling and Thrane, 2002). - Television enables learning from up-to-date and authentic content (Sherrington, 1973; Meinhof, 1998). - Television can support listening and comprehension skills (Sherrington, 1973; Meinhof, 1998). - Television can support learning new language items (Sherrington, 1973; Meinhof, 1998).

Table 7-1: Scenario template I: learning French from French TV programmes (drama and news)

Scenario template Scenario (II) Source	Aspect	Details
Focus groups	1. Learner characteristics	Two medical students at UK university, learning English, age 24
	2. Approaches to second language learning	- Using combination of methods, formal and informal - Use of subtitled TV to learn new vocabulary and see word's spelling - Use dictionary to check unknown terms while watching

Scenario template Scenario (II) Source	Aspect	Details
		TV
	3. Problems and obstacles	- Understanding regional accents - Understanding difficult vocabularies and regional language items that usually appear in an authentic television programme - Sharing TV with others
	4. Technologies used	TV (soap opera, news), subtitled TV, mobile phone.
	5. Approach to teaching	- Learning new language items (vocabulary) - Focusing on developing listening and comprehension skills
	6. Motivations for learning	- Learning informally while doing enjoyable activities, e.g. watching favourite TV programme - Understanding real/native speaker's conversations - Watching and understanding English soap opera and news - Using satellite television to learn about English culture
	7. Opportunities for learning	- Travelling or living in a foreign country - Getting qualifications - Accessing authentic materials, e.g. TV programmes - While sharing TV in households, still being able to learn on an individual basis via mobile phone - Learning on the move
	8. Intervention/future ideas	- Authentic materials: support learning from authentic materials - Learning in context: support learning in the context of TV programmes - Scaffolding: support learning a new language item, scaffold difficult language items with explanations that could be accessed during, before and after a programme show time, scaffold overall understanding (summary), provide dictionary - Usage patterns of (i) TV: people usually share TV among household - Sociability: Support learners in an unobtrusive fashion - Learning on the move: support learning individually via mobile phone while sharing television
Learning	The creative	- Provide "comprehensible input" by scaffolding, e.g.

Scenario template Scenario (II) Source	Aspect	Details
theory	constructionist theory (Krashen; 1981; 1982)	scaffold difficult language items that are slightly above the current level of learner's competence with explanations, scaffold overall understanding through programme summary and dictionary - Enable learners to construct their own individualised knowledge (language items) for later practices
Affordances of iTV		- Television is mainly seen as "leisure" rather than "learning" (Ling and Thrane, 2002). - Television enables learning from up-to-date and authentic content (Sherrington, 1973; Meinhof, 1998). - Television can support listening and comprehension skills (Sherrington, 1973; Meinhof, 1998). - Television can support learning new language items (Sherrington, 1973; Meinhof, 1998).

Table 7-2: Scenario template II: learning English from English TV programmes (soap opera and news)

7.3.2 Phase 2: Development of scenario narratives

In this section, we describe the following two scenarios (I and II) developed on the basis of the templates discussed above.

7.3.2.1 Scenario (I)

Martha lectures in the English department of the University of the South Coast. She has always been interested in languages, mainly because of her life experiences. After a degree in English and French in Bristol, UK, she spent three years living in Quebec, where her hydro-engineer husband's job had sent him. She kept up her French there via reading novels and also by watching popular soap operas, which also gave her some conversational material when chatting to neighbours.

She and the family spend many holidays in France - a good reason for keeping her French up to scratch. She has a subscription to a monthly CD magazine in French which she listens to in the car. She likes the songs and poetry that are included and tries to learn them by heart, talking and singing along to herself in the privacy of the car. She also has her car radio tuned to a local French radio station.

Her Quebec experience has taught her just how effective television can be for getting used to other languages and learning about foreign cultures, and this was at the back of her mind when she took out a subscription to satellite TV. In particular, she liked the idea of being able to see different situations and learn in the context of a number of different authentic TV programmes. She knew that French TV channels were available and harbours a hope of interesting her son Tom and daughter Emma in French. Tom shows no interest in languages: for him French means boring weeks in the French countryside. Emma, however, is keen on languages and is hoping to shine in her exam next term.

Martha has discovered a French TV station that broadcasts with subtitles (in French), which she finds give just the right level of help to allow her to understand the news and dramas without too much concentration. It's useful, as it enables her to see word spelling and also increases word and phrase recognition. However, she finds it difficult to keep up with the speed of subtitles, especially as she's typically doing something else as she watches, whether preparing a meal or talking to the children. The subtitles are usually displayed very fast and it would be helpful if she could adjust them according to her own pace. She can also manage some types of programme without subtitles, but finds it hard to ignore them if they're on the screen. She often finds herself reading the subtitles rather than trying to make out the speech.

Watching television with her children represents precious 'quality time' for Martha, and she certainly doesn't want to make it a chore by insisting they watch educational programmes together. However, she'd like to watch with them while learning some extra odd French words or phrases. She has just read that a new service has become available via cable, enabling viewers to watch subtitles in the language of their choice and to learn new vocabulary via a personal vocabulary service displayable on the television screen or mobile phone. Viewers can use their mobile phone to learn individually while watching in company. Martha is not a fan of mobile phones, though. She has one just for emergencies.

Martha has managed to persuade Tom and Emma that an episode of the police drama Maigret on French TV will be fun to watch. Tom enjoys Maigret, and even recognises a few French words, but the subsequent prospect of the news in French is too much for

him and he disappears to his room. Martha is happy to watch the news and understands almost everything. Emma is keen to try, with her exams looming, but less confident, so she tries the new service by clicking the red button. The service is on its default setting, which displays numbers and proper names. As the news item is broadcast, the newscaster tells viewers about the tense new situation between Havana and Washington. On the semi-transparent overlay on the screen, the name 'La Havane' and its explanations, 'Havana', are displayed, allowing Emma to grasp this unknown term (see Figure 7.2). Emma's quite impressed, especially since the vocabulary she's just seen will also be sent to her mobile, where it will be accessible in her individual learning area (see Figure 7.3). Emma could also use her mobile phone to review the words she just watched and the programme summary on the way to University. The dictionary is also available if she needs to check some unknown terms.

After the news, Martha spots that a classic Truffaut film is on the following evening. Some time during the day she'll make some time to read through the synopsis on the interactive pages so that she won't need to use the subtitles at all (Meinhof, 1998, p.14-15). If Emma wants to join in, she can access the synopsis beforehand on her phone, and receive explanations of words on the phone as she watches. She normally has her mobile with her on the sofa anyway, to text her friends. The unobtrusiveness of the mobile phone approach enables both to enjoy watching the TV as well as giving the sense that they have achieved something worthwhile.

Figure 7-4: iTV display screenshot

Figure 7-5: Mobile phone display screenshot

7.3.2.2 Scenario (II)

Jayron is a medical student studying at Brighton University. She always wanted to improve her English to the degree that she could understand real conversation or watch and follow English soap operas. One of the reasons she agreed to pay for a satellite subscription was to be able to hear English language in context and to learn more about English culture. She found subtitles to be useful for learning word spelling and linking this to pronunciations. She sometimes writes down words that she does not understand so that she can check them later in a dictionary. Most of the time she loses this piece of paper, or is too lazy to take the dictionary down from the shelf to check the meaning quickly enough to commit the words to memory. She has just realised that a new language learning service is available using iTV and mobile phone. The service enables her to learn new English words, together with their explanations, from an up-to-date authentic television programme. It also allows her to use her mobile device to request language learning services, and to learn in the context of the programme. Vocabulary related to different subjects within each TV programme can be displayed on the TV screen or accessed by mobile phone. She likes the idea of using her mobile phone as she often shares TV with her housemate.

A message on the TV screen indicates that a language learning service is available at the press of a button on the remote control. When she presses the required button, the language learning application is executed, which also streams the television programme she is viewing in the top corner of the screen. She can choose to view all the vocabulary that the system recommends, together with explanations, and/or to watch the

programme, with annotations of the vocabulary as it appears. A dictionary is also available.

For a few days before and after the programme she can use her WAP enabled mobile phone to download and practice the entire vocabulary the system recommends. She also saves some vocabulary on her mobile phone for later practice. She usually uses her mobile phone whilst watching with her boyfriend Jack, who has no interest in her language learning. In Jayron's experience, the best thing about using the mobile phone is that it facilitates learning individually while still allowing people to watch in a group. Jayron also uses the service to learn and practice the vocabulary prior to the show, when she is on the train coming back from work. This enables her to enjoy watching the soap operas as well as giving her the sense that she has actually achieved something. She also enjoys practicing the words she added to her mobile phone while coming home from work. By doing this she can make sure she will enjoy the programme even more. A mobile dictionary is also available and she frequently uses it, especially when she is out shopping. She can check out words that she notices in the mall and make sure that she always buys the right items.

Her friend Manuela also decided to subscribe to the service. Unlike Jayron, she has no interest in English soaps, but she can choose other programmes that she often watches. In particular, she watches the news and finds the service useful because it helps her to understand the programme better. She finds some accents difficult to comprehend, so using the annotation function (in a similar way to subtitles) helps her to understand what has been said. Also she finds it useful to have an overall picture of the news headlines. The system makes this easy by providing a news summary both on iTV and the mobile phone. She usually prefers to read it prior to the programme on her mobile phone. The greatest advantage of learning in this way is that it blends into her normal day-to-day activities. Not only does she find the experience enjoyable, but also very rewarding.

The next section describes the final phase of the requirement development process.

7.3.3 Phase 3: Development of requirements from the scenarios

The final phase of requirement development was to abstract out common activities that are envisioned through our scenarios. In order to do this, we analysed the narrative of the scenarios and identified activities that the system should support. These are presented as a list of general requirements to direct the design and development process. Table 7.4 provides one practical example. Through this analysis, we have abstracted seven general requirements. We used the Volere shell (Robertson and Robertson, 2006) in order to provide the detailed reasoning for and description of each of these requirements and to indicate where they originated from, as discussed in section 7.4. The set of general requirements abstracted out from the proposed scenarios is as follows:

GR 1. Support language learning on anytime and anywhere basis.

GR 2. Support learner's decision to learn from authentic television programme.

GR 3. Support language learning in context.

GR 4. Support learner's understanding of authentic materials broadcast on television by scaffolding.

- GR 4.1. Scaffold learner's overall understanding of the programme.
- GR 4.2. Scaffold difficult language items that appear in a programme.
- GR 4.3. Provide support for just-in-time scaffolding.

GR 5. Support learners in constructing their own individualised environment that can be accessible on an anytime and anywhere basis.

GR 6. Support learners in accessing and retrieving their own individualised knowledge on an anytime and anywhere basis.

GR 7. Support learning in an unobtrusive fashion.

Scenarios' activities	**Abstracting out a common activities**	**General Requirement**
Scenario (I)		
Martha lectures in the English department of the University of the South Coast. She has always been interested in languages, mainly because of her life experiences…. She kept up her French there via reading novels and also by watching popular soap operas, which also gave her some conversational material when chatting to neighbours…. She has a subscription to a monthly CD magazine in French which she listens to in the car. She likes the songs and poetry that are included and tries to learn them by heart, talking and singing along to herself in the privacy of the car. She also has her car radio tuned to a local French radio station….	Learners do different activities and use different technologies for their language learning. They see many opportunities to learn a language at different times and in different places. In particular, learning on the move and from an authentic TV programme was advantageous.	GR 1
Her Quebec experience has taught her just how effective television can be for getting used to other languages and learning about foreign cultures, and this was at the back of her mind when she took out a subscription to satellite TV. In particular, she liked the idea of being able to see different situations and learn in the context of a number of different authentic TV programmes…. She knew that French TV channels were available and harbours a hope of interesting her son Tom and daughter Emma in French….	Learners appreciate learning from authentic TV programmes that supports learning: • about a target language and culture • in different situations and contexts	GR 2 GR 3

Scenarios' activities	Abstracting out a common activities	General Requirement
Martha has discovered a French TV station that broadcasts with subtitles (in French), which she finds give just the right level of help to allow her to understand the news and dramas without too much concentration. It's useful, as it enables her to see word spelling and also increases word and phrase recognition. However, she finds it difficult to keep up with the speed of subtitles, especially as she's typically doing something else as she watches…. Watching television with her children represents precious 'quality time' for Martha, and she certainly doesn't want to make it a chore by insisting they watch educational programmes together. However, she'd like to watch with them while learning some extra odd French words or phrases. She has just read that a new service has become available via cable, enabling viewers to watch subtitles in the language of their choice and to learn new vocabulary via a personal vocabulary service displayable on the television screen or mobile phone. Viewers can use their mobile phone to learn individually while watching in company….	Learners appreciate scaffolding support (before, during, after) in the form of on-screen display and subtitle in order to • aid comprehension of a TV programme, e.g. explanations and annotations of difficult language items, programme summary and dictionary • learn new language items	GR 4 GR 4.1 GR 4.2 GR 4.3

Table 7-3: A practical example: extract from the scenarios narrative (I), abstracting out common activities in a form of general requirements

The rest of the scenarios were analysed in the same way, to arrive at the general requirements.

7.4 Lists of general requirements in the Volere shell

In this section we provide a detailed description and rationale for each general requirement using the Volere shell (Robertson and Robertson, 2006). It should be noted that the fields for customer satisfaction, customer dissatisfaction, priority, conflict and history were removed in our documentation for the requirements as they were not relevant in the context of this project.

Requirement #	**GR 1: Support language learning on anytime and anywhere basis**
Requirement Type	General
Event/use case #	Scenario I and II
Description	System should provide a ubiquitous interface across two platforms, iTV and mobile phone, which can be accessed on anytime (before, during, after) and anywhere basis (on move and in the living room).
Rationale	This requirement is based on the result of our focus group studies, which indicate that participants liked to fit learning into different moments of their lives, e.g. on the move. The fact that mobile phone could be used ubiquitously was appreciated. The results of focus group changed the direction of the project to support cross platform via combination of two devices: iTV and mobile phone to facilitate ubiquitous learning.
Originator	Focus group studies
Fit Criterion	The requirement will be fulfilled once the system provides ubiquitous interface across two platforms iTV and mobile phone.
Supporting materials	Chapter 6

Table 7-4: GR 1 in Volere shell

Requirement #	**GR 2. Support learner's decision to learn from authentic television programme**
Requirement Type	General
Event/use case #	Scenario I and II
Description	System should be generically designed in order to assist learning from authentic television programmes of all kinds. (e.g. news, documentaries, soap operas).
Rationale	This requirement is based on our focus group studies. The results indicate that our participants appreciated learning from authentic TV programme of all kinds.
Originator	Focus group studies
Fit Criterion	The requirement will be fulfilled once the system enables learning from a

	number of authentic television programmes.
Supporting materials	Chapter 6

Table 7-5: GR 2 in Volere shell

Requirement #	**GR 3. Support language learning in context**
Requirement Type	General
Event/use case #	Scenario I and II
Description	System should allow learning in the context of a TV programme. The language learning materials should be provided in the context of a programme.
Rationale	This requirement is based on our focus group studies. The results indicate that our participants appreciated obtaining support in the context of an authentic television programme. In this way, the system could aid comprehension of a programme and in learning new language items that are relevant and specific to a target language and culture.
Originator	Focus group studies
Fit Criterion	The requirement will be fulfilled once the system enables learning in the context of a television programme.
Supporting materials	Chapter 6

Table 7-6: GR 3 in Volere shell

Requirement #	**GR 4. Support learner's understanding of authentic materials broadcast on television by scaffolding**
Requirement Type	General
Event/use case #	Scenario I and II
Description	The system should provide the scaffolding support that assists learner's comprehension of a television programme and learning new language items (e.g. vocabularies). Two sub-requirements are devised: GR 4.1 and GR 4.2.
Rationale	This requirement is based on the result of our focus group studies that our participants required scaffolding support to assist them in learning new language items and also in understanding/comprehension of target language TV programme. Moreover, the review of language learning theories indicates the potential of scaffolding in assisting language acquisition. Krashen's theory of creative constructionist mainly supports this type of scaffolding (1981; 1982). The learning affordances of iTV also indicate its strength in supporting listening and comprehension skills and in learning new language items,

	which could be exploited through the scaffolding support (Bean and Wilson, 1989; Spanos and Smith, 1990; Parks, 1994; Koskinen et al., 1996; Koolstra and Beentjes, 1999; Friedman, 2001). In the scenario, we demonstrate how the scaffolding support could be provided in the form of on-screen display and annotation, which could assist learner's comprehension of a programme as well as in learning new language items. It is also important to note that the nature of scaffolding support described in our scenarios is generic across different languages. Our focus group participants regardless of their nationality and the language that were studying appreciated unobtrusive support in the form of subtitles, explanations and annotations that help them to learn new language items and aid general comprehension and understanding of a programme.
Originator	Focus group studies
Fit Criterion	The requirement will be fulfilled once the system provides scaffolding support to learn new language items from a television programme and aids in general comprehension and understanding of a programme.
Supporting materials	Chapter 6 and section 7.2 of this chapter.

Table 7-7: GR 4 in Volere shell

Requirement #	**GR 4.1. Scaffold learner's overall understanding of the programme**
Requirement Type	General
Event/use case #	Scenario I and II
Description	System should provide facility to improve learner's understanding/comprehension of the programme, e.g. by provision of a programme summary and dictionary.
Rationale	Focus group studies showed our participants appreciated unobtrusive support to aid their understanding and comprehension of a programme. In particular, the potential of dictionary and programme summary was mentioned as useful in enabling learners to check unknown terms and also to get overall picture of a programme.
Originator	Focus group studies
Fit Criterion	The requirement will be fulfilled once the system provides dictionary and a summary of a programme.
Supporting materials	Chapter 6

Table 7-8: GR 4.1 in Volere shell

Requirement #	GR 4.2. Scaffold difficult language items that appear in a programme
Requirement Type	General
Event/use case #	Scenario I and II
Description	System should recommend a number of difficult language items, with explanation, that are slightly above the learner's level of competence, and are important to know for understanding a programme. System should also enable asynchronous access of these language items, e.g. prior to, during and after a programme via mobile phone, to enable learning on an anytime and anywhere basis. In addition to this, a dictionary should be provided to enable learners to check any unknown terms.
Rationale	This requirement is based on the result of our focus group studies showing that our participants appreciated scaffolding support to learn new language items from television programmes. Moreover, Krashen's theory of creative constructionist indicates that scaffolding support that is "comprehensible" will assist language acquisition. Therefore, the system should provide explanations and annotation support for difficult language item that appear in a programme.
Originator	Focus group studies
Fit Criterion	The requirement will be fulfilled once the system provides a list of difficult language items with explanations.
Supporting materials	Chapter 6 and section 7.2 of this chapter

Table 7-9: GR 4.2 in Volere shell

Requirement #	GR 4.3. Provide support for just-in-time scaffolding
Requirement Type	General
Event/use case #	Scenario I and II
Description	System should provide just-in-time support for learning difficult language item as they appear on a show by annotating them with explanations in a way similar to subtitles on TV. Alternatively, these language items could be also accessed on mobile phones.
Rationale	Based on the result of our focus group studies. Learners required just-in-time scaffolding of difficult language items with explanations to aid in general comprehension and understanding of television programmes while it is actually running in an unobtrusive way similar to subtitles. Moreover, through the just-in-time scaffolding support, we can provide "comprehensible input" that could assist in language acquisitions (Krashen, 1981; 1982).

Originator	Focus group studies
Fit Criterion	The requirement will be fulfilled once the system provides annotations and explanations of difficult language items in an unobtrusive way similar to subtitles.
Supporting materials	Chapter 6 and section 7.2 of this chapter.

Table 7-10: GR 4.3 in Volere shell

Requirement #	**GR 5. Support learners in constructing their own individualised environment that can be accessible on an anytime and anywhere basis**
Requirement Type	General
Event/use case #	Scenario I and II
Description	System should support learners in constructing their own individualised language learning environment, enabling them to add those language items they found useful to their personal language learning space, and to remove them.
Rationale	Based on focus group results and Krashen's theory of creative constructionist. Our focus group participants appreciated any facilities that enable them to practice those language items that they have learnt. In particular, the concept of vocabulary book was popular as it enabled saving and retrieving language learning items for later practice. Moreover, as discussed earlier in this chapter, Krashen's theory also advocates that enabling learners to create their own learning space and content could assist in second language acquisition.
Originator	Focus group studies and Krashen's theory of creative constructionist (1981; 1982)
Fit Criterion	The requirement will be fulfilled once the system enables the learner to add a language item (from a recommended list) to his/her personal learning space, which could be also accessed via iTV and mobile interface for later practice.
Supporting materials	Chapter 6 and section 7.2 of this chapter.

Table 7-11: GR 5 in Volere shell

Requirement #	**GR 6. Support learners in accessing and retrieving their own individualised knowledge on an anytime and anywhere basis**
Requirement Type	General
Event/use case #	Scenario I and II
Description	System should support learners in retrieving their individualised language items, which have been saved via both iTV and mobile interfaces.

Rationale	This requirement is based on the result of our focus group studies and Krashen's theory of creative constructionist. Learners should be enabled to create, access and retrieve their own individualised language learning content for later practice. In this way, they can construct their own vocabulary list.
Originator	Focus group studies and Krashen's theory of creative constructionist (1981; 1982)
Fit Criterion	The requirement will be fulfilled once the system enables learners to access and retrieve language items from their personal learning space available via iTV and mobile interface for later practice
Supporting materials	Chapter 6 and section 7.2 of this chapter.

Table 7-12: GR 6 in Volere shell

Requirement #	**GR 7. Support learning in an unobtrusive fashion**
Requirement Type	General
Event/use case #	Scenario I and II
Description	System should be designed to support learning in an unobtrusive way, mainly by not introducing a new device or imposing educational materials on fellow viewers who may not be interested in learning a language.
Rationale	Based on focus group studies. Participants required unobtrusive support in a form of annotations and on-screen display that does not obscure their natural way of television viewing. In particular, they perceived television as a shareble device that could be used amongst household members. However, they liked the concept of incorporating it with mobile phone in order to learn individually while using television in company.
Originator	Focus group studies
Fit Criterion	The requirement will be fulfilled once the systems provides unobtrusive support, in a form of on-screen display and annotations. Also, facilities should be provided through two devices, iTV and mobile phone, that could be used as preferred by a learner.
Supporting materials	Chapter 6

Table 7-13: GR 7 in Volere shell

7.5 Conclusions

This chapter discusses the shaping of requirements for a language learning system. A framework for iTV based language learning was developed, incorporating theories and pedagogical approaches to learning with practical data on how people learn languages and use technologies. This framework suggests a cross platform language learning approach that responds to many of the principles articulated by language learners, learning theories and affordances of iTV technology. Two scenarios were developed to conceptualize the design and to generate a number of requirements for iTV and mobile phone based language learning systems.

The framework for an iTV based language learning system proposed in this chapter could be used to inform many different design concepts. Another researcher could use this framework to define different learning activities, scenarios and requirements. In Chapter 8 we provide a detailed description of the TAMALLE system designed and developed based on our proposed scenarios and requirements.

Chapter 8 Design and implementation of a television and mobile assisted language learning environment

8.1 Introduction

In this chapter we concentrate on the design and implementation of TAMALLE, a cross platform informal language learning support system. The system aims to capitalise on the strengths of two specialised technologies, iTV and mobile phone, which tend to be used in different settings and at different times.

We first provide a description of the TAMALLE application (section 8.2). Then we propose a cross platform architecture for TAMALLE development (sections 8.3 and 8.4), followed by our rationale and analysis for cross platform interface design (sections 8.5 and 8.6). Screenshots of the implemented TAMALLE system are also provided. Finally, we discuss the interaction design issues that arise in the context of cross platform dual device systems for ubiquitous language learning (section 8.7).

8.2 TAMALLE description

The prototype of the cross platform language learning support system via iTV and mobile phones, TAMALLE, was developed based on the requirements outlined in Chapter 7. TAMALLE is an informal language learning environment that has dual interfaces across iTV and mobile phones. It can support learning from authentic television programmes, e.g. news, soap-opera, documentaries. The cross platform individual language learning area or sphere, on both iTV and mobile phone devices, allows learners to incorporate “edutainment” with their language learning experiences. To this end, the system provides support for comprehension of specific language items for viewers as they watch a foreign language television programme, that is pitched at a level slightly above their current level of language competence. These language items can be incorporated by learners into their learning sphere, which is also accessible via their mobile phone.

TAMALLE is also a context aware system, in that the mobile sphere supports learning in the context of the TV programme. The television provides authentic materials and a context for learning. The mobile can scaffold learners' understanding of the programme by enabling them to access the programme summary as well as difficult language items, including vocabulary and phrases, that may appear inside a programme. These language items can be accessed prior to, during and after the show. Learners are also enabled to add, find and remove these language items from/into their personal spheres. Even without television, the mobile is still useful as a tool for learning a new language items and for managing personal knowledge.

Annotation-based support is provided to scaffold difficult language items and culturally specific knowledge that helps learners in understanding the programme while watching. If more unknown terms were found, the TAMALLE dictionary could help to check meaning and giving examples. In this process, the system supports learners' comprehension of television programmes and learning of new language items.

The next section (8.3) discusses the technical architecture of TAMALLE system.

8.3 Cross platform architecture

We have investigated two possible end-to-end solutions based on a multi-tier client/server architecture consisting of the broadcast-end tier, the back-end tier and front-end tier for developing the language learning service.

One solution is to use the principle of IPTV architecture discussed in Chapter 3 for delivering learning materials and television content over the traditional IP network. The learning management system (LMS) can be developed and located in the broadcast-end or back-end tier. This LMS provides content to both set-top-box and mobile devices and also holds learning content or learning objects in a database on the back-end tier (MySQL). The television programme in this case will be streamed into the system and will be delivered to the user via IP network. In the front-end tier we have the set-top-box and WAP enabled mobile devices. Two-way communications can be established between set-top-box and back-end tier through telephone modem or ADSL, while mobile phone devices communicate with the back-end tier (Web server) through the

WAP protocol. For interactive SMS messaging, we can use SMS gateway providers. This architecture is illustrated in Figure 8.1 and for TAMALLE development we used this architecture.

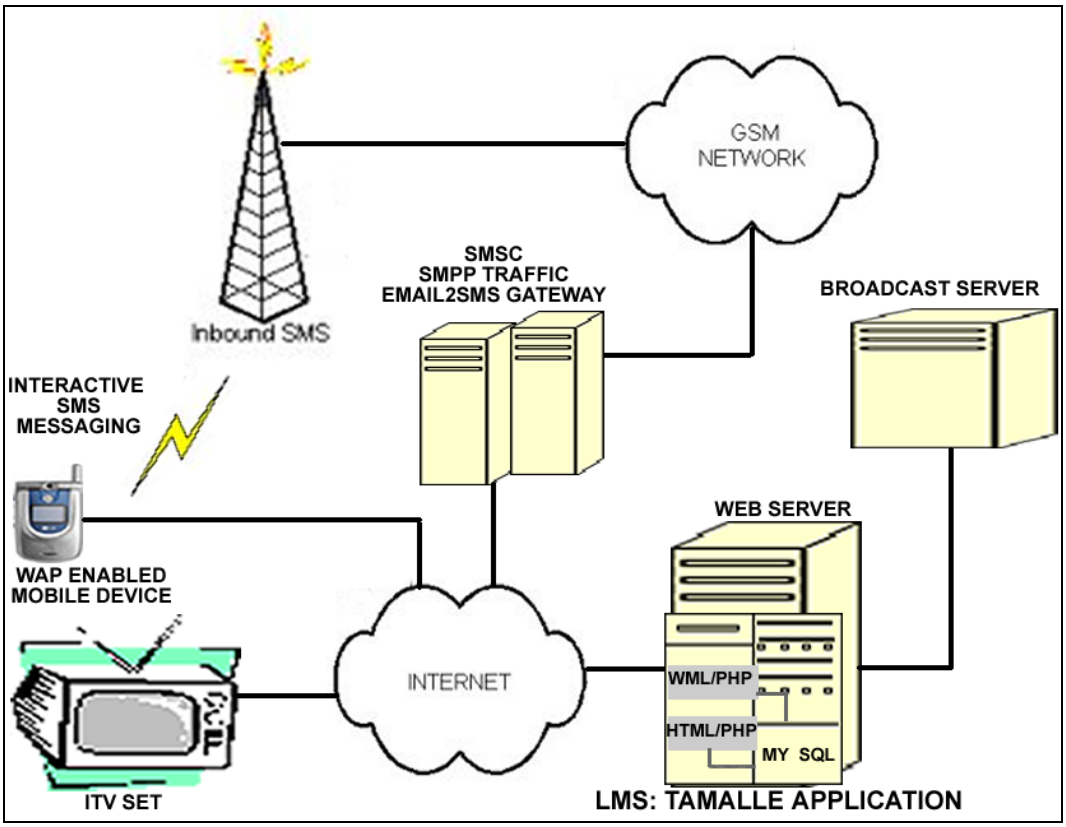


Figure 8-1: TAMALLE cross platform architecture

An alternative solution is to use Digital Video Broadcasting (DVB), Java enterprise solution and Bluetooth (Fallahkhair, 2004). The language learning content and mainstream television programme can be encoded and multiplexed before being broadcast via the DVB stream. The learning content will be retrieved by a client based Java application located in an MHP based set-top-box that also provides the API required for content retrieval and presentation to the mobile devices.

The end-to-end solution architecture for delivering language learning content to both set-top-box and mobile phones is illustrated in Figure 8.2. We propose a multi-tier architecture consisting of broadcast-end tier, back-end tier and front-end tier. The server-side architecture is based on the Java 2 Enterprise Edition (J2EE) and the mobile phone client-side development uses Java 2 Micro Edition (J2ME). Bluetooth technology allows set-top-boxes and mobile devices to communicate wirelessly and the J2ME

development environment allows writing custom applications and deploying them on mobile devices.

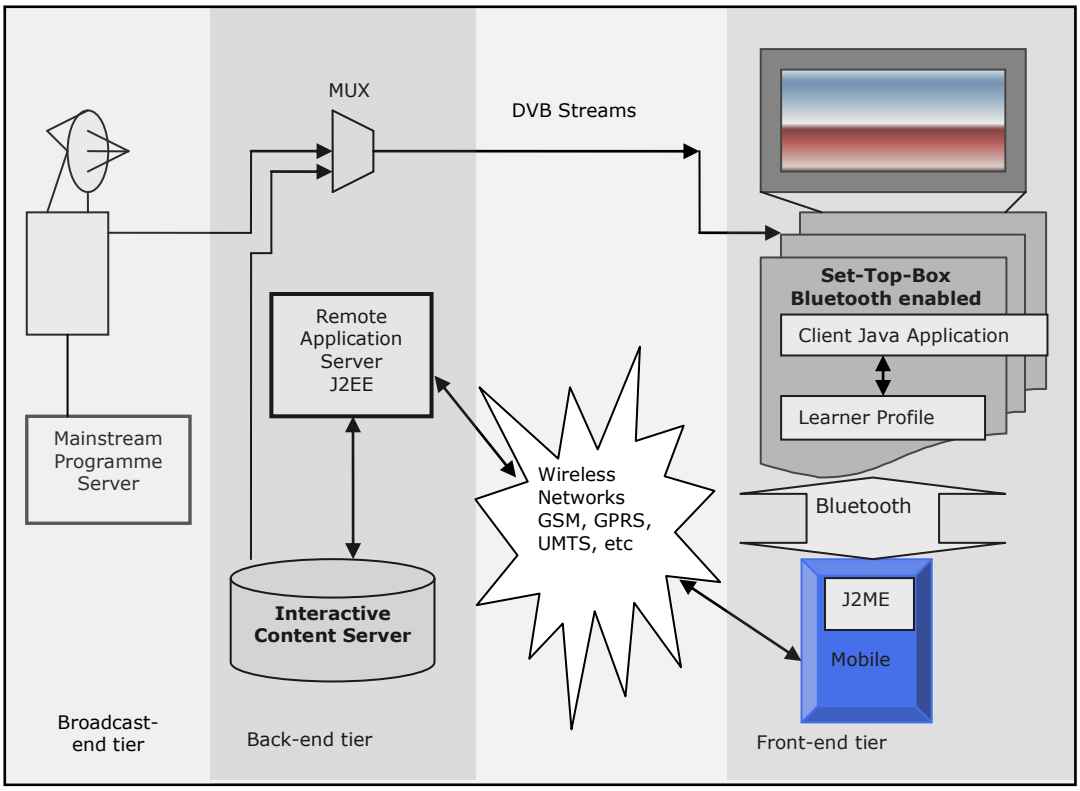


Figure 8-2: Cross platform architecture

The **Mainstream Programme Server** at the broadcast-end contains television programme genres like soap opera, news, documentaries, etc., which can be enhanced by incorporating additional information, learning content, retrieved from an interactive content server. The **Interactive Content Server** and **Remote Application Server** are located at the back-end tier. The Interactive Content Server is a data store that holds the language learning content/data such as relevant vocabularies related to each television programme. The language learning content/data and mainstream programme can be encoded and multiplexed before being broadcast via the DVB stream. The **Remote Application Server**, on the other hand, runs J2EE (Inscore and Kassem, 2002), which deals with the mobile requests that are routed through a wireless network (GSM, GPRS, UMTS, etc.). The **Remote Application Server** processes the request by interacting with the Interactive **Content Server**, mobile services, and user session information, and then generates and formats a response. The response is then sent back to the mobile phone device via the wireless network. The Java based TCP-IP stack can be used to establish communication over GSM, GPRS, UMTS, and similar network.

The **set-top-box** at the front-end tier is Bluetooth enabled, MHP based, with no return channel to the back-end. The set-top-box can hold a **Client Java Application** and **Learner's Profile** component. The Client Java Application is developed to fetch and decode interactive content and provide an interface for content presentation and retrieval onto the TV and/or mobile phone devices. The link layer communication between set-top-box and mobile phone can be via a Bluetooth link. Learning content is likely to be displayed as an overlay similar to a closed caption or subtitle on television screen. The J2ME application running on the mobile phone device retrieves and displays learning content provided from the set-top-box via a Bluetooth link (Mahmoud, 2003). J2ME also enables learners to save and build their own personal dictionary for later use. Another option for the mobile device is to communicate directly with the J2EE server asynchronously when real time learning content is not required, to acquire the learning content prior to the programme broadcast time.

The (optional) **Learner's profile** component, in our architecture is designed to be located in the front-end tier. The Learner's profile component may contain the learner's information, such as age, motivations, language of interest, preferences and language level of competence. The Learner model may also include interaction and viewing habits that are tracked automatically by the system. The Learner profile is stored in the set-top-box in the front-end tier in case it is required for recommendation or personalisation services.

8.4 TAMALLE implemented system

In the previous section, two solution architectures were proposed for a cross platform system that could deliver language learning facilities through iTV and mobile phone. For the TAMALLE implementation we have used the architecture depicted in Figure 8.1, which initially used the IP network for delivering language learning facilities.

TAMALLE's architecture, as a server based technology, ensures its execution on any set-top-boxes that run HTML virtual machine. In particular, with the IPTV infrastructure, which follows similar multi-tier architecture and underlying technologies (IP network), TAMALLE could be delivered not only by a broadcasters and platform providers, but also by other developers of iTV content that use IP based digital

television streaming for delivering interactive applications and content. The iTV side of TAMALLE system, developed using PHP and XHTML languages, can be accessed from http://itsuite.it.brighton.ac.uk/student/sf1/web/practice/tamalle.html.

In developing the mobile side of the application, we set up our IIS (Internet Information Services) server at Brighton University to parse WML content. The mobile application was developed using WML and PHP languages. Although a Motorola V600 phone was used for development and evaluation phases, the mobile side of the TAMALLE system can be accessed through any WAP enabled phone from http://itsuite.it.brighton.ac.uk/student/sf1/web/tamalle/tamalle.wml.

In the following section (8.5), we describe TAMALLE's cross platform interfaces and our rationale for design. A number of screenshots are provided to illustrate the functionalities of the TAMALLE implemented system, which is used for the evaluation studies discussed in Chapter 10.

8.5 Cross platform interface

Developing a cross platform interface that aims to provide functionalities across multiple platforms is a new and challenging area. Despite Robertson et al.'s pioneering CHI paper discussing coordinated iTV and PDA interaction (1996), little is known about cross platform interaction in general or about such interaction in the context of educational technology applications in particular. Robertson et al. (1996) developed a prototype of a multiple device system, consisting of iTV and PDA, for a real estate information service. Users were enabled to interact with the iTV application with the PDA or to use the application as a stand-alone service from both devices. One of the most important themes discussed in this study was the importance of analysing the affordances of individual devices before distributing the functionalities and interaction across them. However, as the nature of the application developed in the Robertson et al. study was different from this project and also there have been significant advances in mobile and iTV technologies since 1996, there were no practical guidelines available that could be used.

In designing TAMALLE, we analysed the affordance of each device. Technically both iTV and the mobile are capable of displaying and manipulating learning materials, which in this case are television programmes and accompanying textual annotations or other information. However, each device is different in terms of its strengths and weaknesses. It becomes clear that we need to study the capability of each device for supporting learning tasks.

There are other issues concerning the physical characteristics and limitations of each device, such as screen size, resolution and memory capabilities, which constrain the user interactions possible. ITV users are limited to a menu-style interface with navigation and action carried out via the remote control or in some cases with an infrared keyboard. Interaction styles with mobile phones are also limited in various ways: small screens (i.e. amount of data that can be displayed on one screen, as well as the size and placement of graphical, textual elements and navigations), soft key use (soft keys for selection and navigations are different in many phones) and memory constraints (Passani, 2002). Section 8.6 provides a detailed analysis of interaction design issues raised in the context of cross platform development.

In the following section we describe the main functionalities of TAMALLE and show how these are displayed and used on iTV and mobile phones. Four types of functionality are implemented and described: 1) scaffolding difficult language items, 2) scaffolding overall understanding, 3) just-in-time scaffolding and 4) managing personal learning sphere. Generally, there are three distinct characteristics for scaffolding support:

- Modelling: model the support required, for example just-in-time annotations
- Support: provide the support required to enable learners to perform a task
- Fading: reduce the support to let a learner become self-reliant (Wood et al. 1976; Pahl 2002)

The scaffolding provided in the TAMALLE prototype aims to support learners in understanding the TV programme by annotating difficult terms that are slightly above the learner's current language competence with their explanations, providing a general

overview of the programme and dictionary. Broadly, by keeping the learner's interest while watching their chosen TV programme, the system provides tools and annotations that help in understanding a television programme and learning new language items. These supports were modelled as a textual on-screen display, similar to subtitles, that accompany the broadcast audiovisual materials. Although the design of the current version of the TAMALLE prototype does not explicitly support fading over time, it allows learners to make their own choice whether or not to use the supports provided. For example, the learner can decide not to use any scaffolding supports at all and watch the TV programme in its normal mode, or just to use just-in-time scaffolding supports or only to review recommended words prior to programme show time, for example via the mobile phone. In this way the learner will be able to fade scaffolding themselves as desired rather than it being reduced and imposed on them by our system.

The TAMALLE cross platform interface is depicted in Figure 8.3. The TAMALLE application on the iTV side is activated by using the conventional call to action, i.e. pressing the red button on the remote control, while watching a programme. From this point the viewer sees the news streamed into the TAMALLE application. The broadcast programme appears reduced on the right side of the screen with interactivity on the left. For mobile use, learners are required to use a WAP enabled mobile phones to connect to the TAMALLE mobile application. In this version, there are no passwords required.

Figure 8-3: TAMALLE main menu

8.5.1 Just-in-time scaffolding

The system provides just-in-time help for difficult cultural or language items as they appear in the programme. By pressing 'Words in Action' from the TAMALLE main menu the just-in-time support will be activated providing textual annotation similar to subtitles on the television screen. The individual items may explicate a word (e.g. Tory = Conservative) or identify a scene or individual (This is 10 Downing St – the Prime Minister's residence). The reason that our design locates the call-to-action dialogue on the iTV side rather than the phone is due to the fact that this just-in-time scaffolding will be only beneficial during the programme show time and not before and after. However, if the learner prefers not to display annotations on the TV screen, perhaps to avoid inconvenience to others or embarrassment to himself, the 'Words in Action' content can be accessed from the mobile phone. Figure 8.4 illustrates the functionality of 'Words in Action' function of TAMALLE system.

It should be noted that in the current version of TAMALLE system, the language learning items for just-in-time scaffolding function is delivered via WAP protocol, not the SMS gateway.

Figure 8-4: Just-in-time scaffolding

8.5.2 Scaffolding difficult language items

Difficult or unusual language items from the dialogue or commentary will be transcribed for TAMALLE viewers by the programme maker before broadcast time.

Viewers who are logged in may select ‘Recommended Words’ to see a list of language items with explanation that the system recommends, which is also accessible via mobile phone (see Figure 8.5). A learner can then select a particular language item and add it into his/her personal learning sphere (My TAMALLE) through both interfaces, iTV and mobile phone. Learners do not need to load all the language items that the system recommends. The iTV side of the application can be used while a programme is actually running whilst the mobile side can be used even before, during and after a programme’s show time.

The main interaction with the TAMALLE application on the iTV side is by remote control, with the red key taking the user to the home page, the yellow key leading to the previous page, and the blue key to exit the application. The arrow keys move the selection up and down the list, while the Select key allows adding a chosen word to a learner’s personal sphere. On the mobile interface, a selected word is highlighted and could be added by pressing the handset’s select key.

Figure 8-5: Scaffolding difficult language item

8.5.3 Scaffolding overall understanding

The viewer’s overall understanding should be improved by providing a summary of programme content. This will differ according to genre, with the news being summarised as headlines, a drama as a brief plot summary and so on. This is accessed via ‘Summary’ on the main menu. In the following screenshot (Figure 8.6), a news

summary is provided on the left hand side of TAMALLE application, activated by the green button on the remote control. The mobile phone version also provides a link to a programme summary that can be accessible before, during or after the show and on move. Again this is augmented by an English to English dictionary facility via both iTV and mobile interface. Currently, we use the brief explanation of words that is supported by Answer.com and is freely available via the Internet.

Figure 8-6: Scaffolding overall understanding

8.5.4 Managing personal learning sphere

The system enables learners to manage their personal learning area or sphere, accessible via iTV and mobile interface. The recommended words can be added to a personal vocabulary list for later practice. Learners can view all their saved language items from the main menu. They can also find specific language items and remove those no longer wanted. Figure 8.7 shows ‘My TAMALLE’ on both iTV and mobile device.

Figure 8-7: Managing personal learning sphere

8.6 Interaction design issues

In designing TAMALLE, we have attempted to make best use of the strengths of each device and to distribute functionality and displays appropriately across them. However, another design aim was to provide consistency in terms of look (structure, icons, text) and feel (navigation, interaction) across both devices in order to support the usability of the overall system. Many functions can be carried out via either interface, and it would be too much of a burden on the user to expect them to learn different methods for each device.

The physical characteristics and limitations of the mobile phone and the interactive television system place heavy constraints on the possible display options and user interactions, which come as a shock to developers used to the relative freedom of PC and Web environments. The typical contexts of use for each device are a source of further constraints: the TV remote has to be usable while watching TV, with as few distracting 'head down' moments as possible, while mobile phones are very often used while on the move or in combination with other tasks. In addition, relatively strong conventions have quickly grown up amongst users and manufacturers of these devices, and designers have to be careful to adhere to platform guidelines so as to avoid upsetting users' expectations (or in the case of iTV applications, having their service rejected by platform providers). Unlike a PC or Web service, which will probably be the

user's entire focus of attention, TAMALLE will be just one amongst many others - the user will expect them to behave roughly the same as other services on the device.

The conventions of iTV have developed quite independently of those for mobile services, a situation which might cause difficulties for a cross platform design. On the one hand, the system needs internal consistency if it is to be usable, learnable and recognisable as the same application though on a different platform. On the other hand, an iTV service must be consistent with iTV design guidelines if it is to be usable and learnable, and similarly for a mobile service. In this section we set out design constraints for iTV and mobile services and indicate how they have influenced the TAMALLE design (BBC, 2002; Gawlinski, 2003; Motorola, 2005; Nokia, 2005).

8.6.1 Display

The traditional TV screen has an aspect ratio of 4:3, and within this, an area approximately 592 x 480 pixels is considered 'safe' for display, i.e. not in danger of being obscured on a particular set. This leaves a remaining 10% around the edges as a 'boundary' area, safe enough for background graphics and so on, but not for key information. Some iTV design involves web-like pages taking up the entire screen, possibly with continuity provided by retaining the audio stream. Other designs involve retaining the video image, typically in the top right hand corner, at one eighth size or larger. Thus textual and other information on an iTV screen tends to be displayed either in an L-shape around the video image, or on a semi-transparent overlay situated to the bottom or side of the full-screen video. A mobile service, on the other hand, once accessed, will typically take up the complete screen, usually, but not always, portrait orientation and may range from 2 x 3 cm upwards. We have tried to display text on the iTV screen in a portrait orientation in a semi-transparent overlay so as to mirror display on a mobile screen.

Text on a TV screen is typically being read from a distance of 2 or 3 metres distance, and needs to be designed with readability at this distance in mind. In the UK, broadcasters have adopted the RNIB's Tiresias Screenfont as a standard, though Gill Sans, Zurich and other Sans Serif fonts are also seen, with a minimum size of 18 point. Colour combinations have a particularly strong impact on TV screen readability, with

highly saturated and strong colours causing ‘seepage’ problems when used in combination. Because of the required font size and the limited screen real estate available, iTV services can display only small amounts of text on a single screen. In addition, complex and detailed graphics display badly on the TV screen. Effects such as bolding or other variants may also go unnoticed.

The mobile screen is similarly limited when it comes to text display, though colour may be used with more confidence. Sans serif fonts such as Arial and Verdana are recommended, and font sizes are typically 5 or 6 point. Short chunks of text are recommended for each device, rather than extended passages. Single screens of information are generally found, though some developers have experimented with more complex layouts such as multiple columns. In terms of screen display, then, both iTV and mobile present very strict limitations, but they are not necessarily at odds with each other. Neither platform can support the reading of large amounts of on-screen text and for graphic design options for text are very constrained. We have tried to keep the design as consistent as possibly by using white Tiresias Screenfont on a dark blue background on iTV and the default, rather similar, Arial in black on white for the mobile phone. In addition, although the physical TV screen is obviously much bigger than a mobile screen, it turns out that the amount of text that can reasonably be displayed on each at one time is roughly the same. Problems may arise, however, if the two devices are used together, as the viewer’s eyes will have to change focus very rapidly, which is more difficult for those with short/long sight.

8.6.2 Navigation and complexity

Users of both iTV and mobile phone are essentially limited to a menu-style interface. Although menu items may be graphical in some more modern phones, these are really graphical menu labels rather than the addressable icon objects familiar from the desktop metaphor. Vertical navigation in iTV applications tends to be limited to 2 or 3 levels, with some horizontal navigation between sections of longer articles. Hypertext, i.e. links from individual items embedded in a longer run of text, is rarely found. Complex navigation, whose effects are often compounded by latency delays and also by the fact that TV viewers tend to be less focused on the screen than PC users, is disliked by iTV viewers (BBC, 2002). For mobile phones too, shallow navigation structures are

recommended, with no hypertext. In designing TAMALLE, these constraints are tackled mainly by simplifying navigation, making navigation controls very salient and minimising the navigation depth. This is in keeping with the "simple and shallow" notion that requires minimizing the number of screens while keeping an appropriate amount of scrolling, balancing breadth and depth, therefore improving the usability and learnability of overall system (Kiili, 2002). In particular, it was felt important to keep categories and labels consistent across the devices.

8.6.3 Interaction

Essentially, interactive viewers can interact with the screen in three ways – navigation, action (e.g. 'Set a reminder', 'Delete from my favourites list') or text editing. The device used is generally the remote control handset, equipped in the UK with a variety of controls depending on the manufacturer. It may include numerical/character keys, four way arrows, an OK button, volume and channel changing controls, possibly with other specialised buttons (e.g. TV guide, teletext) but it will always provide four colour keys – red, green, yellow and blue, always displayed in that order. While the red button tends to be used as the principal 'call to action', i.e. invitation to switch to interactive mode, to such an extent that it is now synonymous with interactivity, it is probably fair to say that the functions of the other three colour buttons, despite platform guidelines (BBC, 2002) are not well established and need to be relearned by viewers for each application. Forcing the viewer to look down from the screen to the handset is to be avoided, so designers tend to replicate colour keys, arrows and often numerical keys on-screen, so that the viewer will not have to shift focus. Text entry is tedious (though some viewers use an infrared keyboard) and there has been no TV equivalent of the mobile SMS phenomenon. Mobile phone interaction is constrained in very similar ways. Navigation, action and text entry are achieved via the keypad and arrow keys, with the soft keys playing an important role. Like the TV remote, each mobile handset is different and uses different conventions.

Interaction with the TAMALLE application on the iTV side is via the handset. The red key takes viewers to the home page for the interactive service, in response to a red button on-screen as a call to action, the yellow key is labelled Back and leads to the previous page, and the blue key is used to exit the application. Each menu item also has

a numerical label allocated to it, giving an alternative selection mechanism. The arrow keys move the selection up and down the list, while the Select key adds a chosen word to a learner's personal sphere. On the mobile phone interface we use the conventions of the phone itself (Motorola): the user can move up and down the list of menu options using the arrow keys and use the right and left soft key to choose an option. The back button in mobile interface mirrors the iTV yellow button. A selected word is highlighted and can be added to the personal sphere by pressing the handset's Select key, giving a reasonable degree of consistency. The use of the mobile and TV in synchronous, co-located mode is currently being investigated, in particular the expectation of coordination identified by Robertson et al. (1996). This is an area where the clash of guidelines on consistency is clear. Users expect a new service such as TAMALLE to adhere to platform conventions for their TV and their mobile phone. However, there is no TV handset that currently mirrors works a specific mobile handset, meaning that a consistent interface that crosses devices is not possible.

8.6.4 Branding

Unlike most desktop and web applications, services on iTV and mobile phones co-exist in a commercial environment with services from other providers. As Rondeau puts it, brand competition is prevalent on enhanced mobile phones, "with the device, wireless carrier, data provider, third-party software creator and many others trying to gain brand presence in an already complicated interface" (2005, p.66). This is also true for commercial iTV, where the set manufacturer (Sony, Philips, etc), the platform provider (Sky, NTL), the broadcaster of 'families of channels' (e.g. BBC, Home and Leisure), possibly the individual channel broadcaster (BBC3, Home and Leisure Bright Ideas) and the production company are jostling for recognition. Physical branding then becomes a part of the drive for usability, as we try to help the user answer questions about what the service offers, who is providing it, what its relationship is to a broadcast programme, who, if anyone, is asking for payment and so on. In other words, clear branding may help the user develop a clear mental model of the service, which will enhance usability. (This is an opposite perspective from that provided by Spool (1996) who was concerned with the effects of usability on strengthening brands). At the moment we are simply using the word TAMALLE as a brand across both devices, but

this is a stopgap measure as we look for a solution that instills brand awareness without confusing or distracting the user.

8.7 Discussion

Some of the reasoning behind the design decisions of cross platform interfaces was discussed in the previous section, 8.5. However, the design solution presented is not the only one possible; another team could start with similar requirements and end up with quite a different set of choices for functionality and interaction design.

In particular, media choice may be worth commenting on. The justification for providing text annotations for just-in-time support was research by Koskinen et al. (1996) showing that combined video and textual annotation of spoken language in the from of a subtitle or closed caption could aid learning vocabulary, improving listening, comprehension and reading skills (Neuman and Koskinen, 1992).

The decision of whether to display video on the mobile phone, on the other hand, was based on our understanding of the affordances of the device at the time when TAMALLE was implemented in 2004. With the advent of the DVB-H standard and availability of new generation of mobile devices (e.g. Nokia n-series, iPhone), we might now consider using video and television programme on mobile phones. However, more research needs to be done in order to explore the potential of these new generations of mobile technologies for language learning.

Enhancing the learning experience in as unobtrusive a way as possible was one of the most important issues in the TAMALLE design. This is also widely recognised in the mobile learning research community where it is suggested that “technology that is used to support learning should be blended with everyday life seamlessly, unobtrusively, and feel natural rather than disrupting to use” (O’Malley et al., 2003, p.26).

8.8 Conclusions

The design of TAMALLE as a cross platform learning system raised a number of issues which needed to be addressed by further research. The first concerned the nature of the support material. Ideally we would have liked to find guidance in the language teaching

literature on selecting individual words or phrases for attention. However, little practical guidance was available to help us make a reasoned choice. Without such rules or guidelines, automating the functionality of TAMALLE, which would be necessary if it is to be widely used and sustainable, will not be possible. In addition, it may well be useful to tailor this support material to the learner's level of competence, motivation, preferences and so on. We designed a study to draw up guidelines for provision of language learning materials from English broadcast television programmes, which could be used with recommendation, and annotation functions of TAMALLE system. A full account of this study is given in Chapter 9.

The second issue concerned the evaluation of the TAMALLE system as a cross platform learning environment. Not only should we evaluate it in terms of its usability but also its desirability and acceptance as a medium for assisting in second language learning. Therefore, multiple evaluation techniques were used to assess different aspects of the TAMALLE system, as discussed in Chapter 10 of this thesis.

Chapter 9 Development of language learning objects from broadcast television programmes

9.1 Introduction

In Chapter 8, we described TAMALLE, a prototype system that supports learners in their television viewing, as just one element in their language learning activities. As the focus of the learners will be on media consumption rather than on conscious language learning, this support is designed to be as discreet and non-intrusive as possible. The system provides support, in the form of captions and other onscreen displays, for comprehension of specific linguistic and cultural items for viewers as they watch television programmes. These items and their annotations, together forming Language Learning Objects (LLOs), may be saved by learners in their personal 'learning sphere', a private data storage area accessible both via the TV and mobile phone. These LLOs can be accessed prior to, during and after the show. Learners are also able to add, find, and remove LLOs from their personal spheres.

In this chapter we describe a learner-centred study designed to elicit criteria for selection of those LLOs whose annotation or explanation could best enhance the advanced learner's understanding of popular broadcast television programmes in English. Three different TV genres (UK soap opera - EastEnders, news broadcast and lifestyle programme - Relocation, Relocation, Relocation) were shown to advanced EFL learners, who were asked to annotate a transcript of the programmes to indicate items they found difficult or would have liked to pursue. The results suggest a number of categories of broadcast language that may need support via annotation and explanation. It might be expected that such selection criteria would already exist in the language pedagogy literature, but this is pedagogic knowledge that does not seem to have been formalised. Deciding which elements of a specific TV programme to highlight in a formal and/or face-to-face teaching context will be heavily dependent on the teacher's knowledge of the learners' competence and/or the learning outcomes of a particular stage. The context for which we are designing is informal or even incidental language

acquisition by adult learners, where neither competence nor learning outcomes can be specified, and here a generalisable approach is needed.

9.2 Method

Three groups, each of 4-6 advanced EFL learners, took part in the study. Each session took about one hour. After a screening questionnaire (age, nationality, gender and language qualifications), they were asked to watch ten minute clips of programmes from three different genres:

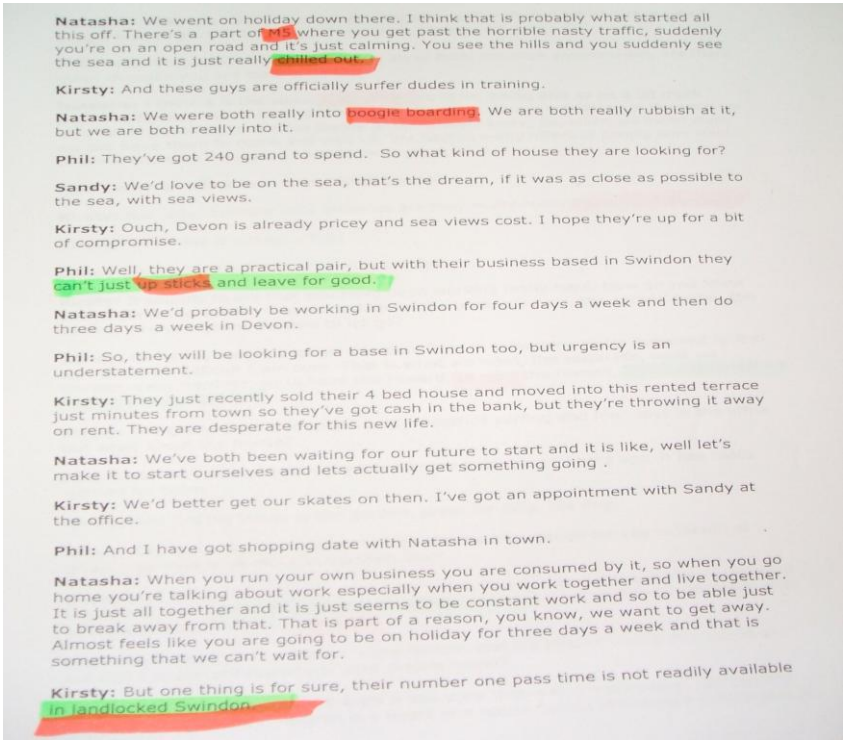
- UK soap opera - EastEnders
- News broadcast
- Lifestyle programme - Relocation, Relocation, Relocation

Although more genres could have been selected, the above are considered to be distinct enough to highlight different aspects of broadcast television. After each clip, participants were given a transcript of what they had just watched and were asked to use two differently coloured highlighters to mark a) parts of the sound track whose meaning was not clear when they viewed the programme, i.e. those sections that they just didn't 'get' because they were indistinct, unknown, obscure and so on, and b) items that they would have liked to have more information about, i.e. unfamiliar or intriguing vocabulary, phrases, expressions. Figure 9.1 illustrates a page of a participant's marked transcript of Relocation, Relocation, Relocation. Each group was shown the clips in the same order, on the assumption that their understanding of what we saw as the most difficult clip, the soap opera, would be enhanced by 'warming up' on the rather formulaic lifestyle programme and the very familiar news format.

Once they had seen all three programmes and highlighted the transcripts, participants were asked a number of questions about the clips, which they were asked to rank in terms of ease of comprehension. They were also given a list of categories of language item and asked to rank them to indicate a) those they would most like to see annotated on-screen as the programme ran and b) those they would have liked to be able to refer to before or after the programme. The categories we used were:

- Place names, e.g. Westward Ho!
- Language referring specifically to UK culture, e.g. GP or General Practitioner for family doctor
- References to Western culture, e.g. David and Goliath from the Bible, “the stuff dreams are made of” based on Shakespeare’s The Tempest
- Figurative expressions, e.g. get your skates on, up sticks
- Slang, e.g. stuff Swindon, crash pad
- Regional accents, e.g. East London, Northern Irish
- Numbers
- Homophones (different words that sound the same), e.g. rains, reigns, reins
- Words that mean different things in different contexts, e.g. pad, provisional
- Phrasal verbs, e.g. pile in, pile up, pile on.

The categories were developed on an informal basis drawing on our personal experience and also suggestions from language teachers, which resulted in numbers and phrasal verbs being included. Participants could also recommend categories that did not figure on the list, although none did so.



Natasha: We went on holiday down there. I think that is probably what started all this off. There's a part of M5 where you get past the horrible nasty traffic, suddenly you're on an open road and it's just calming. You see the hills and you suddenly see the sea and it is just really chilled out.

Kirsty: And these guys are officially surfer dudes in training.

Natasha: We were both really into boogie boarding. We are both really rubbish at it, but we are both really into it.

Phil: They've got 240 grand to spend. So what kind of house they are looking for?

Sandy: We'd love to be on the sea, that's the dream, if it was as close as possible to the sea, with sea views.

Kirsty: Ouch, Devon is already pricey and sea views cost. I hope they're up for a bit of compromise.

Phil: Well, they are a practical pair, but with their business based in Swindon they can't just up sticks and leave for good.

Natasha: We'd probably be working in Swindon for four days a week and then do three days a week in Devon.

Phil: So, they will be looking for a base in Swindon too, but urgency is an understatement.

Kirsty: They just recently sold their 4 bed house and moved into this rented terrace just minutes from town so they've got cash in the bank, but they're throwing it away on rent. They are desperate for this new life.

Natasha: We've both been waiting for our future to start and it is like, well let's make it to start ourselves and lets actually get something going .

Kirsty: We'd better get our skates on then. I've got an appointment with Sandy at the office.

Phil: And I have got shopping date with Natasha in town.

Natasha: When you run your own business you are consumed by it, so when you go home you're talking about work especially when you work together and live together. It is just all together and it is just seems to be constant work and so to be able just to break away from that. That is part of a reason, you know, we want to get away. Almost feels like you are going to be on holiday for three days a week and that is something that we can't wait for.

Kirsty: But one thing is for sure, their number one pass time is not readily available in landlocked Swindon.

Figure 9-1: One participant’s marked up transcript

9.3 Participants

Participants were recruited on the basis that they had to be advanced English foreign language learners. Fourteen people in total from twelve different nationalities participated in the three sessions. There were eleven females and three males. Seven were between 20 and 29 years old, five were between 30 and 39, and two were 40 to 49. The nationalities were: Iranian [1], Turkish [1], Malaysian [1], Kuwait [1], Chinese [2], Romanian [1], Sri Lankan [1], Brazilian [2], Spanish [1], Mexican [1], French [1], and Dutch [1]. They were volunteers from the staff and students of Brighton University, mainly research staff and PhD students in a wide range of disciplines. They were all advanced EFL learners with qualifications equivalent to IELTS 7 or TOFEL 725 and several had acquired undergraduate or postgraduate degrees in the UK. None of the participants had seen these particular episodes before, although they were familiar with the various formats.

9.4 Data analysis

The raw data was analysed first by aggregating the words and sentences highlighted in each paragraph of the transcript. This was necessary when it became clear that participants had not distinguished between the 'during' and the 'before/after' conditions. We then identified those language items that were selected most often by our participants. A shortlist was made for each clip, eliminating items chosen by only one participant. These were used in conjunction with the results from the questions to form the rationale for selecting language items for annotation (see below).

(We also analysed the items on the shortlist in terms of the theme to which they related. Eight different subject themes emerged from the content: literature, sport, family affairs, immigration, geography, politics, health and religion. These were not used in the rationale but we expect them to be of use in the information architecture of any further vocabularies at a later stage).

9.5 Results

Most of the participants indicated that television had had a positive impact on their language learning experience in the past. Only one participant mentioned that he had never used any television programme for language learning. Television was recognised

as a useful medium for learning about foreign culture as well as language. It also provides an opportunity to hear different accents, dialects and pronunciations, which helps towards acquiring better listening skills. A full account of our results is given within the following two sections: comprehensibility of TV genres and categories of language learning objects.

9.5.1 Comprehensibility of TV genres

We asked our participants to indicate which programme they found easiest to understand. As Figure 9.2 shows, the news was rated most comprehensible, followed by the lifestyle programme, with the episode of the soap opera rated most difficult to understand. Only one person thought the soap opera was the easiest to understand.

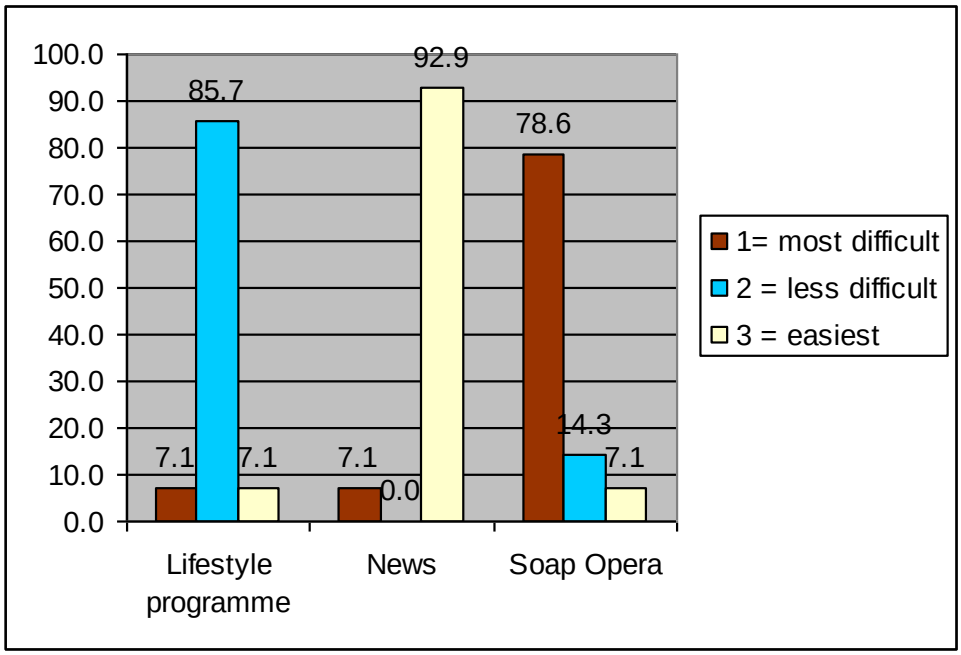


Figure 9-2: Comparing TV genres for comprehensibility

The three genres compared here are also different in terms of their general characteristics and the way they are structured. This might be the reason that our participants indicated the results above. For example, the news has a rigid structure, starting with the main headlines which are followed by more information. It is also sign-posted with other on-screen materials and explanations like figures, numbers and images, which make it easier to follow the spoken language. On the other hand, soap opera and lifestyle programmes usually contain lots of regional, colloquial and figurative language that makes them more difficult for language learners to understand.

9.5.2 Categories of language learning objects

Participants noted items from a number of different categories which they thought could be usefully either displayed or explained on-screen during the programme. Figure 9.3 indicates all ten categories suggested and the participants' ratings of the potential usefulness of each category. The five most wanted categories were:

- Word referring to UK culture (85.7%),
- Figurative expressions (71.4%)
- Names of unknown places (64.2%)
- Slang (64.2%)
- Western references (57.1)

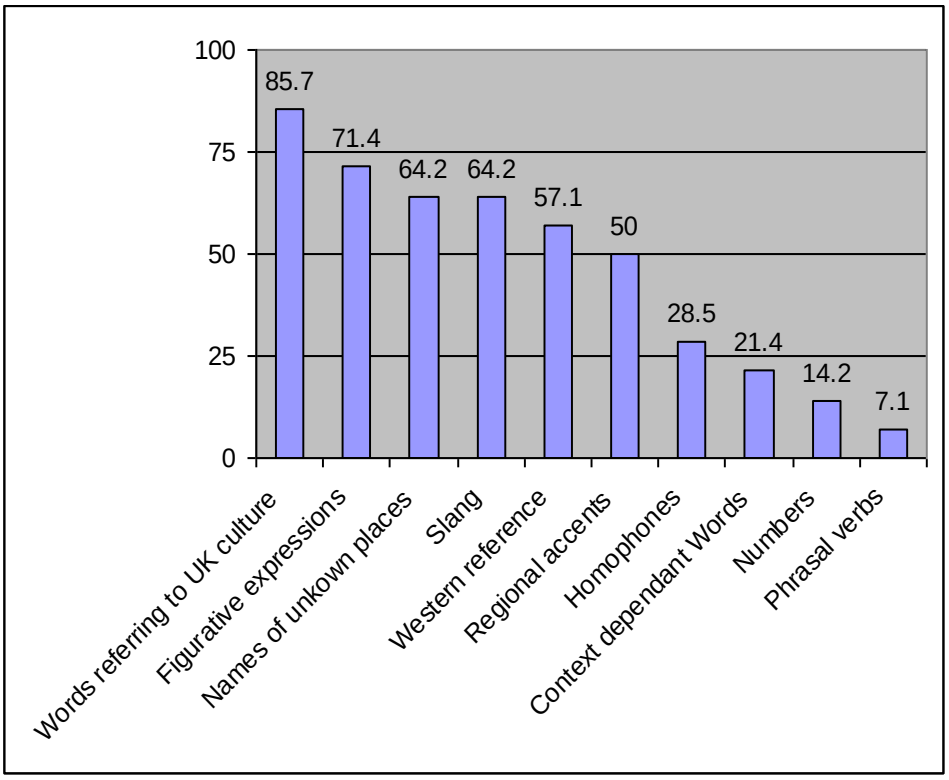


Figure 9-3: Categories of items selected for annotation

Participants also rated the desirability of being able to access information about the same categories of language item categories before or after the programme show time. Figure 9.4 indicates all ten categories suggested and the participants' judgements on the usefulness of each category. The five most wanted categories were:

- Word referring to UK culture (92%),
- Figurative expressions (71.4%)
- Slang (64.2%)
- Name of unknown places (57.1%)
- Western references (50%)

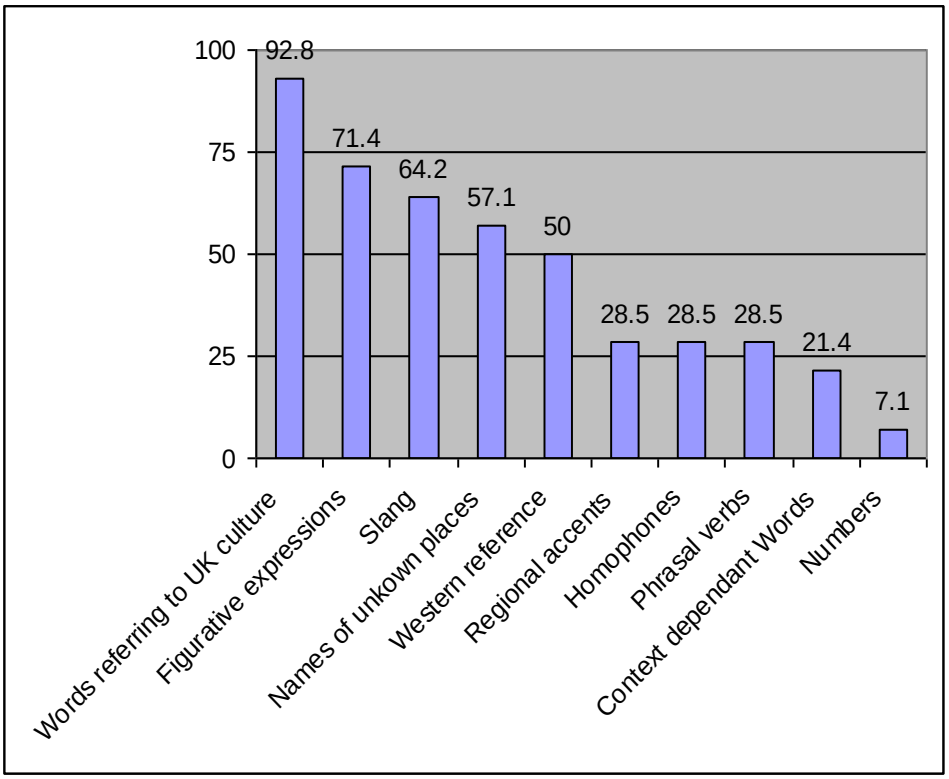


Figure 9-4: Categories selected for before/after retrieval

Although we expected participants to request different services during and outside the programme transmission time, the above results indicate that this is not the case. The five most wanted categories selected by more than half of our participants in the above questions were the same, with only a slight change in order.

These results, indicating the most wanted categories of language item, were combined with the results of the participants' selection of raw language items from the programme transcripts to form the basis of a rationale for selecting language items for display and/or explanation. It was also important to bear in mind that any explanations had to be brief, suited to the learners' assumed level of competence and sensitive to context. Between 35 and 50 items were extracted for each clip and short explanations were

provided for each. Table 9.1 shows some examples of the simple learning objects that were developed for news, lifestyle programmes and soap operas. Appendix C provides a full list of LLOs with their on-screen explanations.

TV Genre	Language item	On-screen	Further Explanation
News			
	Stop the drain on NHS	Stop waste of NHS funds	NHS = National Health Service
	GP	Family doctor	GP = General Practitioner
	Bradford	industrial city in Yorkshire	
	David against Goliath	Struggle of weak against strong	Struggle of weak against strong. Biblical – from story of giant Goliath against boy David
Lifestyle - Relocation, Relocation, Relocation			
	It's the stuff dreams are made of	An ideal	Poetic – Shakespeare, The Tempest
	High and dry	Left stranded	Dead metaphor. Strand = beach
	Westward Ho!	Seaside village in Devon,	Devon – rural county in SW UK
	We put in the blood, sweat and toil	We worked very hard	Echo of speech by Winston Churchill
	Get our skates on	Hurry	Ice skates or roller skates
Soap opera - EastEnders			
	The novelty wears off	It becomes normal and less interesting	
	Stop fighting the inevitable	Accept what has to happen	
	Spiteful	Nasty, hateful	
	Provisional	Temporary (driving licence)	Practical information on driving licences
	Once the cat is out of the bag	Once a secret is in the open	

Table 9-1: Examples of simple LLOs developed for news, lifestyle and soap opera programmes

As can be seen from Table 9.1, explanations provided could be extended to include more information and explanations. This would be especially useful for those learners who seek to gather more information about a particular aspect of the LLOs. For example, in the case of 'David and Helen against Goliath', more information, possibly in the form of a hyperlink, could be provided to explain the source of this expression (i.e. the Bible), and an example of its usage in different situations could be given. Also, a more general definition could be provided for specific geographical locations like 'Bradford'. However, the affordances of media in use, in our case iTV and mobile, do not allow for the provision of long textual information and explanations and therefore they were not developed within the TAMALLE system.

9.6 Discussion and implications

The study described here was designed to begin the process of developing guidelines for selecting language items from authentic TV programmes for annotation to support the comprehension of adult advanced EFL learners. By eliciting learners' perceptions of the language of three genres, we found that annotation of a number of categories of language item - place names, figurative language, culturally specific vocabulary and so on - was perceived as being potentially useful to learners.

This exploratory study raises a number of questions. At the level of methodology, it is clear that this study is limited by a) the small number of genres tested and b) the number and range of learners. It could be that non-academic or younger/older participants would have found other language items to be of interest, or that they would have responded differently to our categorisation, which could be criticised for being too formal. It is not clear, for instance, whether figurative language or phrasal verbs are labels comprehensible by all learners. A subsequent study might also need to take into account the length of time each user had spent in the target language country and also their levels of TV consumption. A further development would be to elicit similar data from language teachers, to see if their perceptions match those of independent adult learners.

Several aspects of the annotations lend themselves to adaptation and personalisation. As discussed earlier, between 35 and 50 annotations were developed for each 10 minutes of

audio-visual content. This means that an average maximum on-screen display time of between 12 to 17 seconds. This time frame seems to be more than enough for reading a brief line of text on-screen, (although it assumes no gaps between displays, which is arguable) (Ofcom, 2005). However, as most research in this area has been directed at full subtitles for deaf people, we know little about its applicability for language learners. More directed research would be required to investigate the suitability of speeds for annotated words for language learners. Speed and rate of display are areas where learners would likely benefit from adaptation and customization. A full system would provide features to allow learners to select the number of words for attention, e.g. in accordance with their own pace or cognitive loads. Details of screen display, such as font size, might also be adaptable.

A different aspect of adaptation might also be developed to allow a system to display annotations not simply according to the category based criteria described here, but also with regard to themes of interest to the user - historical, social geographical - and/or in accordance with different individual differences, e.g. age, attitude, motivations, cognitive ability, etc. This might also change the nature of the annotation. For instance, a viewer with little time might choose to see only minimal, semantic annotations, to enable basic comprehension, whereas someone with more time or different interests might prefer to find out about register, style, history, source and other aspects of language items.

Another issue important for further development is the possibility of *automatic* selection of items for annotations and the annotations themselves. Currently, there are a number of methods developed for indexing video content, using speech recognition and closed captions. These methods originally aimed to provide assistance in developing metadata from videos that could be employed by applications for search and segmentation (Lin et al., 2005). Natural Language Processing (NLP) techniques also help in retrieving text in accordance with different rules and in real-time systems (Plu et al., 2002). Using similar techniques, algorithms could be developed to select and segment the part of the text that utilizes the result of our experiment, for example to segment slang, cultural knowledge, name of places etc., from programme transcriptions or closed captions.

9.7 Conclusions

We have described a small scale exploratory study that develops a methodology for eliciting user centred requirements for a language learning facility for iTV and suggests a ranking of categories of types of language item that might usefully be annotated for learners. The most frequently chosen categories were names of unknown places, references to UK culture, references to western culture in general, figurative expressions and slang. We suggest that further studies exploring in more depth, using different genres and learner types, may eventually lead to the possibility of automated and personalised generation of language-oriented learning objects from audio-visual material.

The results discussed here have been integrated into the TAMALLE prototype, the evaluation of which is discussed in Chapter 10. However, we believe that others could also benefits from these results, when developed with more rigour. For example, language teachers who incorporate authentic TV programmes into their lessons, could use them as heuristics for directing students' attention during comprehension exercises, and/or self-directed learners might like to develop the strategies to better understand target language programmes and learn more from their television viewing.

We identified two main areas for further research: customisations and adaptation of TAMALLE interface, and automatic generation of learning objects.

Chapter 10 Evaluating TAMALLE

10.1 Introduction

This chapter reports the evaluation of the TAMALLE system. The TAMALLE system, as described in Chapter 8, can be seen in three ways:

1. A prototype system developed based on a set of requirements derived from a theoretical framework grounded in the user study, learning theories and affordances of iTV technology.

2. A language learning environment that supports learners' understanding of authentic materials broadcast to television and provides explanations which act as scaffolding for learning difficult language items, supports learners' overall understanding and enables them to construct and organise their own individualised knowledge and environment, all of which can be accessed on an anytime and anywhere basis. In this process, the system may support learners' comprehension of television programmes and learning of new language items.

3. A multimedia system that has a dual interface across iTV and mobile phone.

The evaluation of TAMALLE needed to consider all of these dimensions: against the requirements it developed, its perceived usefulness, desirability and acceptance as a learning environment, and the usability of its dual interfaces.

In order to achieve this, two phases of evaluation studies including analytic and empirical evaluations were carried out. Section 10.2 gives a full account of the analytic evaluations, including a study with expert users of iTV and mobile phones, to test the usability of the TAMALLE dual interfaces and to evaluate TAMALLE against general requirements. Section 10.3 describes an empirical study carried out with advanced EFL learners to gauge the usability, perceived usefulness, desirability and acceptability of the TAMALLE system. A combination of methods, including observation, questionnaire, and card sorting, were used. Finally, participants' comments and suggestions for further improvement of the system are discussed.

10.2 Analytic evaluations

The analytic evaluation includes the evaluation of TAMALLE by expert users and also against general requirements. The following section provides an account of both studies.

10.2.1 Expert evaluation

In order to identify interface problems as early as possible in the development of the TAMALLE system, an expert evaluation was conducted. Expert evaluation is the approach used to uncover major usability issues that cause immediate obstructions to the user experience. Usually usability specialists judge whether each element of a user interface follows a list of established usability heuristics or guidelines (Nielsen, 1994).

10.2.1.1 Method

Prior to a learner evaluation of TAMALLE, an expert evaluation was conducted using the cognitive walkthrough technique (Wharton et al., 1994). The cognitive walkthrough is a usability inspection method used to explore the ease of use and learnability of an interface.

A low fidelity TAMALLE prototype in Microsoft PowerPoint was developed and used for this evaluation. Three usability specialists who have expertise in the design of iTV and mobile phone applications were invited to take part in three different evaluation sessions. Each session took about two hours. The TAMALLE interfaces on the mobile and iTV sides were tested separately. An evaluation sheet was provided, which included a number of core set tasks developed for iTV and mobile interfaces, with required steps to perform, e.g. view recommended words that the system provides, add a difficult word to your personal sphere, and so on. For each step of the task, the evaluators were expected to answer three predefined questions: (a) “Will the user know what to do?” (b) “Will the user see how to do it?” and (c) “Will the user understand from the feedback whether the action was correct or not?”

For analysis, those tasks that were identified as problematic were gathered together with the participant’s comments and suggestions for fixing the problems.

10.2.1.2 Results

Generally, the expert participants were positive about the way the navigation and information structure were designed both on the iTV and mobile interfaces. In particular, the consistent use of the 'Back' button was praised. Participants also found the system very easy to learn. However, there were some problems, mainly associated with the labelling and positioning of text on the iTV side of the TAMALLE interface. Table 10.1 outlines some of the main problems and the proposed solutions.

Problems associated to the interface	Solution proposed
Inconsistent use of text colour and background on iTV interface	The text colour should be used consistently throughout the application, using white on blue background
The use of 'Digest' to refer to a summary of a TV programme	The word 'Summary' is more appropriate
The recommended words were alphabetically ordered on the iTV and mobile interfaces	It would be more useful to order words chronologically, in accordance with the time they appeared on the TV programme, both on the iTV and mobile interfaces
Positioning and alignment of some text and graphics on the iTV interface was inconsistent	Inconsistent positions should be identified and corrected
Inability to go to the main menu button when there is a large amount of information to read on the mobile interface.	A button to take the user to the main menu

Table 10-1: Expert evaluation results and suggested solutions

All solutions and suggestions for further improvements to the system were incorporated into the TAMALLE prototype (discussed in Chapter 8) prior to its evaluation by potential learners. The possibility of adding search options for personal and recommended words on both the iTV and mobile interfaces was also mentioned by the expert evaluators. However, this facility was not implemented in the current version.

10.2.2 Evaluation against general requirements

A number of requirements derived from the scenarios proposed in Chapter 7 were used in TAMALLE's development. Table 10.2 discusses the general requirements and how TAMALLE satisfies these requirements.

General Requirements (GR)	TAMALLE system
GR 1. Support language learning on anytime and anywhere basis	System provides ubiquitous interface across two platforms, iTV and mobile phone, which can be accessed any time (before, during, after the programme) and anywhere (on the move and in the living room).
GR 2. Support learner's decision to learn from authentic television programme	System designed to be generic in order to provide support for a range of television programmes. However, the prototype is demonstrated through the News, EastEnders and Relocation, Relocation, Relocation.
GR 3. Support language learning in context	The use of authentic television programmes that are broadcast every day, within the TAMALLE system provides rich context-dependent material showing a number of different situations and settings. The language learning materials provided are in the context of a programme.
GR 4. Support learner's understanding of authentic materials broadcast on television by scaffolding	Two sub-requirements are devised: GR 4.1 and GR 4.2.
GR 4.1. Scaffold learner's overall understanding of the programme	System provides a summary of the programme, and dictionary facilities that would enable learner to read and get overall picture of what will be happening in the programme. If unknown terms are recognised, a dictionary enables the user to check for meaning and increases overall understanding of a programme. In this process, the system supports the comprehension of a specific TV programme, which also aids in acquisition of better listening and comprehension skills and in learning new language items (vocabularies).
GR 4.2. Scaffold difficult language items that appear in a programme	System recommends a number of difficult language items with explanation that are slightly above the learner's level of competence and are important to know for understanding a programme. These language items can be viewed and studied before, during and after a programme. Therefore, the system

General Requirements (GR)	TAMALLE system
	provides an opportunity to learn new language items.
GR 4.3. Provide support for just-in-time scaffolding	System provides just-in-time support for learning difficult language items as they appear on a show by annotating them with explanations in a way similar to subtitles. These language items can be also accessed on mobile phones. In this process, system supports the comprehension of a specific TV programme.
GR 5. Support learners in constructing their own individualised environment that can be accessible on an anytime and anywhere basis	System supports learners in constructing their own individual language learning environment, enabling them to add/remove those language items they found difficult to/from their personal language learning space (My TAMALLE). The system supports learning new language items.
GR 6. Support learners in accessing and retrieving their own individualised knowledge on an anytime and anywhere basis	System supports learners in retrieving individualised language items that have been saved and sorted in an alphabetical order via both iTV and mobile interface. This provides the opportunity to learn and practice new language items on an anytime and anywhere basis.
GR 7. Support learning in an unobtrusive fashion	TAMALLE is designed based on a 'media consumption' model of language learning, which assumes that the learner is primarily concerned with understanding a TV programme but would welcome unobtrusive support for language learning while doing so. The scaffolding functions are designed in a way similar to subtitles/close captions in order to be less distracting. In case learners want to share the television with others, they have an alternative device, mobile phone, which can be used in an unobtrusive fashion.

Table 10-2: General requirements and TAMALLE system

The next section describes an empirical evaluation of the TAMALLE system.

10.3 Empirical evaluation

An empirical evaluation of the TAMALLE prototype was carried out with advanced EFL learners using a combination of observations, questionnaires and card sorting. Data were gathered in different dimensions to test the usability of the software itself, the perceived usefulness of the features provided, the desirability of system use and its overall acceptance. The main aim was to explore how useful and desirable an application such as TAMALLE would be and how further improvements can be made in the future.

10.3.1 Study design

The study was carried out in University of Brighton domestic usability lab. The lab consists of a room, four meters by three meters, fitted out as a domestic lounge. It contains two and three-seat sofas, a coffee table and a television set including VHS players. A two-way mirror is set in a sidewall to enable observation of user's behaviour and interactions. The users can be recorded by close-circuit television cameras on motorised mounts within the room without being distracted. Two cameras record user interactions. One is located above the TV set and records a panoramic view of the room, showing the positions and interactions of the room's participants. A second camera fitted with a motorised zoom lens, placed to one side, records the manipulations of the TV remote control. The motorised pan, tilt and zoom provide a constant close up view of the remote control enabling user's interactions and manipulations to be recorded. User's feedback and conversation will be picked up by a microphone attached to the wall which will be combined with the video via a video multiplexer and digitiser (MPEG format) and is stored on the hard disc of a PC for later analysis (Pemberton and Griffiths, 2003). For resource reasons, we had to use 24 inch TV for the TAMALLE evaluation. This was not ideal: a larger screen would have improved readability.

For the evaluation, we ran TAMALLE application on the Brighton University's IIS server, connected to both television screen inside and a monitor outside the lab, and imitated user interaction, using a simple 'Wizard of Oz' protocol (Kelley, 1984). The 'Wizard of Oz' was needed as we did not have the facility to ran TAMALLE application via the platform provider's and/or broadcaster's head-end that could be

executed on the set-top-box, which enables interactions via their remote control and infrared keyboard.

The users could interact with the TAMALLE system, which was running on the Brighton University's IIS server, with mouse and keyboard. However, in order to make the user experience as realistic as possible, we asked our participants to use a remote control and infrared keyboard. Figure 10.1 illustrates the set up of the lab for TAMALLE evaluation.

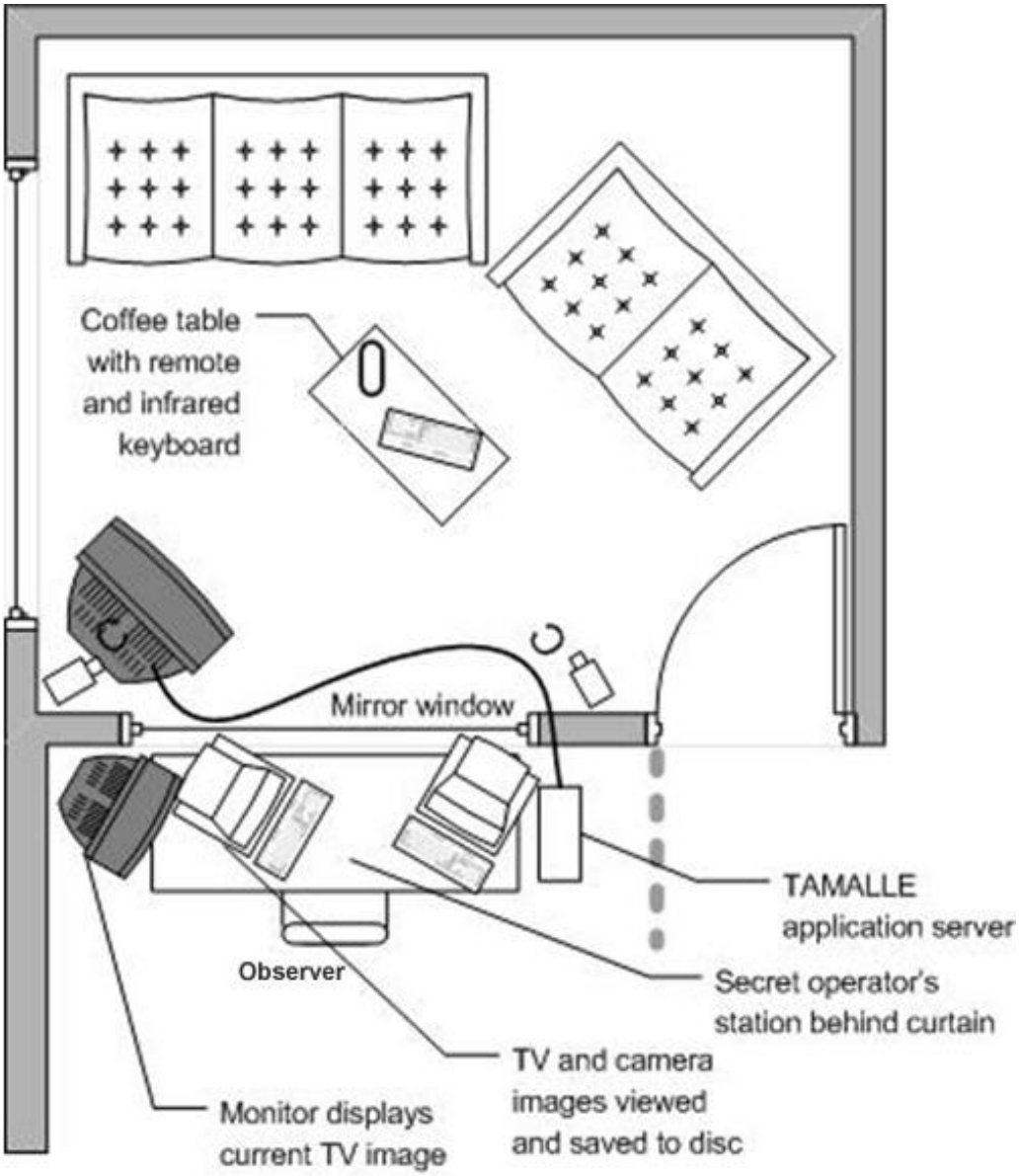


Figure 10-1: Set up of usability lab for the TAMALLE evaluation

While the user interacts with the TAMALLE using a remote control and infrared keyboards, the observer sitting outside the lab in front of the two-way mirror imitates the user's interactions using a mouse and keyboard.

Although this process of imitation cause a little delay in system performance, the simulation was effective, with subjects reporting that they believed they really were directly controlling the TV. This was helped considerably by the secret operator having knowledge of the tasks the participants were carrying out, and the participants' comments as they attempted them. Also, evidence from other research projects using similar usability evaluation technique revealed that with careful planning of tasks and scenarios to be performed by study's participants, this method can produce appropriate and effective interaction (Springett and Griffiths, 2006).

Unlike the iTV side, there were no simulations involved for evaluating TAMALLE on a mobile phone. We did not need to use any mobile phone operator to deliver our WAP application and content to users. The mobile side of TAMALLE system was executed on the same Brighton University's IIS server and generated the WML content that can be executed and accessed by any WAP enabled mobile phone. Therefore, there were no simulations required. We used a Motorola V600 phone throughout the evaluation session.

10.3.2 Method

Each session was prearranged with individuals in accordance with their own time preferences and lasted around two hours; each participant received a £10 voucher. Details of the participants are given in section 10.3.3. After a brief screening questionnaire (age, nationality, gender and language qualifications), and an introduction to the technology (the remote control, infrared keyboards and Motorola mobile phones), the participants worked through two relatively well-specified scenarios: using TAMALLE in the living room and on the move (see Figures 10.2 and Table 10.3). This meant participants were in a position to give informed responses in the subsequent phases, as well as to supply detailed usability data.

The participant's behaviour and usage of the system during the evaluation session were recorded by two cameras. Figure 10.2 shows the recorded camera perspectives, which were subsequently analysed for the observation study.

Figure 10-2: User interactions with TAMALLE system

Scenario 1	Scenario 2
The first usage scenario was TAMALLE in the living room, in which participants had to imagine that they were sitting in front of the TV watching the News and wanted to learn a few words that appeared within the programme. They were then required to follow a number of set tasks, i.e., read recommended language items and news summary, use dictionary to check unknown terms, and so on. A facilitator was also available throughout the session if they needed any help or assistance.	The second usage scenario was TAMALLE on the move, in which participants used the TAMALLE application on the mobile phone. We asked them to imagine that they were sitting on a train coming back from work. They were planning to watch some TV programmes and wondered if they could use TAMALLE to learn a few words and also to read what would happen in the programme prior to watching it. A facilitator asked them to use the WAP enabled phone to login to TAMALLE, and to note that TAMALLE was available for the News, Relocation, Relocation, Relocation and EastEnders. They were asked to choose a programme they wanted to watch that evening from the available options and read its recommended words and summary. The participants were then also encouraged to go to the 'My TAMALLE' option on the mobile phone and to add, remove and review words, including those words that were added using the TAMALLE's iTV interface. They were also asked to use the mobile phone's dictionary.

Table 10-3: Scenarios for TAMALLE evaluation

After using the two TAMALLE interfaces, participants were asked to fill out the usability questionnaire, give comments on the usefulness of TAMALLE features, carrying out the desirability evaluation and answering questions on overall acceptability. Finally participants were asked to contribute their comments and suggestions for further improvements. In the following section we describe the methods that were carried out.

10.3.2.1 Observational usability study

Participants' use of system was analysed for any problems that arose. The aim was to collect qualitative data in order to understand any usability problems or difficulties the users experienced while performing a task. Participants were asked to think aloud (Erickson and Simon, 1987) as they used the system. They were also encouraged to converse and make any verbal contribution that they considered relevant.

For the analysis, we reviewed all the recorded video-clips of the evaluation sessions and selected sections where participants were experiencing difficulties in using the system. The selected areas were transcribed. We analysed the transcriptions to identify the most common problems in association with the TAMALLE system (Lindgaard, 1994). A number of themes emerged, which are discussed below in section 10.3.4.1.

10.3.2.2 Usability questionnaire

For the usability evaluations we adapted the ISO Metrics questionnaire (Gediga et al. 2000). Six categories out of seven of ISO Metrics were selected: suitability for learning, self-descriptiveness, controllability, conformity with user expectations, error tolerance and learnability. The category for suitability for individualization was omitted. For each category of the ISO metric, we changed the wording of some questions to correspond to the task that our participants were doing, mainly to make them more understandable for them. For example we replaced 'task' with 'learning' in the suitability for the learning section. The category 'suitability for learning' was also changed to 'learnability'. Apart from this minor rewording no other changes were made. This gave us a selection of 54 questions of usability.

The participants were required to indicate the extent to which they agree or disagree with each of the 54 statements, making use of the scale of 1= *predominantly disagree* to

3=*so-so* and 5=*predominantly agree*. The ratings of the negative statement were formulated by $ri = 6 - ri$ before the individual averages were computed (*ri* corresponds to the participant's choice on the scale). The arithmetic mean and standard deviation of the rating were calculated and provided for each statement.

10.3.2.3 Feature rating

We were interested in capturing users' perceptions of the usefulness and possible effectiveness of the TAMALLE system's services. Participants were asked to rate the usefulness of 21 features on a scale from 1 to 5 (1 = useless and 5 = useful). For instance, they were asked to rate the provision of the programme summary on mobile phone, saving words in personal vocabulary space and so on. In addition they were asked for their three favourite features and the three least liked, with explanations of their choices. Participants also answered questions on their perceptions of the particular language skills that might be supported by TAMALLE (i.e. spoken or written comprehension or production) and the TV genres that might best lend themselves to the augmentation via TAMALLE services.

These questions elicited different reactions from the usability-oriented phase of the evaluation and it was clear that participants were judging potential efficacy in supporting their language skills rather than ease of use.

10.3.2.4 Desirability rating

The third phase of the evaluation sessions aimed to gauge the desirability of the proposed system. Both iTV and mobile phone use are highly personal, and we were particularly interested in finding out whether users would find the language support services intrusive and inappropriate. If this were so, then usability and likely efficacy might be irrelevant. We used the Product Reaction Card method developed by (Benedek and Miner, 2002). This method provides an effective way for evaluating those aspects of user's experiences that are more intangible and difficult to measure in the lab setting. It provides rich data from user and can inform future design changes (Benedek and Miner, 2002). However, this method has limited use in providing generalizations for a larger audience or figures of statistical significance.

Users are presented with 118 cards marked with a range of adjectives showing judgments of the system, e.g. annoying, appealing, personal, powerful, valuable, inconsistent and so on. Users select a collection of relevant terms and then refine their selection to give a top five of most appropriate judgments, to which they can add comments.

10.3.2.5 Overall acceptability questionnaire

To conclude this phase we also asked users about overall attitudes to the software, its perceived strengths and weaknesses and the likelihood of them using it if it were to become commercially available.

10.3.3 Participants

Participants were recruited on the basis that they had to be advanced English foreign language learners. They included 14 paid volunteers of varied age and nationalities. They comprised eight women and six men. Ten were 21–29 years old and four 30–39 years old. Participants were among the staff, postgraduate and doctoral students of University of Brighton. Eleven different nationalities were included: Brazilian (3), Hong Kong (1), Bahrainian (1), Korean (1), Egyptian (1), Iranian (2), Mexican (1), German (1), Romanian (1), Burundese (1) and Dutch (1).

All participants indicated that they were frequent users of computers. They all owned and used mobile phone on a regular basis mainly as a communication tool and for texting, but less than half of them (n = 6) mentioned using it for other purposes such as: email, music and movie download, dictionary, Internet browsing, games, weather forecast, ring tones and booking tickets. Twelve mentioned that they had used television for language learning before. The use of second language subtitles was also praised by 10 people who explicitly indicated that the use of subtitled TV - e.g. watching television shows and movies with subtitles either broadcast or on a digital video disc (DVD) - had helped in mastering listening and comprehension skills in the past. However, only two participants had experience using iTV applications or services.

10.3.4 Results

This section provides the results of the usability observational study (section 10.3.4.1), and usability questionnaire (section 10.3.4.2), together with results on perceived usefulness (sections 10.3.4.3, 10.3.4.4 and 10.3.4.5), desirability (section 10.3.4.6) and overall acceptance (10.3.4.7) of the TAMALLE system.

10.3.4.1 Observational usability study

In this section we provide the results of the observational study, using TAMALLE on iTV and mobile phone.

ITV side of TAMALLE

The most frequently reported problems with the usability of the iTV side of the TAMALLE interface were related to the readability of text and on-screen display. There were also some problems in using the remote control handset.

Participants mentioned that they experienced difficulty in reading text from the television screen. Three out of 14 participants found it difficult to read annotated words provided through the 'Words in Action' function, *"In particular I'd like to mention about subtitles in TV programme. In my case, I don't like to read from television. It's a bit hard to read the whole explanation of the recommended words".* Manipulating information that is presented in different modalities required a lot of participants' attention, *"It is difficult to read the words (as they appeared very small) side by side with the video/graphics and voice on at the same time".*

Participants who found readability a problem suggested that the reason might be related to their habit of TV viewing with a bigger size screen than the one we used for the evaluation (24 inch), *"TV screen should be big…it is more enjoyable…I am used to watch TV with a bigger screen anyway".*

Some participants (six out of 14) experienced difficulties with the remote control handset. A particular problem was refocusing for the switch between remote control and screen, *"The remote control is difficult to use and navigate (have to scroll up and down a lot) and very cumbersome to use".* Although in our study only one participant failed

to notice the association between the colour keys and their corresponding icons on the screen, this was seen by Rice and Fels (2004) as a common usability problem in iTV applications.

Another usability problem related to the remote control was the fact that there is no standard convention for handsets. We used the BSKYB remote control for the evaluation, however, it was clear that some participants were more used to other remote control conventions created by different platform providers (e.g. NTL) or manufacturers (e.g. Sony). This factor created some problems for some participants. They had to remember different labelling of a number of buttons that perform similar functions across different handsets, e.g. OK and Select button.

Despite these problems, throughout the observation study, it was clear that participants found the navigation straightforward. In particular, participants liked the way that each menu item was also associated with the numbered keys of the remote control. In addition, the consistent use of 'Back' button both on iTV and mobile phone interface was seen as a positive feature.

Mobile phone side of TAMALLE

The main usability issues identified here were related to entering text, scrolling and the screen size of mobile phone used. There were also some concerns regarding the price of using WAP based applications. It is important to distinguish usability problems that are related to the phone, the operating system and the application. In our observational study, the problems were mainly associated with the mobile phone used, the Motorola V600. Therefore, some of the reported problems may not exist if using TAMALLE with more advanced mobile phones that may provide different interaction mechanisms and a bigger screen size.

Five out of 14 participants found the screen size of mobile phone rather small to read text and navigate through, *"I like the mobile phone for SMS, but generally don't like to read from it: the screen is often too small for me"*. As mentioned earlier, for the evaluation study, we used the Motorola V600 phone, which features a reasonable TFT screen size: 87 x 47 x 23 mm. However, as TAMALLE can be used with any WAP

enabled mobile phones that offer bigger screen size, e.g. Nokia n-series, this may not be a problem for the future.

Another usability problem was related to scrolling on the WAP page. Not all our participants (six out of 14) knew that they could scroll vertically to go up/down the screen in order to view the page provided. Although a little trigger on the left hand side of the Motorola phone is available to indicate where the scrolling is, this option was not obvious to all participants. Nevertheless, when the facilitator demonstrated how the scrolling works using the directional arrow keys, there were no further problems.

Generally, participants felt that entering text on mobile phone was cumbersome, *"I simply don't like to type using the mobile phone"*; *"I have such big fingers, every time I want to enter text I have problems"*. Participants expressed a wish for an alternative method for entering text; in particular the use of a voice input option was mentioned.

Another concern was associated with the price of using WAP application. This tended to reduce participants' willingness to explore the system. In one instance, a participant asked for permission every time she attempted to press a button to view and navigate through the system. Although the facilitator tried to ensure that this was not a problem, the user still felt that by using the service she might incur an unacceptable cost. However, as many wireless providers, like O2 in the UK, offer free access to the WAP and the Internet browsing on the phone, users may not see this as problem now.

Overall, the mobile side of TAMALLE system was perceived to be easy to use and navigate. In particular, participants liked the consistent navigation structure provided throughout the application. The use of the 'Back' button was seen to be a good navigational feature of the system.

In addition, participants contributed a number of ideas for further development of TAMALLE's cross platform interface, which are discussed in section 10.3.5. The next section (10.3.4.2) presents the result of the ISO questionnaire that was also conducted for the usability evaluation.

10.3.4.2 Usability questionnaire

On the usability questionnaire, TAMALLE scored an overall 3.9 indicating positive attitudes and statements towards its cross platform interfaces. Suitability for learning (3.9), self descriptiveness (4.1), controllability (4), conformity with user expectation (3.8), error tolerance (3.6) and learnability (4.4).

Although TAMALLE was perceived to be easy to use, some participants found the interface slightly slow to respond. Comments varied regarding the speed of the application. The reason for this variation might be related to simulation of the iTV side of TAMALLE interface, which was influenced by both facilitators and participants. Note that as the sessions progressed, facilitators became quicker at following users' interactions. However, their job was made difficult when participants chose not to follow each step of a given task and/or scenario in a sequential way. Facilitators, in this case, had to constantly look at what the user selected in order to simulate their interaction. The results of the usability evaluations for different categories of the ISO metric questionnaire are provided in Appendix D.

10.3.4.3 Perceived usefulness of TAMALLE's features

In this section we present the results of the study of the perceived usefulness of TAMALLE's features, for which we used a feature rating method. This part of the questionnaire aimed to ask how useful users found TAMALLE features and what features were liked and disliked. The participants were required to rate 21 features of the TAMALLE prototype (e.g. the provision of programme summary on iTV, the provision of recommended words on mobile) on a scale from 1 to 5 (1=*useless* and 5=*useful*). They then identified three or more features that they liked/disliked the most, with comments.

All features scored on average more than 3.5. Four features that scored the highest on average (4.6) were: difficult language items, recommended words on mobile, accessing 'My TAMALLE' via mobile phone and mobile dictionary. The most liked/disliked features that were selected by more than five people out of 14 were listed in the Table 10.4. A full account of the statistical results of the users' attitude survey of the perceived usefulness of TAMALLE's features is presented in Appendix E.

Liked features	Disliked features
The provision of recommended words on both mobile and iTV	The frequency of subtitled word (the 'Word in action' feature)
The provision of programme summary on both mobile phone and iTV	The readability of annotated words
Annotations of difficult words with explanation similar to subtitles while watching the programme (the 'Word in action' feature)	
Adding/retrieving words from personal vocabulary sphere (My TAMALLE)	
Mobile phone dictionary	

Table 10-4: TAMALLE liked/disliked features

Participants contributed a number of comments in relation to different features of the TAMALLE system. Some of these are given below:

"I think the difficult words explanations are the best feature of the TAMALLE, especially because when people are watching TV they don't usually search for the words in the dictionary, so the unknown words or English expressions are not understood at all. With TAMALLE besides having a better understanding, you may improve your vocabulary."

"I really like the idea of having a dictionary on my phone, as I always, or the majority of time, like to carry a small dictionary with myself, but because its sometime too heavy I don't take it with me. But with having a dictionary on my phone it will sort out my problem."

"I think it is very interesting to have words whose meaning you might not remember easily kept in your mobile. Because I think that learning has two steps: first you discover the word and meaning, but then you have to get familiar with them."

"Words in action is very useful: its nice to have a quick explanation on the most important words."

"I guess the mobile phone is more useful as we are carrying it everywhere rather than iTV. I believe the mobile phone is more useful as you can take it anywhere to read or review your vocabulary, privately without anyone knowing what you are doing, and you are able to check more words from the dictionary even when you are out."

"I like the recommended words because you might not have noticed some of them while watching. Chronological sequence of words is good, because it relates to the film."

"As I like to go through the new words I learn very often, I like the idea of My TAMALLE and being able to sort them in the sequence I have learned them."

The fact that participants have given a high score for the usefulness of difficult language items provided may also confirm the criteria developed for selecting LLOs in Chapter 9. Also similar features on both devices, such as the dictionary, 'Summary' and 'Recommended words', scored higher on the mobile phone device than on iTV. The reason might be related to our participants' demographics as most of them were more frequent users of mobile phone than of iTV and also they were from the young population (20-40).

Although the results of perceived usefulness of TAMALLE features are pleasing, it should be noted that we cannot put too much weight on this as almost all technology innovation may score high in the lab-based evaluation. Therefore, more study, over a longer period of time and in natural settings (at home or on the move) may enrich our knowledge about the users' attitude towards TAMALLE system.

10.3.4.4 Usefulness of different TV genres

In the second part of the feature rating study, participants were asked to rate the usefulness of nine different television genres on a scale from 1 to 5 (1=*useless* and 5=*useful*). The genres include, news, drama, documentary, soap opera, reality show, lifestyle programme, chat show, sport and musical talent show.

A full account of the statistical results of the users' attitude survey of the perceived usefulness of different TV genres is presented in Appendix E. To summary here, documentary and news scored the highest (average mean of 4.8 and 4.7), followed by

soap opera in second place (4.1). The documentary was generally perceived to be very useful as it can provide a great deal of technical and contextual information about different topics, e.g. geography, politics, history and more. Perceived advantages of soap opera were mentioned as they provide a medium for hearing regional dialect, accents, and cultural information. Also, being able to learn new, common expressions, and slang was mentioned. Most of the participants also found it more difficult to watch and understand the soap opera in comparison with other programmes, *"I never can understand what they say, there is too much slang"*.

Dramas and sports scored the same (3.8). Generally, male participants liked the idea of being able to watch sport and learn some specific technical language terms regarding the games and players, *"Not just great fun, but also to catch up with English language, yes!"*.

Reality and musical talent shows scored the lowest (2.1 and 2.7). Participants could not see many benefits in learning from reality shows in particular. Some mentioned other genres that were not included in our question lists, such as comedy show, cartoons, cooking programmes, gardening programmes and Bloomberg. They were particularly fond of comedy shows because they enable them to learn about English humour and jokes. Overall they thought it really depended on an individual's preferences and motivations.

10.3.4.5 Learning different areas of language skills

In the final part of the feature rating study, the participants were asked to comment on the usefulness of the system in supporting different areas of language skills. The usefulness of the tools in supporting the following language skills was judged, on a scale from 1 to 5 (1=*useless* and 5=*useful*):

- Spelling
- Fluency in writing
- Reading
- Pronunciation
- Fluency in speaking
- Learning new words and phrases

- Making out what people are saying on television
- Making out what people are saying in ordinary life
- Understanding the meaning of what people are saying on television
- Understanding the meaning of what people are saying in ordinary life

A full account of the results of the users' attitude survey of the perceived usefulness of TAMALLE in supporting different area of language skill is presented in Appendix E. To summarise here, the TAMALLE scored well in supporting the learning of new words and phrases (5), making out what people are saying on television (4.6), making out what people are saying in ordinary life (4.6), understanding the meaning of what people are saying on television (4.6), understanding the meaning of what people are saying in ordinary life (4.5), reading (4.1), pronunciation (4.1), fluency in speaking (3.9) and spelling (3.6).

From the results above it is apparent that TAMALLE is perceived to be a useful tool for supporting learners' comprehension of television programme and learning of new language items, especially those that are not explicitly available in the dictionary, such as cultural, regional, slang and idiomatic expressions. The results also suggest that by using TAMALLE users thought that a learner may benefit in developing better listening and comprehension skills and in learning a new language and cultural items. Writing scored the lowest (3.1), as expected. Some of the comments that participants provided in relation to TAMALLE's perceived advantages in supporting different areas of language skills were:

- Learning new words and phrases, *"It helps for two reasons: information and entertainment"*.

- Comprehension and making out what people are saying on television and in day-to-day life, *"Slang, dialect are explained, definitions not usually found in dictionaries", "Making out what people are saying in ordinary life or on television goes with the option of being able to view words prior to watching the programme", "Shows words in context, how and when to use"*.

- Reading, "*You will read the words over and over again then you will memorise and then you become fluent"*. The dictionary function was considered very helpful for developing reading skills. It was also mentioned that TAMALLE provides an alternative way to improve reading skills, in particular for those learners who may be scared about making mistakes, *"People who are less fluent will be less scared to read".*

- Pronunciation, *"You will hear a native speaker's accent"*. It was said that the phonetic dictionary option is useful for improving listening and pronunciation skills.

10.3.4.6 Desirability

To measure desirability we used the product reaction cards described by Benedek and Miner (2002). A total of 118 words including 40% negative/neutral and 60% positive statements were presented to users. The participants were required to pick those that best described TAMALLE. In the first round they were able to select as many cards as they wanted. In the second round, they then narrowed down their selection to the five cards that best expressed their opinion and wrote down their detailed comments for these five cards. In this section we discuss the results.

The negative/neutral cards most mentioned were: 'busy', 'confusing' and 'slow'. The audiovisual and textual materials appearing together on one screen made the interface look busy. This factor might distract from normal television viewing.

The positive cards that were selected by more than half of our participants were: 'useful', 'helpful', 'motivating', 'easy to use', 'accessible', 'attractive', 'personal', 'connected', 'consistent', 'convenient', 'effective', 'engaging', 'entertaining' and 'familiar'. Table 10.6 depicts the number of times a card was selected in the first and the second round. In the first round, total numbers of positive cards were 314 and negatives were 24 cards. In the second round, total numbers of positive cards were 52 and negatives were 4. This corresponds to 93% positive and 7% negative out of the total number of choices the participants made from the first and second rounds.

The comments regarding the slowness of the software were all concerned with the iTV side of the TAMALLE interface where we had to simulate the user's interactions.

In summary, the results obtained from the product reaction cards clearly indicate that our participants liked the concept of TAMALLE, which they perceived as a useful, helpful, easy to use and accessible tool that could enable ubiquitous learning from familiar technologies. Table 10.5 provides some of the participants' comments and the cards that they selected in their final review. A full account of this is presented in Appendix F.

Cards	**Comments**
Accessible	*"It is easy to understand, to use and as TV is so present in our ordinary life it is a great medium to help learning"*
Connected	*"My TAMALLE could become like my own dictionary of information storage accessible at or away from home"*
Consistent	*"It has a very solid design with very intuitive navigation"*
Convenient	*"You can use the service at home or on the go*"
Empowering	*"Learning in this way is very empowering to understand not only the language but the culture as well"*
Engaging	*"It makes you engage better with the programme you are watching"*
Entertaining	*"It is fun to work with TV and mobile. It is a better way to advance students that at that point are tired of books and teachers"*
Helpful	*"It will help non native English speakers to learn the expressions"*
Motivating	- *"If I will have this, maybe I will watch more things on TV which I don't understand (soap-operas, documentaries)"* - *"The best thing about TAMALLE is it makes the user to want/learn more just but watching or typing a word on keyboard (Dictionary) without getting up and go to find a dictionary back on shelf"* - *"Encourage learning while you are entertaining yourself"*
Personal	*"I can choose my words and go back to them, cause I can make my own vocabulary list"*
Relevant	*"Summaries of News are very useful"*
Time consuming	*"From my point of view sometime it can be time consuming going through pages to get what you want, imagine having bad reception"*
Time saving	- *"You can save words; you will read the summary and learn word via WAP. You have your words saved on your phone and be able to study at anytime"* - *"Very good service when watching TV can save time, rather than searching for the dictionary and wasting time looking for the word when it can give me the exact meaning in context"*
Useful	- *"It is very useful not only for non English speakers but I am sure for English speakers as well in a cultural sense"* - *"Useful because makes you read, listen and watch some programmes which creates for you some English language environment"* - *"As a whole the software is very useful for any kind of English level, from beginner to advance level or even to English speaker"* - *"Very good learning method. It makes learning interesting and helps to improve the language vocabulary without any effort while watching TV and having fun"*

Table 10-5: Desirability evaluations: Learners' comments

Accessible	9	3	Creative	10	1	Fast	3		Meaningful	3		Slow	2	
Advanced	5	1	Customizable	4		Flexible	5	2	Motivating	10	4	Sophisticated	1	
Annoying	1		Cutting edge	2		Fragile			Not Secure	1	1	Stable	2	
Appealing	4		Dated			Fresh	3	1	Not Valuable			Sterile		
Approachable	5		Desirable	4		Friendly	5	1	Novel	2		Stimulating	3	
Attractive	8		Difficult	1		Frustrating	1		Old			Straight Forward	4	1
Boring			Disconnected			Fun	6	1	Optimistic	1		Stressful		
Business-like	1		Disruptive	1		Gets in the way	2	1	Ordinary	1		Time-consuming	1	1
Busy	2		Distracting	2		Hard to Use			Organized	4		Time-Saving	4	1
Calm	1		Dull			Helpful	11	4	Overbearing			Too Technical		
Clean	3		Easy to use	10	2	High quality	5	1	Overwhelming	1		Trustworthy	1	
Clear	2		Effective	7	1	Impersonal	1		Patronizing	1		Unapproachable		
Collaborative	3		Efficient	5	1	Impressive	2		Personal	8	3	Unattractive		
Comfortable	3		Effortless	3		Incomprehensible			Poor quality	1		Uncontrollable		
Compatible	4		Empowering	4	3	Inconsistent			Powerful	5	1	Unconventional		
Compelling	2		Energetic	2	1	Ineffective			Predictable			Understandable	6	2
Complex	1	1	Engaging	7	2	Innovative	4	1	Professional	4		Undesirable		
Comprehensive	4	1	Entertaining	7	1	Inspiring	4		Relevant	6	1	Unpredictable		
Confident	4		Enthusiastic	1		Integrated	1		Reliable	2		Unrefined		
Confusing	2		Essential	3		Intimidating	1		Responsive	1		Usable	4	
Connected	7	1	Exceptional	1		Intuitive	5		Rigid	1		Useful	11	8
Consistent	7	2	Exciting	3		Inviting	2		Satisfying	3		Valuable	3	
Controllable	3		Expected	2		Irrelevant			Secure	2				
Convenient	7	1	Familiar	7		Low Maintenance	1		Simplistic	3				

1st: the number of times a card was selected in the first round

2nd: the number of times a card was selected in the second round

Table 10-6: Desirability evaluation: the number of cards selected

10.3.4.7 Overall acceptance

In this section we discuss the results of the part of the evaluation sessions that aimed to gauge the overall acceptability of the system. We asked users about overall attitudes to the software, its perceived strengths and weaknesses and the likelihood of them using it.

Despite the slowness and business of the interface on iTV, most participants (9 out of 14) said they would definitely use it. All participants mentioned they liked the concept of TAMALLE and would use it not only for language learning purposes but also for learning new information and cultural knowledge. As one participants said, *"TAMALLE should not be seen as a pure language learning system, but more as a situated information base"*.

The greatest advantage of TAMALLE was thought to be the ability to:

- Provide immediate access to a dictionary and to words which are not in a typical learners' dictionary.

- Learn new language items, such as vocabulary, expressions and slang, *"it can be very helpful in the areas that most standard learning tools don't help, such as idioms and expressions"*.

- Learn while doing ordinary and enjoyable activities, *"It is entertaining rather than other tools like books and CD-ROMs that are not in our ordinary life like TV and mobile"*.

  "It is helpful, reliable, useful and easy to use and you can use it without having to switch from your favorite programme. You learn while watching TV: it is fun and useful at the same time."

- Learn on the move, *"you can learn wherever you are"*.

- Provide flexible access to learning materials, *"Being able to add words to my list of new words, which I can refer back to whenever I want"*.

- Acquire cultural knowledge, *"Westminster! I knew where it was but I did not know that the UK parliament was located in Westminster".*

The perceived disadvantages of TAMALLE were:

- Distraction from watching TV, *"It can become obtrusive or in the way of just watching TV. On screen data can add up to too much information at the same time, distracting from the main focus".*

  "Makes TV watching a learning experience, something you don't always want."

  "Might be distracting while listening to the programme, so people read the words in action for example rather than listening to it and trying to understand the meaning of it in speech."

- Difficulties in reading the text on-screen while viewing, *"Lack of visibility, small font size. I would like to have text bigger on screen".*

- Costs of using the services.

The next section explains our attempt to find out how effective the TAMALLE system could be for language learning.

10.3.4.8 Effectiveness of TAMALLE for language learning

In order to gain some insight about the effectiveness of TAMALLE, at the end of each evaluation session, we asked our participants whether using TAMALLE had actually helped them in learning new knowledge of language items.

Eight out of fourteen people mentioned that they had actually learned between 1 and 4 language items. One said, *"Most of the expressions that were shown were not familiar to me, so I have learned lots of new things in a very short time"*. Others, who could not recall any words, felt that if they had time to go back and review it again they would definitely learn and remember, *"I didn't remember most of the words that weren't*

familiar to me, so I think that it would be very useful the function to see these words again on the TV and the mobile. The expressions are also easier to memorize with the summaries".

The figurative expressions and slang were amongst those language items that our participants noticed and recalled. Expressions such as 'ducking and diving', 'top myself', 'high and dry', and 'up sticks' were mentioned.

Ideally, one could carry out a comparative test of language learning in order to evaluate TAMALLE's effectiveness. However, with the resource that we had available in this project, this area could not be exploited and had to be delayed for future research. More importantly, TAMALLE is intended for personal and informal learning, rather than as a competitor for formal teaching methods. This, with the difficulty of finding comparable test subjects at this level, would make experimentation to gauge effectiveness very difficult.

In terms of cost associated with the system, it is still in an early development stage and it requires further analysis of business and branding models in order to be able to compare the cost of using such system with the subtitled television per se. Also, it must be remembered that subtitles are not always available for all programmes to be used and compared with the functionalities of the TAMALLE system.

10.3.5 Comments and suggestions for further improving TAMALLE

This section discusses participants' comments and suggestions for further improving the TAMALLE system.

10.3.5.1 Cross platform interfaces

Participants made some comments regarding the cross platform interfaces. In particular they preferred to have different options to view the list of words both in 'My TAMALLE' and 'Recommended words'. In addition to being able to obtain the recommended words in chronological order, they also wanted to be able to view them alphabetically. A search facility was also mentioned. Participants also mentioned the advantage of being able to search for important words that appear in a certain time slot;

a time-based search was therefore proposed as a good additional feature, "*Having a feature that enables me to access the key words that were used in the last minute is good*".

The dictionary was perceived to be one of the most important and popular features of the system. The participants made a number of comments for improving it on both the iTV and mobile interfaces. First, they asked whether it would be possible to use a character button to select the appropriate section of the dictionary, for example A, B, and so on. Some suggested the use of voice input to avoid the need to type. In general, participants found writing with iTV and mobile phone interfaces more challenging than with a PC, and therefore using another input strategy was mentioned. A spell check facility for the dictionary when entering text was suggested, *"If it had a spell check would have been helpful".* A dictionary with audio pronunciations would also be appreciated. Some would have preferred to have a multilingual dictionary, including their own mother tongue languages, *"I prefer to have the option of choosing another language for the dictionary and words in action: in Arabic in my case"*. A thematic dictionary with different subject matters, such as health, science, history and so on, possibly with more usage examples would also be appreciated, "*I would love to have a scientific dictionary to check different concepts"*.

10.3.5.2 Customization and adaptivity

Participants mentioned the importance of being able to customise the dual interfaces and learning materials in accordance with their own preferences, *"I just wanted to select words from the recommended words to be played with the words in action"*, *"Before watching a programme when interacting with the TAMALLE by phone, maybe I can add the words in My TAMALLE and then they could appear on the words in action as I watch the programme"*.

It was felt that the 'Word in action' option would be more useful if the frequency with which it displayed on the screen could be customized and more under control of the learner, "*instead of showing or subtitling the recommended word once on the screen, being able to dictate the TAMALLE to show it two times or more*".

Users reported they would also like to be able to insert and type words into their personal learning sphere via both iTV and mobile, learning new words which they would like to practice later, *"Buttons that allow adding words to My TAMALLE should be made available"*. Being able to add words from the dictionary to 'My TAMALLE' was also mentioned.

Although participants appreciated the idea of being able to choose and add individual words to their personal sphere, they also valued the function which enabled them to add all recommend words in one go. They were mainly concerned about the cost of pressing buttons whilst using the WAP phones, *"Button that allows adding all words to My TAMALLE should be made available especially in WAP where it costs money to access a page"*. With this in mind, some suggested that offline access to 'My TAMALLE' on the mobile phone would be advantageous.

Participants also mentioned a desire to customize both interfaces on mobile phone and iTV in accordance to their own individual preferences in terms of text size, background colour and positioning, in a similar way to the PC.

10.3.5.3 Learning materials

Participants made some comments in relation to the learning materials provided. They mainly required more examples and explanations. The advantages of gaining cultural knowledge and learning ordinary expressions were pointed out frequently by most of participants.

They wanted extra information on the 'Words in Action' function, which include: note on dialect (e.g. Scottish), annotation with additional comments (e.g. humorous, sarcastic), and annotation with cultural context (e.g. Shakespeare). The phonetics of recommended words, possibly in audio format, was also appreciated.

Participants mentioned that they had found unknown terms even in the explanations provided, and therefore would prefer to have the functionality to ask for explanations of the words presented both in the 'Summary' and 'Recommended Words' functions. One suggested that the idea of having all words linked to a dictionary would be useful. However, a drawback of this is the nature and generalisation of the definition provided

by a dictionary as it includes all possible definitions and is less effective for providing context dependent explanations.

10.4 Conclusions

The TAMALLE design responds to the requirements we derived from multiple sources. Learning from engaging, up-to-date and authentic materials that are of intrinsic interest to language learners is enabled. Learning in context is made possible, with rich multimedia content providing a comprehensible setting for the new language. Learning on the move is supported, while the leisure use of television is respected. Learners can also choose to take advantage of one device without the other. Scaffolding learning opportunities can aid learners' comprehension of television programmes and learning of new language items. The textual annotations can facilitate just-in-time support for learning cultural specific knowledge and difficult language items. Finally, TAMALLE supports learners in creating and managing their own personal language knowledge accessible on an anytime and anywhere basis.

On initial evaluation, learners perceived TAMALLE as 'useful', 'helpful', 'motivating', 'easy to use', 'accessible', 'attractive', 'personal', 'connected', 'consistent', 'convenient', 'effective', 'engaging', 'entertaining' and a 'familiar' tool for language learning. The usability evaluation revealed an overall score of 3.9 indicating positive attitudes and statements towards TAMALLE's dual interfaces. Although there were some reported difficulties in reading text and on-screen display on the iTV side and for entering text and scrolling a page on the mobile side of the interface, overall they found the TAMALLE dual interfaces very easy to use and learn. They liked the concept of TAMALLE and mentioned that they would use it not only for language learning, but also for gaining contextual and cultural knowledge. TAMALLE was also recognised as an engaging and attractive tool that supports the learning of new phrases, vocabulary, and expressions, and helps learners in comprehension and understanding of what people are saying on the television and ultimately in their ordinary lives.

We have tried to evaluate TAMALLE using three different augmented programmes. More TV programmes should be considered for further evaluations. Also, more evaluations of TAMALLE in natural settings - according to learner's own motivation, at

home or on the move, over a longer period of time, and with more users - will be important for future research. The two hours the users were allowed to use the TAMALLE dual interfaces and also to envision a number of usage scenarios were simply not enough to observe all possible shortcomings and benefits of the system.

In the next chapter, Chapter 11, we describe how the research questions proposed were addressed through the course of this project, and draw some conclusions from our programme of research.

Chapter 11 Conclusions and further research

11.1 Introduction

This project, through its broad aims has, from the very beginning, attempted to explore the potential of iTV technologies for language learning, and has tackled a wide variety of research and development issues that arise in the context of cross platform system design for ubiquitous language learning.

The literature survey (Chapter 2 to 4) and the study of adult language learners' approaches and attitudes towards technology (Chapter 6) were used to shape the working framework for the iTV based language learning system, and placed various constraints on the design and development process. This framework suggested a cross platform approach, combining iTV with mobile phone technologies to support informal language learning. On the basis of the framework, a number of scenarios were developed, which were subsequently translated into a list of general requirements (Chapter 7). TAMALLE (Television and Mobile Assisted Language Learning Environment), a prototype system based on these requirements, was designed and developed for adult advanced EFL learners (Chapter 8). A study was conducted with EFL learners to identify criteria for the selection of LLOs from authentic TV programmes that could further scaffold learners' understanding through the recommendation and annotations functions of the TAMALLE system (Chapter 9). Finally, a multi-method approach was used for evaluation, which revealed an overall positive response from the language learners as well as pointing to useful extensions. TAMALLE was perceived to be a useful, usable and desirable tool for supporting informal language learning via iTV and mobile phones.

This chapter discusses and reflects on the process of addressing the research questions and highlights the contributions made to our current knowledge of the potential of new technologies for supporting the second language learner (section 11.2). The limitations of this research and directions for future work are also presented (section 11.3 and section 11.4).

11.2 Addressing the research questions

The research methodology adopted in the project emphasises a two-stage process: the *analysis/activities stage*, which includes the user study, investigations of theory and learning affordances of technology, and the *design stage*, which conceptualises the design space through scenarios and implementations.

The first part of the design process was concerned with building up a working framework for iTV based language learning. Our research investigation started with an extensive analysis of what knowledge needed to be incorporated in order to inform the design stage. Therefore, the very first question was:

(Q1) What should be the elements for a framework for iTV based language learning in order to inform the design?

To address the above question a working framework of iTV based language learning was developed that pulled together two elements of the socio-cognitive engineering methodology (user study and theory of use) with an overview of the learning affordances of iTV technology. In the light of this framework, the relevant areas for literature review were identified. Chapter 2 provides an extensive analysis of language learning literature, including learning and teaching theories, factors influencing successful language learning, adult learning theories, and practices. The literature review indicates that language learning requires acquiring different areas of language skills. It also involves a complex combination of instructed and self-directed approaches as well as conscious and unconscious processes. This overview also indicates how little we know about independent adult learners, about their approaches, and their use of the available technologies.

In order to gain insight into the way language learning technologies have developed over the years, Chapter 3 provides an overview of a number of different media technologies - including print, language lab, radio, tapes, CD, film, TV, DVD, computers, the Internet, email, chat and discussion forums, video conferencing, blogging, virtual reality and mobile devices - and their affordances for language learning. This review indicates that technology provides vast opportunities for second language learning. TV has been recognised as an excellent medium for supporting

language learning, and showing the target language and culture. In particular, TV with subtitles is generally perceived as a useful medium for learning lexicon and improving listening, comprehension, spelling and reading skills. This review also indicates further research directions for identifying characteristics and attributes of the lexical items that can be learned from television viewing. Mobile devices have great potential to support language learning, especially for learners who are on the move.

To further investigate the learning affordances of iTV technology, we provide a review of the iTV technologies, platforms, standards, and applications literature in Chapter 4. This review indicates the potential of iTV in supporting learning in general and language learning in particular.

Another element of our proposed framework was the empirical study of adult language learners. The focus group method was used to investigate approaches that a number of independent adult learners have adopted towards their language learning and their attitude towards a range of language technologies, including iTV and mobile phones. While Chapter 5 provides the overall research methodology adopted in this project, Chapter 6 presents a full account of our focus group studies and answers research questions (Q2) and (Q3).

(Q2) What approaches, techniques and technologies have been used or adopted by adult language learners for second language learning?

(Q3) How do adult language learners perceive iTV as a medium for language learning and what technological supports, tools and contents may extend their language learning experiences from the use of this medium?

The focus group study suggested a broad direction for our work. The results indicate that foreign language television was seen as a valuable medium for language learning. However, participants did not perceive iTV as a medium for formal learning. They were enthusiastic about multimedia and authentic materials of all kinds that could support informal and incidental leaning. We indicate briefly some of the most important themes that emerged:

- Authentic materials: learners were enthusiastic about learning from authentic materials of all kinds. They appreciated the fact that these materials are engaging.

- Learning in context: learners appreciated the advantage of learning in context, with different media complementing one another, each providing the context for the other. Foreign language television was seen as a beneficial medium, showing the use of language in different contexts and situations, and in the way that it is spoken by native speakers.

- Scaffolding: learners used a number of different strategies to scaffold their understanding. In particular, they liked the idea of target language subtitling as it anchored speech in written form, making it possible to find unknown terms. In addition, subtitles can make it easier to follow speech. Gestures and other graphical information can express extra-linguistic meaning. However, speed was a problem. The potential of TV for scaffolding learners' comprehension and learning new language items should be exploited.

- Sociability: participants indicated that they watch TV in company. The fact that imposing educational materials on fellow viewers who might not be interested in language learning was a big issue.

- Learning on the move: some participants liked the idea of being able to learn on the move, especially when travelling. Also, using a mobile phone had the advantage of not imposing learning materials on other viewers who were sharing the television.

Some limitations of this part of the study relate to the sample size. Firstly, people from only five countries took part and this is not representative of the full population of learners. Secondly, most of the participants were volunteers from amongst the students and staff of Brighton University, and therefore their approaches to second language learning and their attitudes towards using technology may be coloured by the fact that

they are technology users. Therefore, further studies should be undertaken to include participants selected from different nationalities and backgrounds.

The focus group results were incorporated with other elements of the framework, theory of use and learning affordances of iTV. The next question to address (Q4) was how the proposed framework could be translated into a set of general requirements for technology to support language learning.

(Q4) What requirements can we infer from the framework of iTV based language learning?

At this stage, the focus group results and findings of the literature review changed the direction of the research towards a cross platform approach: iTV and mobile phone, taking advantage of the best aspects of each medium, rather than concentrating on a single technology. A cross platform approach to language learning suggests that independent learners might learn from authentic materials broadcast on TV by receiving comprehensible input and constructing personal learning spaces. Two scenarios were developed and a list of general requirements was proposed for system design. Chapter 7 discusses the process of shaping requirements to artefact design. The following requirements emerged :

GR1. Support language learning on anytime and anywhere basis
GR2. Support learner's decision to learn from authentic television programme
GR3. Support language learning in context
GR4. Support learner's understanding of an authentic materials broadcast on television by scaffolding
    GR4.1. Scaffold learner's overall understanding of the programme
    GR4.2. Scaffold difficult language items that appear in a programme
    GR4.3. Provide support for just-in-time scaffolding
GR5. Support learners in constructing their own individualised environment that can be accessible on an anytime and anywhere basis
GR6. Support learners in accessing and retrieving their own individualised knowledge on an anytime and anywhere basis
GR7. Support learning in an unobtrusive fashion

The TAMALLE system, an informal language learning environment with dual interfaces across iTV and mobile phone is designed based on the requirements proposed. It can facilitate learning from authentic materials broadcast on TV, and enables learners to make use of these materials, and to construct and organise their own individualised learning environment that can be accessed on an anytime, anywhere basis. In this process, the system supports learners' comprehension of television programmes and learning of new language items (vocabularies). Chapter 8 therefore answers question (Q5).

(Q5) How can the set of requirements inform the design and development of a cross platform language learning support system?

Two novel cross platform solution architectures were proposed. The first uses the power of DVB streaming, Java Enterprise solutions, and Bluetooth technology. The second uses the principle of IPTV and WAP for delivering content to both set-top-boxes and mobile phones. For the TAMALLE prototype we used the second architecture, which provides a proof of concept for its utilisation. Although both architectures are demonstrated through the language learning system, they are designed in a way to be abstract enough to be used with other cross platform applications.

A detailed analysis of interaction design issues that arise in the context of cross platform systems for ubiquitous language learning through iTV and mobile phone was carried out. We analysed a number of issues concerned with the physical characteristics and limitations of each technology, alone and in combination, including on-screen displays, navigation and interactions. This is presented in Chapter 8.

As discussed briefly above and in detail in Chapter 8, TAMALLE provides annotation support to scaffold learners' understanding of a programme. These scaffolding facilities involved answering the question of exactly which aspects of the broadcast material are more problematic for advanced EFL learners. So, the following research questions were proposed:

(Q6)What language items/objects in televised programmes are problematic for the EFL learner?

(Q7)How do EFL learners perceive different television genres for language learning?

To answer the above, Chapter 9 presents the study designed to elicit criteria for selection of language items/LLOs from English authentic TV programmes. Three different TV genres were studied and compared: a popular UK soap opera (EastEnders), a news broadcast and a lifestyle programme (Relocation, Relocation, Relocation). The results indicate that television is a useful medium for learning about foreign culture as well as language. In addition, television provides an opportunity to hear different accents, dialects and pronunciations and this helps towards acquiring better listening skills. A number of desirable and useful criteria were identified for the provision of LLOs and their explanations. Names of unknown places, words referring to UK culture, western references, figurative expressions and slang were perceived to be difficult to understand, and therefore areas where help was required. Moreover, comparing different television genres in terms of their difficulty revealed that news was the easiest programme to use as opposed to soap operas, which were the most difficult. This study also identified two main areas for further research: customisation and adaptation of the TAMALLE interface, and the automatic generation of LLOs.

The limitations of this part of the study relate to the sample (advanced EFL learners), the number of genres used, and the length of the TV programmes (10 minutes) investigated. Ideally, we would have liked to include more TV genres, including documentaries, cartoons, reality shows, chat shows, etc., and also to consider other languages, but in the time available this was not possible. Moreover, in this study we have targeted advanced EFL learners; it may be that other viewers would find this approach of use, such as beginners, immigrants, and so on. More research is needed for other possible target users in the future.

Finally, for evaluation, a multi-method approach was used in order to investigate whether the TAMALLE system is usable, useful, desirable and acceptable as a tool to support EFL learners in learning via iTV and mobile phones, and to establish whether the system satisfies the general requirements proposed. This study addresses research question (Q8).

(Q8) Is this language learning environment (TAMALLE) perceived to be usable, useful, acceptable and desirable as a tool to support EFL learners?

Fourteen advanced EFL learners were asked to envision two scenarios of use for TAMALLE; at home and on the move. For the usability evaluation, we carried out the ISO Metrics questionnaire (Gediga et al. 2000) and observational usability study. To measure the perceived usefulness of its features we used feature rating methods. To measure desirability we used the product reaction cards described by Benedek and Miner (2002) and finally we asked questions about the overall acceptability of the system and the likelihood of learners using it if it were available.

The TAMALLE design responds to the general requirements that we derived from multiple sources. The usability evaluation revealed an overall 3.9 indicating positive attitudes and statements towards TAMALLE's dual interfaces. The usability observational study reveals the main problems associated with the iTV side of TAMALLE were related to a readability of text and on-screen display and using the remote control. The usability problems with the mobile side of TAMALLE were mainly associated to the physical characteristics of the mobile phone we used (Motorola V600). These problems were the screen size, scrolling a page, entering text and the price of using the WAP application.

On initial evaluation, learners perceived TAMALLE as a 'useful', 'helpful', 'motivating', 'easy to use', 'accessible', 'attractive', 'personal', 'connected', 'consistent', 'convenient', 'effective', 'engaging', 'entertaining' and 'familiar' tool for language learning. Although users found the interface on the iTV side to be slightly busy and likely to distract from natural television viewing, overall they found TAMALLE's dual interfaces very easy to use and learn. They liked the concept of TAMALLE and mentioned that they would use it not only for language learning, but also for gaining contextual and cultural knowledge. TAMALLE was also recognised as an engaging and attractive tool that supports the learning of new phrases, vocabulary, and expressions, and helps learners in comprehension and understanding of what people are saying on the television and ultimately in their ordinary lives.

Although the application of several evaluation methods in a single session was quite demanding of participants' time and concentration, the sessions succeeded in gathering a rich range of data. The results can now be integrated into the next version of the system. It should be pointed out, though, that as a learning support system, its effectiveness can only be evaluated when it is deployed over an extended period in a realistic setting. The artificial nature of lab setting for domestic and mobile applications, the small number of participants and time allowed for the system usage will have influenced the results. Also, the fact that, when choosing a programme, learners' interests and motivation are so varied, and that only three programmes were included in the evaluation, may have had an impact on the results. Therefore, more programmes, possibly from different television genres, should be considered for further evaluation. Chapter 10 further addresses the (Q8) and presents a full account of the results of the TAMALLE evaluations.

It should be noted that the system is suitable for informal learning. It can be used in association with formal learning, e.g. language class. However, this is less likely to happen as live access to broadcast television programmes, which may have different broadcasting times, is required. This factor will make it problematic to access TAMALLE in a regular formal classroom context. In addition to this, the system is designed to assist learners to learn from a television programme that they prefer: if it is used in association with a formal language class, it will be very difficult or almost impossible to accommodate all learners' motivations, interests and knowledge level.

Different parts of this multi-disciplinary process of analysis, design and implementation of a cross platform language learning support system are discussed thoroughly through the course of the thesis. There are a number of research ideas and issues that could not be studied within the time and resources available for this project, and which could be explored in further work. These are presented in section (11.3).

11.3 Further research

The previous section reports how the research questions were addressed throughout this project and suggests how the limitations of this work could be resolved. This section will provide ideas and research directions for further work.

11.3.1 More research on language learners

In this thesis, we report on small scale studies of adult language learners' strategies, motivations and use of technologies, using the focus group technique that directed the development process. Although the result contributes towards understanding of how adults go about their language learning, it could be further extended by more in-depth investigations, such as interviews and ethnographic studies. In addition, replication of the focus group studies with a wider range of subjects from different backgrounds and cultures - immigrants, housewives and so on - would be beneficial for further development.

11.3.2 Further development of LLO

In Chapter 9 of this thesis we discuss the study conducted for the development of LLOs from authentic television programmes, to be used within the recommendations and annotation function of the TAMALLE system. However, the limitations to this study were related to the sample size (Advanced EFL learners), the small number of genres studied (3), and the duration of the programmes used (10 minutes). More research therefore, has to be done to extend our studies by investigating more genres, possibly with longer duration of time, and with wider populations of learners (different levels of language competence, different demographic and different nationalities and cultures.

A further direction of research with regard to the development of LLOs is the possibility of automatic generation of content. Currently, a number of methods have been developed for indexing video content, using speech recognition and closed captions. These methods originally aimed to provide assistance in developing metadata from the videos that could be employed by applications for search and segmentations (Lin et al., 2005). Advances in Natural Language Processing (NLP) techniques also help in retrieving text in accordance with different rules and in real-time systems (Plu et al., 2002). In this case, algorithms could be developed to select and segment the part of the text that utilizes the result of our experiment; for example, to segment slang, cultural knowledge, names of places from the close captioned text available for a video.

Finally, unlike e-learning applications where there are standards for developing and operationalising learning objects and their metadata through LOM, IMS, and SCORM,

there is no standard in place for the development of learning content from television programmes. Currently, there is only one organisation (TV-Anytime) which is working towards developing a standard for segmentation of a digital TV programme with its metadata that could be mainly used for delivering personalised TV content to the consumer's set-top-box. Although researchers have already identified the potential value of integrating TV-Anytime and SCORM (Frantzi et al., 2004), more research has to be done in this direction in order to investigate the development of educational metadata for digital TV programmes. This research could also help in the development of automatic generation of LLOs from TV programmes that may also be delivered on a real time basis.

11.3.3 Further development of TAMALLE

There are a number of ideas for further development. In this section we summarise them within five categories: input strategy, dictionary, customization, adaptation, and search facility.

11.3.3.1 Input strategy

As both iTV and mobile phones are very limited in terms of text input, the possibility of using audio input facilities should be considered. Some mobile devices already have these facilities for activating calls and accessing phone book, therefore, a voice recognition interface could also be employed for TAMALLE interactions.

In TAMALLE, there is currently no functionality provided to enable users to add new words that are not recommended by the system into their own personal learning space. It is perceived by our language learners that if this function were added it would be very useful. Therefore, more support in the form of either text or audio input should be provided from the interface to implement this requirement for future development. When combined with speech input for instance, this might allow a learner to input language captured from native speakers.

11.3.3.2 Dictionary

TAMALLE provides an English to English dictionary facility on both iTV and mobile interface. However, the potential of a multi-lingual dictionary is recognised and should

be further developed for the system. Also, currently, we use the brief explanation of words that is supported by Answer.com and is freely available via the Internet. However, for copyright reasons, the TAMALLE dictionary does not feature all the English words which are available. As our concern for TAMALLE development was on its functionality and form, not on its dictionary content, this was not addressed in the research. However, for future development of TAMALLE, the possibility of using a well-developed source, such as the Oxford English Dictionary or a specialized EFL dictionary should be also considered.

The provision of pronunciations, either for dictionary or recommended words should also be developed. These functions can be well supported by the mobile phone interface, but for the iTV application, especially while the actual TV programme is running, they might not be suitable, unless the stop and replay functionalities of viewing a programme were supported to avoid playing two audio streams (programmer's audio stream with words pronunciations) at the same time. Therefore, more research has to be done in this direction.

11.3.3.3 Customization

The provision of tools for customizing the interface, similar to those available on personal computers, should be further investigated. In particular, parameters such as background and text colour, font and size should be adjustable in accordance with the user's preference. The 'Words in action' function of TAMALLE also would be improved by giving users a choice for selection of a number of language items to display and the frequency of their appearance. This will enable learners to study at their own individual pace and maximize the readability of the text. However, as discussed in Chapter 8, the interaction design issues for iTV and mobile phone are different from the PC. Therefore, more research is required to investigate how customization of the interface can best be supported by these devices.

11.3.3.4 Adaptation

From the evaluation studies reported in Chapter 10, there were a number of ideas for further improvement of TAMALLE that directs the development of adaptive and adaptable system. Adaptation could be developed in accordance to different parameters,

learner model, learning materials, interface, device specifications, and location of use (Tretiakov and Kinshuk, 2004).

For the development of adaptive learning materials, for example, LLOs could be created to accommodate different learners' interests, age and language competence. For an adaptive user interface, text, graphics, and multimedia content could be combined together to support a learner's cognitive style. For example, the annotation and recommendation functions of TAMALLE could be developed to match a learner's language competence. Adaptation in accordance with different device characteristics, and location of use (home, place of leisure and on the move) could also be considered. However, these issues have not been addressed within the scope of this project. Further research is required to investigate how the adaptive and adaptable functionalities could be developed for cross platform systems in general and for applications such as TAMALLE that facilitate language learning via iTV and mobile devices, in particular.

11.3.3.5 Search facility

The provision of a search facility for TAMALLE's recommended words as well as for the personal learning space, 'My TAMALLE', should be further developed for both the iTV and mobile interfaces. However, as mentioned earlier, entering text for both devices for search can be tedious; the possibility of using voice input for these functions should also be further deployed. At present we demonstrate the TAMALLE application with three programmes, but for TAMALLE to become a real life application, more programmes may be available. Therefore, the possibility of developing the search and sort functions that look for specific programmes, and/or themes within programmes, should also be investigated.

11.3.4 Collaborative learning

In this research we address how learning from television could be enhanced through the new development of iTV and mobile technologies. One of the ideas for development that came out from reviewing the language learning theories was the advantage of collaboration and discussion among language learners for improving communication skills. Currently, the Internet and WWW provide this opportunity for one-to-one and group discussions through chat-rooms, emails and discussion boards. ITV technology,

on the other hand, enables these communications tool that could be also further developed for language learning. Further research is required to investigation how these communication facilities could be further developed to support language learning through iTV and mobile devices.

11.3.5 Integration of other media

The research, with its original aim of exploring and developing the potential of iTV for language learning, has changed its direction towards the development of a cross platform application, combining iTV with mobile phone to support ubiquitous learning. Although, through the discussion of language learning technologies presented in Chapter 3, we intended to demonstrate the potential value of other media technologies - including video and audio based technologies, the Internet, communication technologies, and games - for language learning, this research has made little attempt to investigate how these technologies could be combined together in order to enhance learning practices. In particular, with the advancement of new technological development, much of the specific functionality of these technologies is blending across a number of devices. For example, mobile phones are no longer perceived as a pure communication medium; they also have the functionalities of the Internet, cameras, music players, TV, and more. Moreover, software is becoming available for mobile handsets with the ability to download podcasts and MP3 files.

The potential of all these media, in conjunction with television, should be explored for language learning. Taking the example of podcasting facilities, a number of functionalities could be added, i.e. multiple audio channels could be delivered, extra audio materials for listening and comprehension practices could be developed, and the authentic voices of the learner and native speakers could be provided (Munro, 2005).

In addition, the functionalities of TAMALLE could be further developed to include Web-based applications. However, more research is required to establish how language learners perceive this multi-medium delivery of learning, as we do not want to change the perception of informal and blended learning practice they already have (i.e. while engaging in enjoyable and day-to-day activities, such as watching television, playing games, etc.) into a more formal and structured one.

11.3.6 Business model

As discussed in Chapter 8, unlike most desktop and web applications, services on iTV and mobile phones co-exist in a commercial environment with services from other providers. Broadcasters (e.g. BBC, Home and Leisure), manufactures (e.g. Sony, Philips, Nokia), content producers (e.g. Endemol) and platform providers (SKY, Vodaphone) all share the provision of digital content to the end users. In this case, TAMALLE could be owned and maintained by all these stakeholders or be owned by third party software developers. In particular, if the provision of learning materials (such as language learning items, programme summaries or a dictionary) is supported by other providers, their interests also have to be considered when designing the business or branding model. However, this research does not address the issue of maintaining a balance between the interests of all stakeholders. Future research in this direction is required. The commercial and pricing aspects of such a system are other areas for further investigation.

11.4 Future horizons for cross platform development

In this project, we explored the design and development process of a cross platform learning system. Although language learning was the central focus of this project, many issues that were addressed might be of interest to other projects. In particular, some of the strands of this work will be expanded and used in the context of European Union funded project called LOGOS[38], which aims to develop a knowledge-on-demand learning platform for PC, iTV and mobile devices (Pemberton et al., 2007). We hope that the result of this research will find application in a wide range of cross platform development for ubiquitous learning in the future.

[38] LOGOS is a European Union funded project (FP6-2004-IST-4) that is due to be completed in February 2009. For more information see the LOGOS web site: http://www.logosproject.com/

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Appendix A: Related publications

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Pemberton, L. and Fallahkhair, S. (2005). Design Issues for Dual Device Learning: Interactive Television and Mobile Phone. *Proceedings of the 4th World Conference on Mobile Learning (mLearn)*, Cape Town, South Africa, 25-28 October. pp. 55-61.

Appendix B: ITV applications

This section provides some more examples of the applications of intra-programme and extra-programme interactivities.

Applications of intra-programme interactivity

One more example of intra-programme interactivity is the Bloomburg, the financial service corporation, which has developed an interactive service on digital satellite and cable in the UK (see Figure A-1). The enhanced TV application has similar functions to the traditional Bloomberg and offers a broad variety of financial information and services with a personalised tool and content. The application provides: price information on UK, European and World markets (e.g. Dow Jones and FTSE); graphical charts to shows market movements over a certain period of time; market indices to indicate the most active stocks and biggest risers and fallers; a currency calculator covering 18 major currencies; up-to-date news on UK and world business, technology, governments and sports; and a tool to create a personal portfolio of shares. The Bloomberg channel itself is also integrated with the interactive application that allows viewers to participate using email.

A number of reality television shows have recently been developed which enhance viewer participations by enabling them to cast votes and to change the narrative of the show. These include “Big Brother”, “I’m a Celebrity - Get me out of Here”, and “Pop Idol”. The “I’m a Celebrity - Get me out of Here” interactive iTV application (see Figure A-2) allows viewers to select the interactive service during the show, by pressing the red button, and to cast votes using the remote control to choose which celebrity should take a challenge or leave the show.

Figure A-1: Bloomberg iTV service on Sky Digital

Figure A-2: “I’m a Celebrity - Get me out of Here” interactive service

Gobarkingmad’s interactive application on Sky digital platforms allows viewers to bet on Greyhound races (see Figure A-3). The interactive service is simple to use and navigate, and placing a bet is easy. The viewer can use the betting service whilst

watching a race as the video remains constantly available in the top right hand portion of the screen.

Figure A-3: The Gobarkingmad's interactive application

The interactive advertisement developed for Coca-Cola on BSkyB platforms encourages viewers to register for the Coca-Cola “Text for Music” promotion (see Figure A-4). The promotion allows viewers to collect special codes from packs of Coke and in return receive music credits which they can exchange for limited edition CDs. By pressing the red button, the viewer is taken from the conventional advert to the interactive service where they can register for the promotion by entering their mobile telephone number (the set-top-box is connected to Sky via its internal modem).

Another example developed for the BSkyB platform is the quiz-based game “Who Wants to be a Millionaire?” (see Figure A-5). The game has similar functions to the television programme and offers familiar features, such as “Phone a Friend”, “50/50” and “Ask the Audience”. Players interact by using their remote control arrow or numbered keys to give their answers.

Figure A-4: The Coca-Cola Text for Music Interactive advertisement

Figure A-5: “Who Wants to be a Millionaire?” interactive game

Applications of extra-programme interactivity

One more example of extra-programme interactivity is AOL that provides the communications service for the BSkyB digital satellite platform in the UK that offers email and instant messaging whilst the user is able to continue watching the TV in quarter screen mode (see Figure A-6). Text entry is possible using the remote controls or the Sky infrared keyboard.

Figure A-6: AOL communications on digital satellite platform

MTV (Music television channel) have provided a service for TV to SMS communications. The service allows viewers to register and to send their SMS messages to a guest chat celebrity host. The messages are then displayed in the application window on screen, which can also be resized by viewers, using the up and down keys, in order not to obscure the programme (see Figure A-7). Also, by pressing the blue button, the viewers can remove the application from the screen.

Another example is the national Lottery, which enables the purchase of a Lotto ticket through the TV (see Figure A-8). Once the user has set up a National Lottery account, by providing their name, address and debit card details, they can transfer money into that account and buy tickets either by choosing numbers with the remote control or by selecting random numbers with the ‘Lucky Dip’ function.

Figure A-7: MTV TV to SMS interactive service

Figure A-8: The national Lottery interactive service

Appendix C: Language learning objects developed from broadcast TV programmes

This section provides a full list of LLOs, with their on-screen explanations, that were developed for TAMALLE evaluation. However, it should be noted that these explanations are provided in the context of the programme concerned, therefore, more detailed and general explanations should be acquired from other sources, e.g. Oxford English dictionary, Wikipedia, etc.

TV Genre	Language item	On-screen
News		
	TB	Tuberculosis
	NHS	National Health Service
	Libel laws	Laws to protect reputation from written attack
	Landmark human right	Important
	Asbestos	Dangerous building material
	Crunch time	Critical time
	Row	Argument
	Bypass protesters	People protesting about building of new road
	Conservatives	Tories
	Stop the drain on NHS	Waste of NHS funds
	Inner city practices	Doctors' offices in large cities
	Bradford	Northern England industrial cities
	Portfolio	Collection
	Spelled out	Explained
	Screened	Tested
	HIV	Human Immunodeficiency Virus that causes AIDS
	Asylum seekers	Refugee
	Off shore	Outside the UK

TV Genre	Language item	On-screen
	Ratcheting up	Making more extreme statement about
	Bidding war	Competition
	Tackling	Trying to solve
	Pander	Indulge them
	Killers	Fatal diseases
	Back in 1930's	The 1930's
	Grips	Deal with, Solve
	Complacency	To make people feel there is no need for acting
	One off	Single
	GPs	Doctors
	Westminster	Site of UK Parliament
	Landmark ruling	Important decision
	Fair hearing	A fair trial
	Strasbourg	City in North East France
	David and Helen against Goliath	Struggle of weak against strong
	Defendants	People who are accused or sued
Lifestyle - Relocation, Relocation, Relocation		
	It's the stuff dreams are made of	An ideal
	Surfer babes	Surfer girls
	High and dry	Left in difficulties
	Swindon:	Inland town in Soth West England
	Pad	Home
	Enough is enough	They have had enough
	Devon	Coastal county in South West England
	M5	Motorway 5
	Chilled out	Relaxed
	Surfer dudes	Surfer
	Boogie boarding	Type of surfing

TV Genre	Language item	On-screen
	240 grand	240 thousand pounds
	Pricey	Expensive
	Up sticks:	Leave
	Get our skates on	Hurry
	Landlocked Swindon	Inland Swindon
	Stuff Swindon	Forget Swindon
	Let go of the rein?	Give up control
	To reap the reward	Get the reward
	A bit of a Playpen	Somewhere to play
	Congregate	Come together
	Appledore	Seaside village in Devon
	Westward Ho!	Seaside village in Devon
	Croyde	Seaside village in Devon
	Beach hut	Simple one-room building on beach
	Swanky	Fashionable
	Period	Old style
	A shack on the beach	Simple building
	Be real boon too	Advantage
	Stretch his legs	Take some exercise
	Devon has gone Ballestic	House prices in Devon have risen a lot
	Funky urban pad	Fashionable city home
	Sound a note of caution	Give a warning
	Bitten the bullet	Made a difficult decision
	We put in the blood, sweat and toil	We worked very hard
	Riding their breakers	Surfing the waves
	Crash pad	Home
	Watery vistas	View of the sea
	The heat is on	Pressure in high
	Lined up	Ready

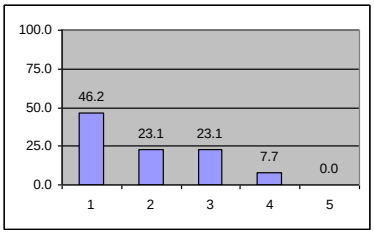
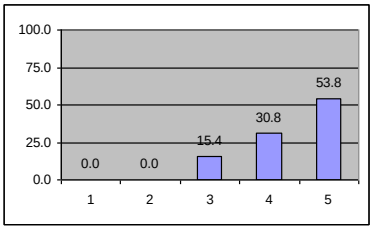
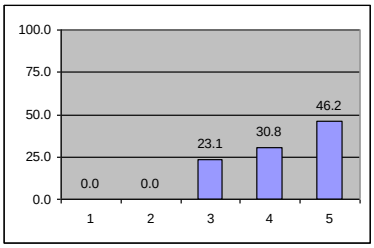
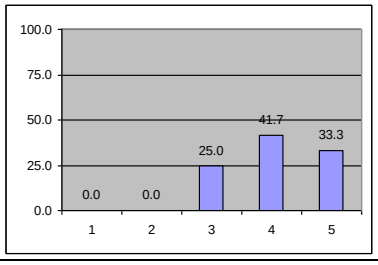
TV Genre	Language item	On-screen
Soap Operas - EastEnders		
	Offered herself on a plate	Offered herself
	Stag do	Party for bridegroom on day before wedding
	Whirlwind romance	Rapid romance
	Cutting it fine	You are risking being late
	Give me a lift	Give me a ride
	Old banger	Old car
	Novelty wears off	It becomes normal
	Motorist	Driver
	Got your heart set on	Really want
	Joy riders	People (normally young men) who steal cars and drive too fast in them
	Road rage	Angry behaviour on the road
	Death trap	Very dangerous place
	Hang on	Stay
	Bit Derrick's head off	Spoke angrily
	Carriage awaits	Car is waiting (humorous)
	Ducking and diving	Hiding from trouble
	Stop fighting the inevitable	Accept what has to happen
	Get over him	Stop being in love with him
	Top myself	Kill myself
	Blond bimbos	Attractive but unintelligent young woman
	Frosty	Unfriendly
	Lashed out	Attacked (in words)
	Once the cat is out of the bag	Once a secret is in the open
	On the spur of the minute	Without planning
	Highway code	Book of rules of the road
	Provisional	Temporary driving licence
	Deposit	Money paid as security to landlord
	At short notice	Quickly

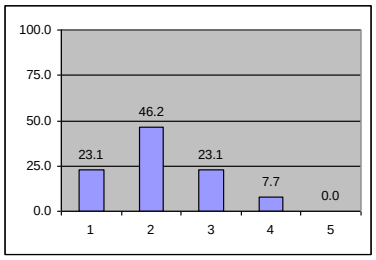
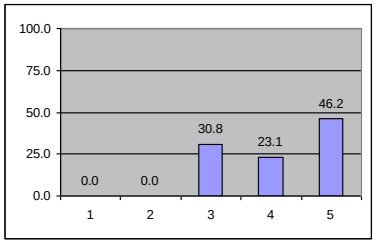
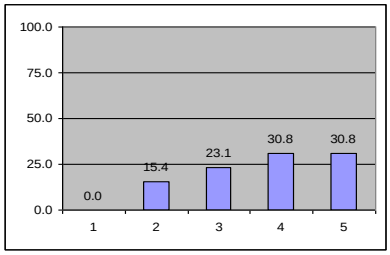
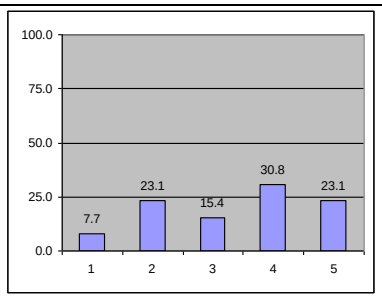
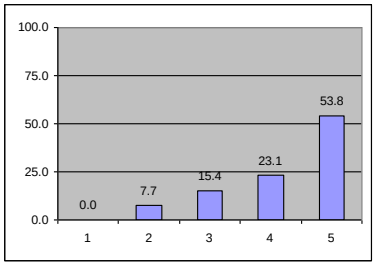
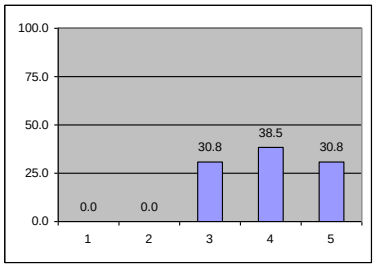
TV Genre	Language item	On-screen
	Faced up	Deal with
	You make yourself scarce	Go away; Disappear
	Don't have a clue	Don't know
	Bloke	man, Guy
	A crush	Temporary attraction
	A pack of lies	not true
	Snogged	Kissed
	On your bike	Off you go, Go away
	And all	In addition, As well
	Pushbike	Bicycle
	Behind the wheel of a car	Driving
	Spiteful	Nasty, Hateful
	Because of my nerves	I become anxious easily

Appendix D: The results of the ISO metric usability questionnaire

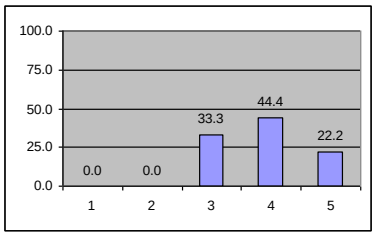
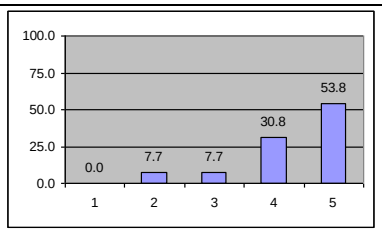
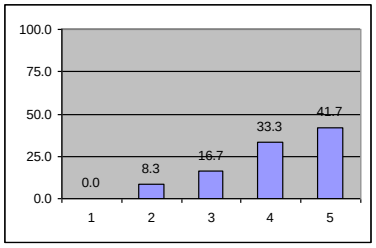
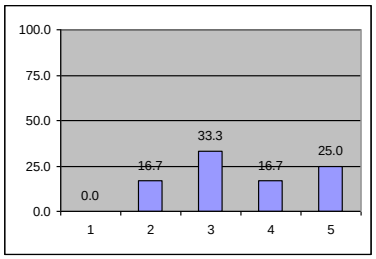
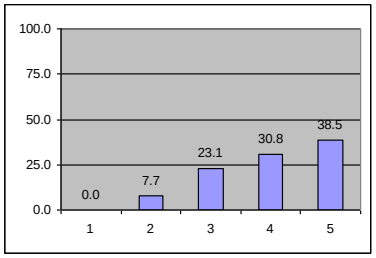
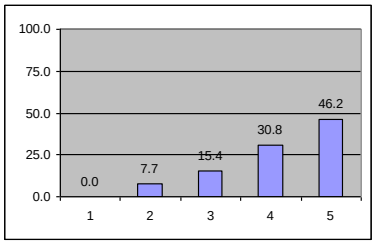
This section provides the results of the usability evaluations for different categories of the ISO metric questionnaire.

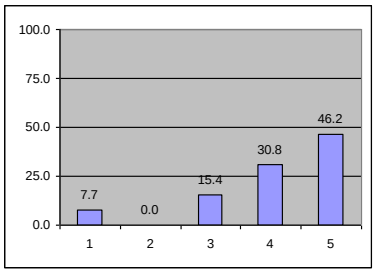
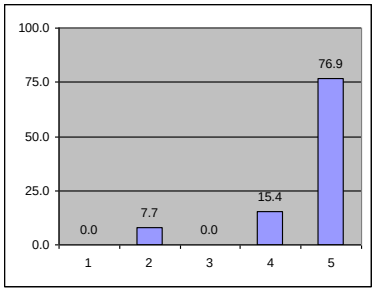
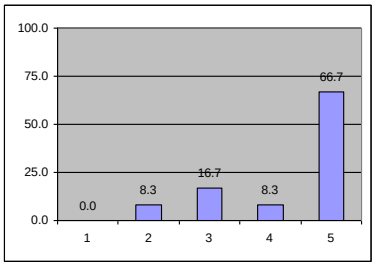
Results of usability questionnaire for the category 'Suitability for learning'

Question	#Res	1= predominantly disagree ←→ 5=predominantly agree	Mean	St Dev
Suitability for learning				
The software forces me to perform tasks that are not related to my actual learning	13		1.9 (4.1)	1.0
The functions implemented in the software support me in performing my learning	13		4.4	0.8
The way in which data is entered is suited to the tasks I want to perform with the software, e.g. dictionary data entry	13		4.2	0.8
I perceived the arrangement of the learning materials on-screen sensible for my learning	12		4.1	0.8

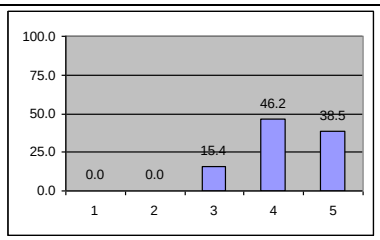
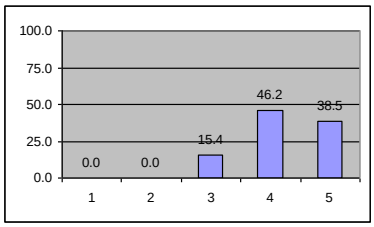
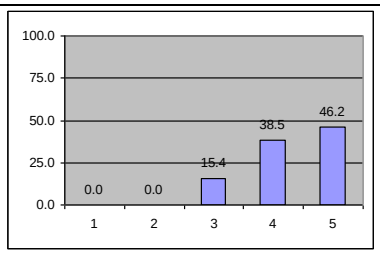
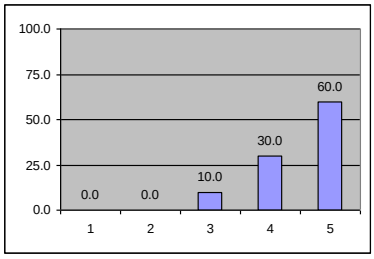
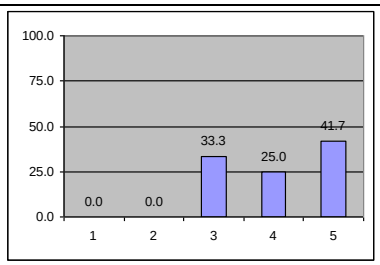
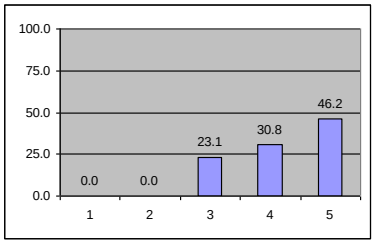
Question	#Res	1= predominantly disagree ←→ 5=predominantly agree	Mean	St Dev
Suitability for learning				
Too many different steps need to be performed to deal with a given learning task	13		2.2 (3.8)	0.9
The way in which learning materials were presented suited to task of my learning	13		4.2	0.9
The software is well suited to the requirements of my learning	13		3.8	1.1
In a given screen, I find all of the information I need in that situation	13		3.4	1.3
The terminology used in the software reflects that of my own learning	13		4.2	1.0
The presentation of the information on the screen supports me in performing my learning	13		4.0	0.8
Category average	**3.9**			

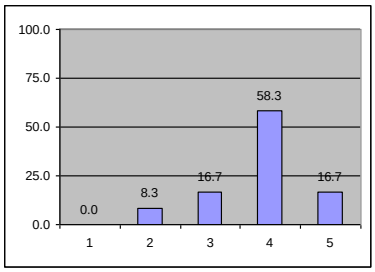
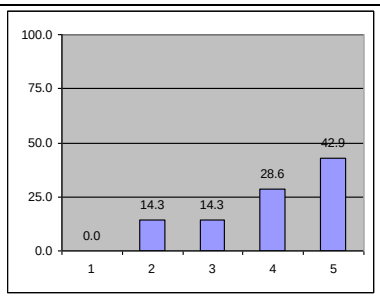
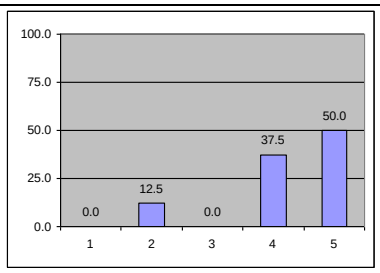
Results of usability questionnaire for the category 'Self-descriptiveness'

Question	#Res	1= predominantly disagree ←→ 5=predominantly agree	Mean	St Dev
Self-descriptiveness				
I can call up for specific explanations for the use of the system, if necessary.	9		3.9	0.8
I understand immediately what is meant by the messages displayed by the software.	13		4.3	0.9
It is easy to retrieve information about a certain entry field.	12		4.1	1.0
When menu items are not available in certain situations, this fact is visually communicated to me.	12		3.3	1.5
The software provides me with enough information about which entries are permitted in a particular situation.	13		4.0	1.0
I can tell straight away which functions are invoked by the various menu items.	13		4.2	1.0

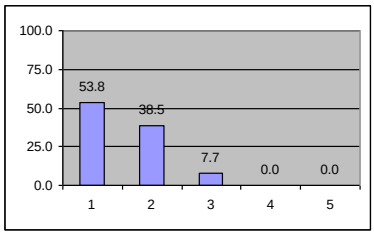
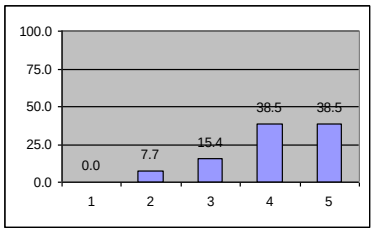
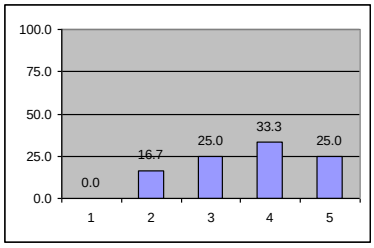
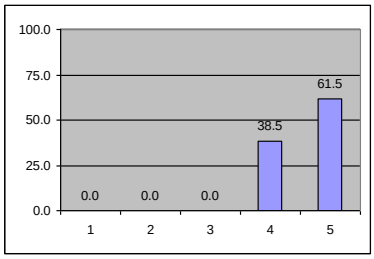
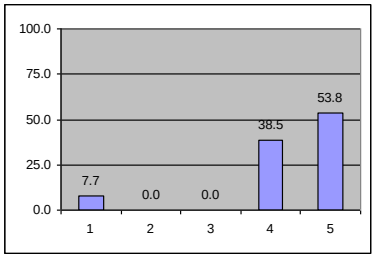
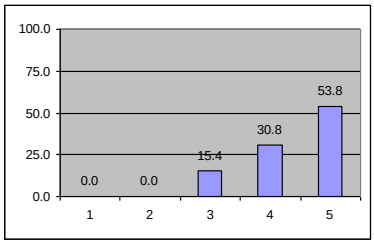
Question	#Res	1= predominantly disagree ←→ 5=predominantly agree	Mean	St Dev
Self-descriptiveness				
The terms and concepts used in the software are clear and unambiguous.	13		4.1	1.2
The software always visually marks the current entry location (e.g. by a highlight, a contrasting colour, a blinking cursor, etc.).	13		4.6	0.9
I can easily tell the difference among feedback messages, requests to confirm inputs or commands, warning, and error messages.	12		4.3	1.1
Category average	**4.1**			

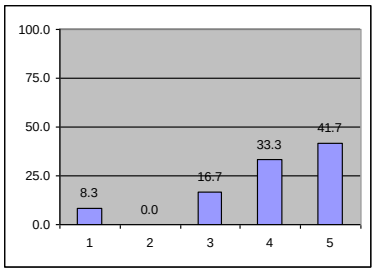
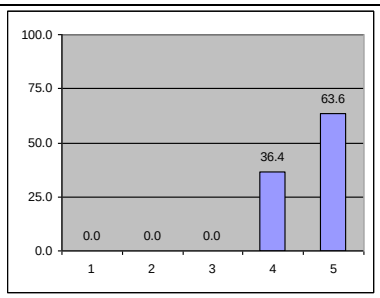
Results of usability questionnaire for the category 'Controllability'

Question	#Res	1= predominantly disagree ←→ 5=predominantly agree	Mean	St Dev
Controllability				
The possibilities for navigating within the software are adequate.	13		4.2	0.7
The software makes it easy for me to switch between different menu levels.	13		4.2	0.7
The software let me return directly to the main menu from any screen.	13		4.3	0.8
I can interrupt any dialog at any time.	10		4.5	0.7
It's easy for me to move back and forth between different screens.	12		4.1	0.9
The navigation facilities of the software support optimal usage of the system functionality.	13		4.2	0.8

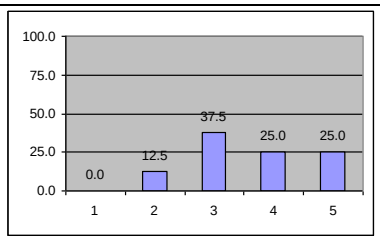
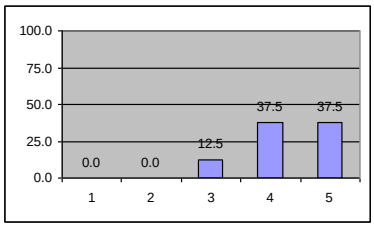
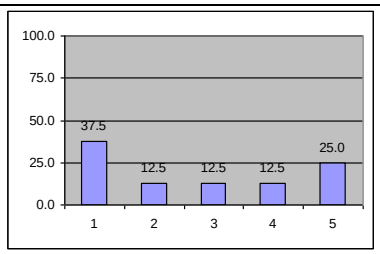
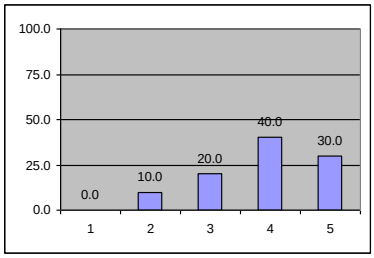
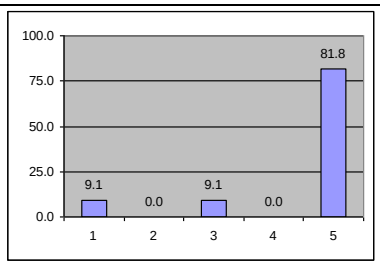
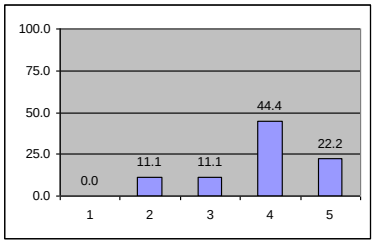
Question	#Res	1= predominantly disagree ←→ 5=predominantly agree	Mean	St Dev
Controllability				
In order to perform my tasks, the software requires me to perform a fixed sequence of steps.	12		3.8 (2.2)	0.8
When selecting menu items, I can speed things up by directly entering a letter or a command code.	7		4.0	1.2
It is always possible to terminate a running procedure manually.	8		4.3	1.0
Category average	**4**			

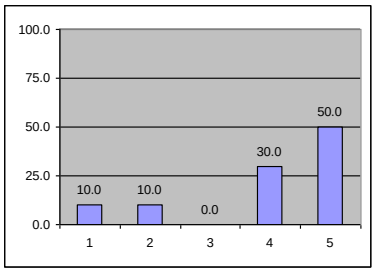
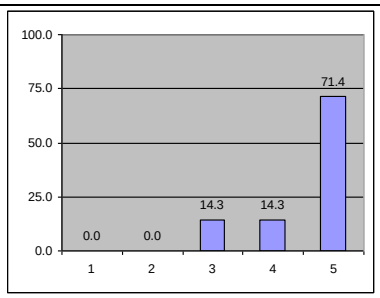
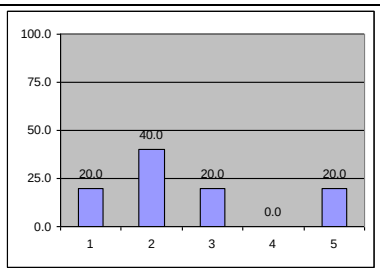
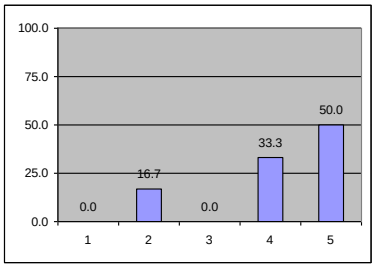
Results of usability questionnaire for the category 'Conformity with user expectations'

Question	#Res	1= predominantly disagree ←→ 5=predominantly agree	Mean	St Dev
Conformity with user expectations				
The software is inconsistently designed, thus making it more difficult for me to do my work.	13		1.5 (4.5)	0.7
I can anticipate which screen will appear next in a processing sequence.	13		4.1	1.0
I have no difficulty in predicting how long the software will need to perform a given task.	12		3.7	1.1
The designations are used consistently in all parts of the software I am familiar with.	13		4.6	0.5
I find that the same function keys are used throughout the program for the same functions.	13		4. 3	1.1
When executing functions, I have the feeling that the results are predictable.	13		4.4	0.8

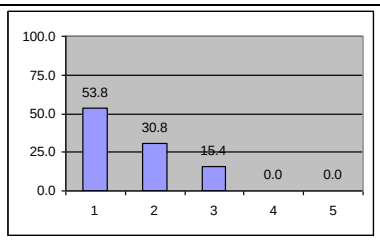
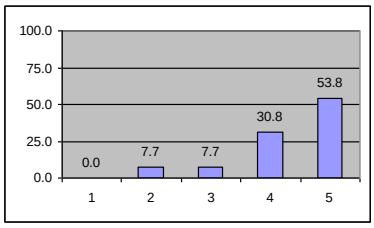
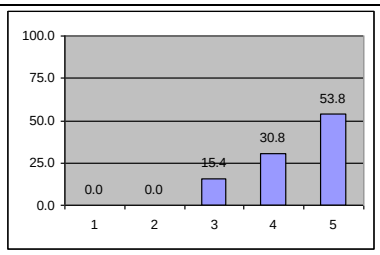
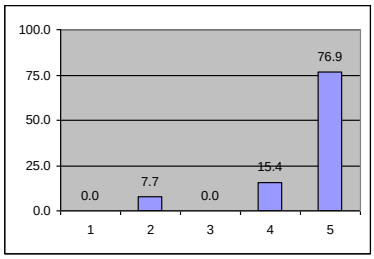
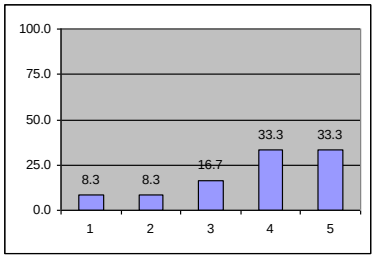
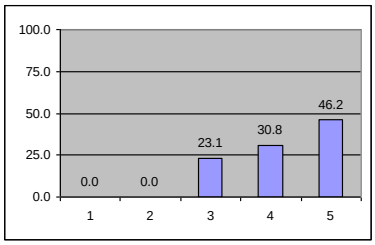
Question	#Res	1= predominantly disagree ←→ 5=predominantly agree	Mean	St Dev
Conformity with user expectations				
My impression is that the same possibilities are consistently available for moving within and between different parts of the software.	12		4.0	1.2
The messages output by the software always appear in the same screen location.	11		4.6	0.5
Category average	**3.8**			

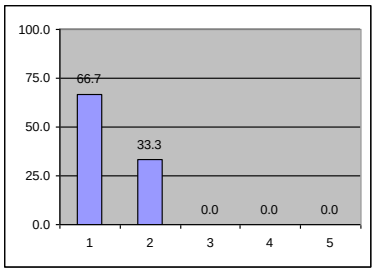
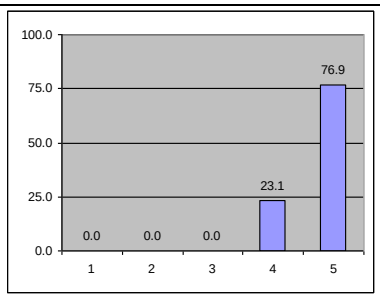
Results of usability questionnaire for the category 'Error tolerance'

Question	#Res	1= predominantly disagree ←→ 5=predominantly agree	Mean	St Dev
Error tolerance				
Even if I make a mistake, the information (e.g. data and text) which I have just entered is not lost.	8		3.6 (2.4)	1.1
If I make a mistake while compiling a form, I can easily restore everything to its previous state.	8		3.8	1.7
When I attempt to perform a destructive operation (e.g. deletion of data, etc.), I am always first prompted to confirm the action.	8		2.8	1.8
My impression is that very little effort is involved in correcting mistakes.	10		3.9	1.0
No system errors (e.g. crashes) occur when I work with the software.	11		4.5	1.3
If I make a mistake while performing a task, I can easily undo the last operation.	9		3.4	1.6

Question	#Res	1= predominantly disagree ←→ 5=predominantly agree	Mean	St Dev
Error tolerance				
I have never made an entry that caused a software error (e.g. a system/program crash or an undefined dialog state)	10		4.0	1.4
The software includes safety features to help prevent unintended actions (e.g. critical keys spaced well apart, highlights, designations that are not easily confused).	7		4.6	0.8
The software provides me with useful information on how to recover from error situations.	5		2.6	1.1
I perceive the error messages as helpful.	6		4.2	1.2
Category average	**3.6**			

Results of usability questionnaire for the category 'Learnability'

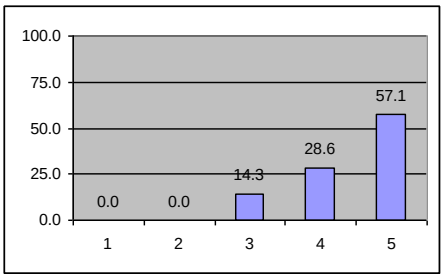
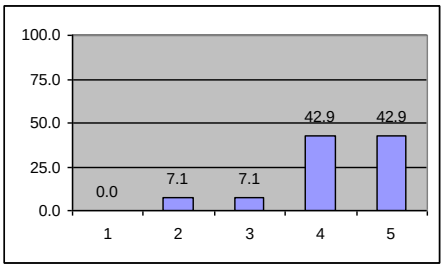
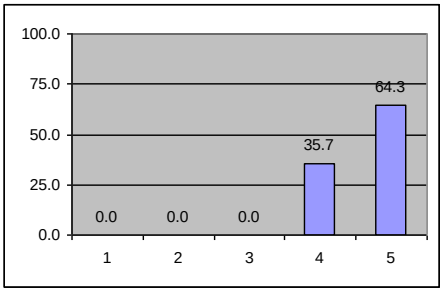
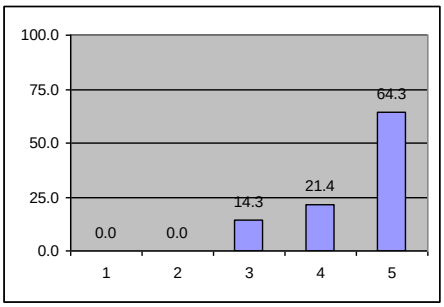
Question	#Res	1= predominantly disagree ←→ 5=predominantly agree	Mean	St Dev
Learnability				
I need a long time to learn how to use the software.	13		1.6 (4.4)	0.8
It is easy for me to relearn how to use the software after a lengthy interruption.	13		4.3	0.9
The explanations provided help me understand the software so that I become more and more skilled at using it.	13		4.4	0.8
So far I have not had any problems in learning the rules for communicating with the software, i.e. data entry	13		4.6	0.9
I was able to use the software right from the beginning by myself, without having to ask co-workers for help.	12		3.8	1.3
I feel encouraged by the software to try out new system functions by trial and error.	13		4.2	0.8

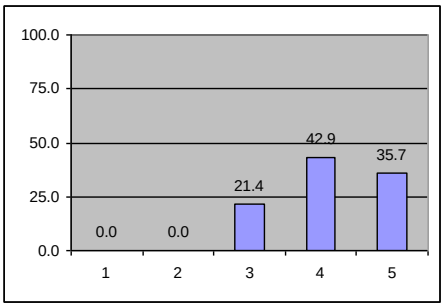
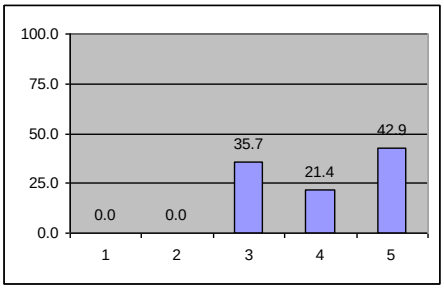
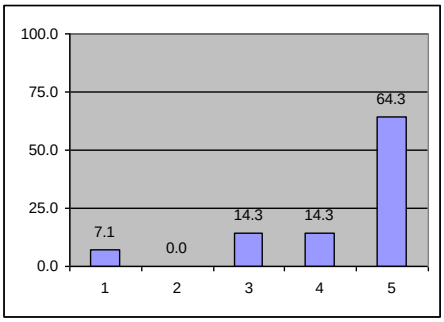
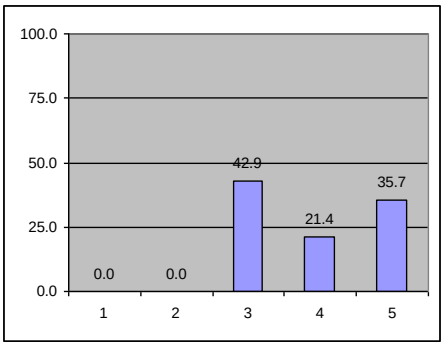
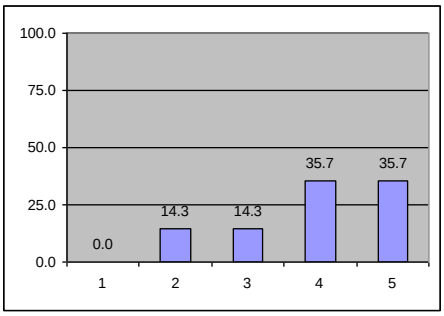
Question	**#Res**	**1= predominantly disagree ←→ 5=predominantly agree**	**Mean**	**St Dev**
Learnability				
In order to use the software properly, I must remember a great many details.	12		1.3 (4.7)	0.5
I find it easy to use the commands.	13		4.8	0.4
Category average	**4.4**			

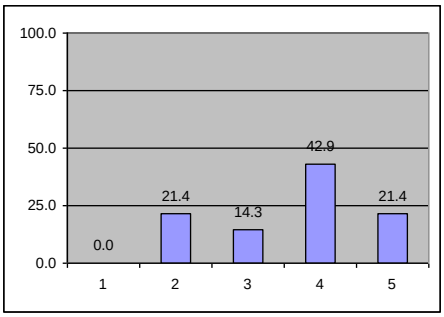
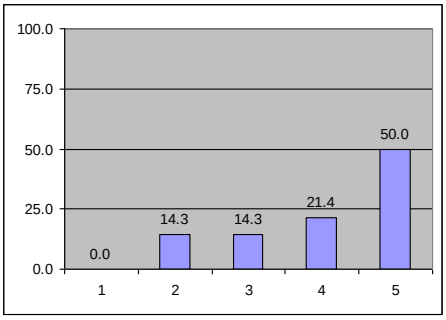
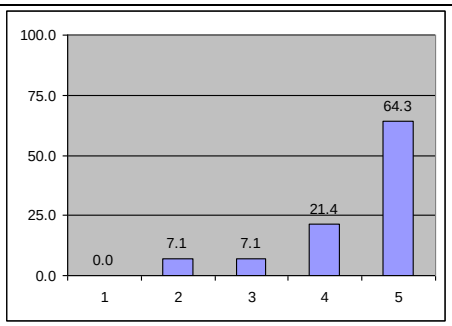
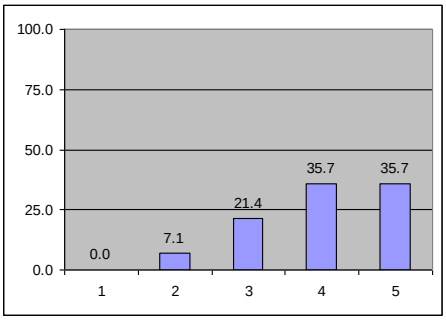
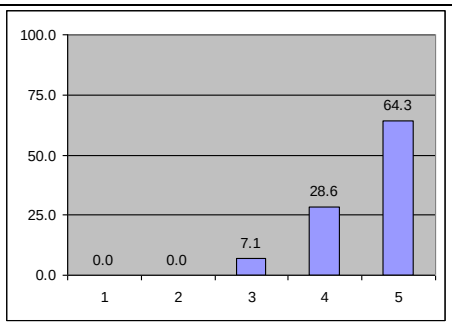
Appendix E: User attitude survey: the results of perceived usefulness of TAMALLE system

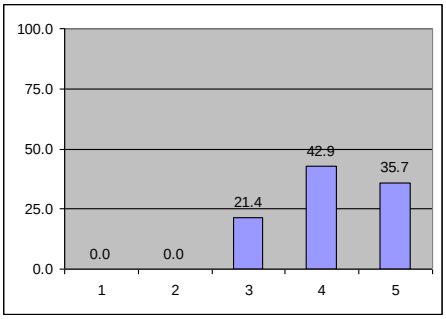
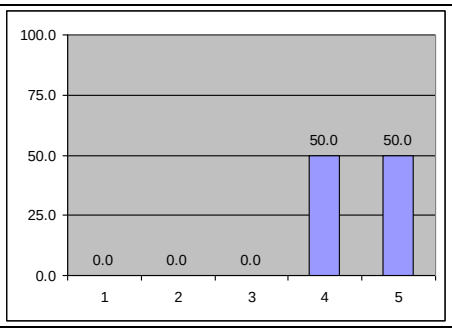
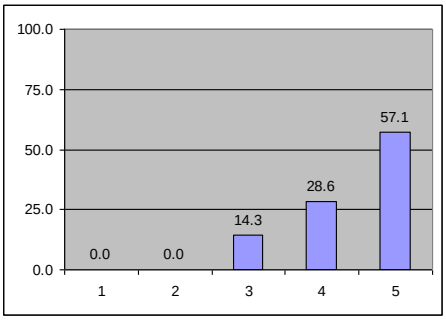
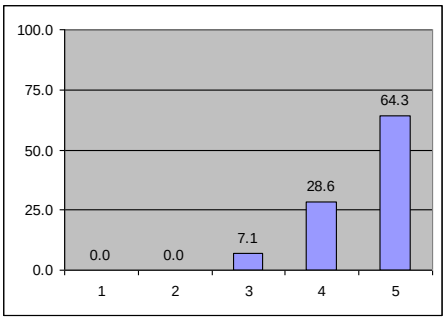
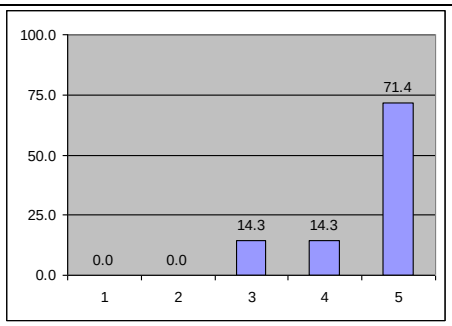
This section provides a full account of the results of the users' attitude survey of perceived usefulness of TAMALLE's features, perceived usefulness of different TV genres and perceived usefulness of TAMALLE system in supporting different area of language skill

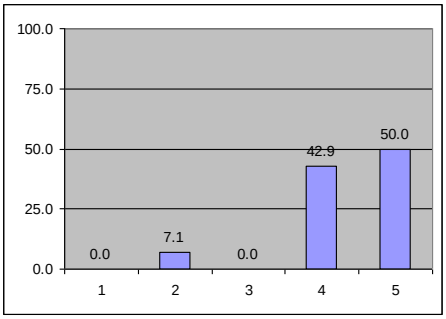
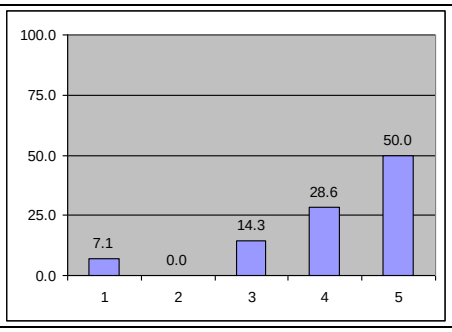
Perceived usefulness of the TAMALLE's features

Features	**#Res**	**1= useless ←→ 5=useful**	**Mean**	**St Dev**
1. Learning via two mediums: iTV and mobile phones (e.g. while watching a TV programme or on move)	14		4.4	0.8
2. The provision of recommend words on ITV (e.g. being able to read a list of difficult words while watching a programme)	14		4.2	0.9
3. The provision of recommended words on mobile (e.g. being able to read a list of difficult words on move and before, during or after the programme show time)	14		4.6	0.5
4. The explanations provided for difficult words	14		4.5	0.8

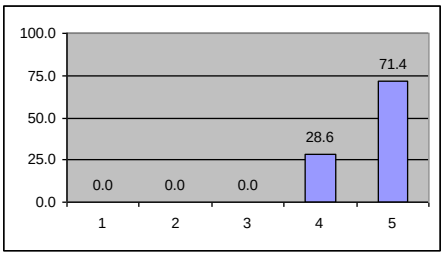
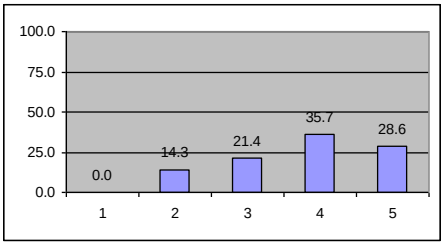
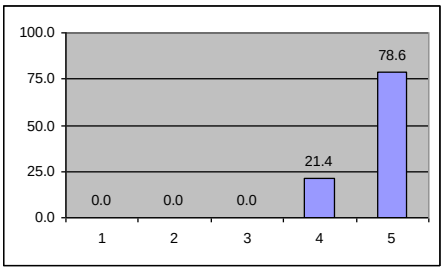
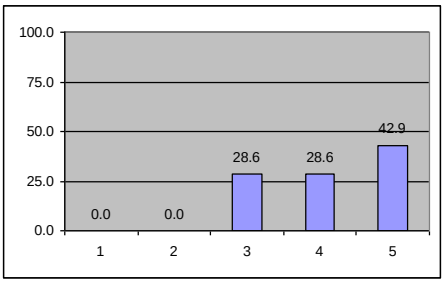
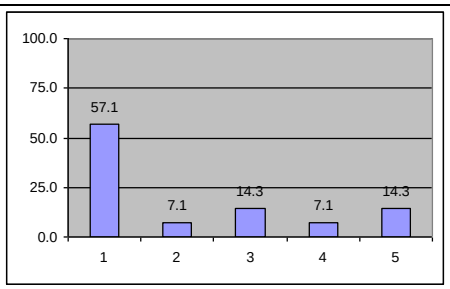
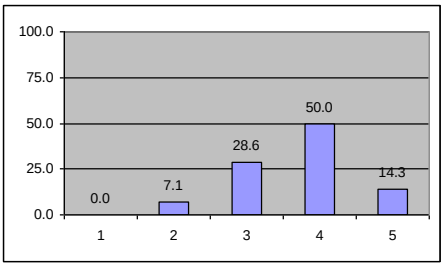
Features	**#Res**	**1= useless ←→ 5=useful**	**Mean**	**St Dev**
5. The provision of programme summary on iTV	14		4.1	0.8
6. The provision of programme summary on mobile phone	14		4.1	0.9
7. Annotations of difficult words with explanation similar to subtitles while watching the News (Words in Action) function	14		4.3	1.2
8. Annotations of difficult words with explanation on your mobile phone by SMS	14		3.9	0.9
9. The frequency of subtitled words (Words in Action) function	14		3.9	1.1

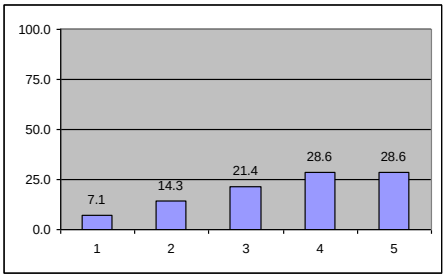
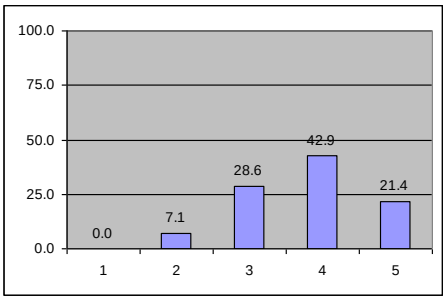
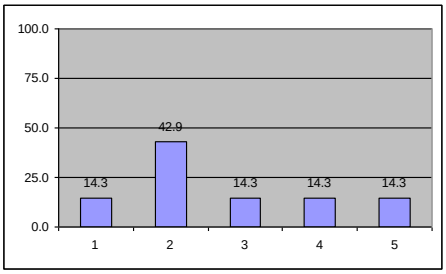
Features	**#Res**	**1= useless ←→ 5=useful**	**Mean**	**St Dev**
10. The readability of subtitled words (Words in Action) function	14		3.6	1.1
11. Saving words in your personal vocabulary space (My TAMALLE) via iTV	14		4.1	1.1
12. Saving words in your personal vocabulary space (My TAMALLE) via mobile phone	14		4.4	0.9
13. Accessing your personal vocabulary list (My TAMALLE) via iTV	14		4.0	1.0
14. Accessing your personal vocabulary list (My TAMALLE) via mobile phone	14		4.6	0.6

Features	**#Res**	**1= useless ←→ 5=useful**	**Mean**	**St Dev**
15. Removing/deleting unwanted word from your personal vocabulary space (My TAMALLE) via iTV	14		4.1	0.8
16. Removing/deleting unwanted word from your personal vocabulary space (My TAMALLE) via mobile phone	14		4.5	0.5
17. iTV Dictionary	14		4.4	0.8
18. Mobile phone Dictionary	14		4.6	0.6
19. The usefulness of difficult language items provided	14		4.6	0.8

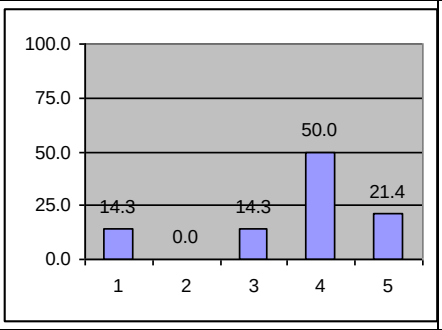
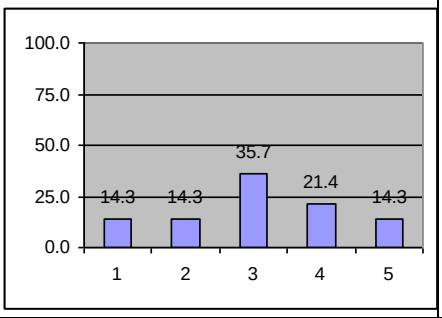
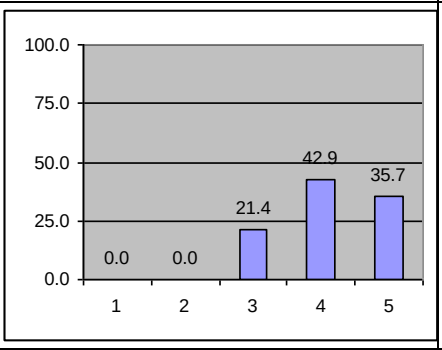
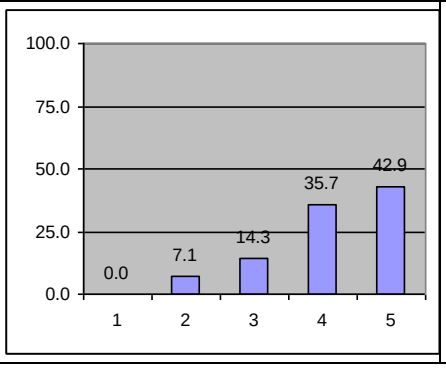
Features	**#Res**	**1= useless ←→ 5=useful**	**Mean**	**St Dev**
20. The usefulness of definition/explanations of difficult language items provided	14		4.4	0.8
21. The usefulness of content of programme summary provided	14		4.1	1.2

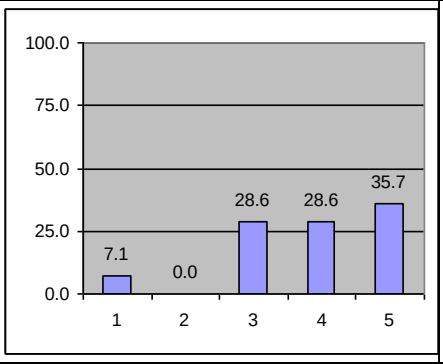
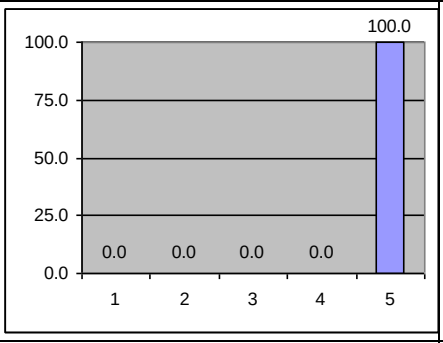
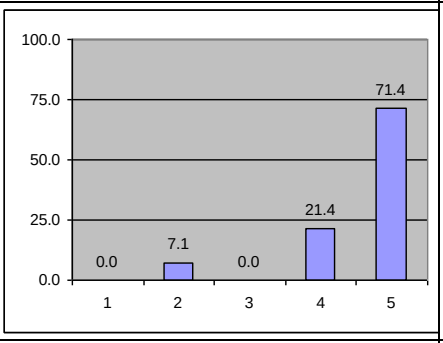
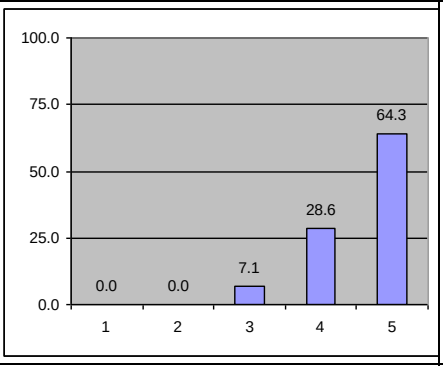
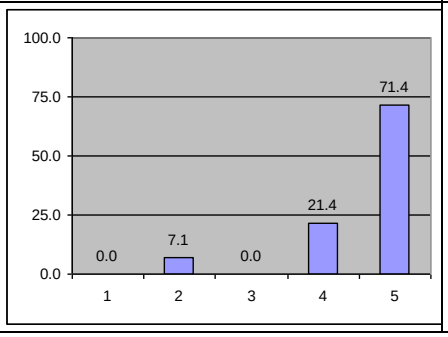
Perceived usefulness of different TV genres

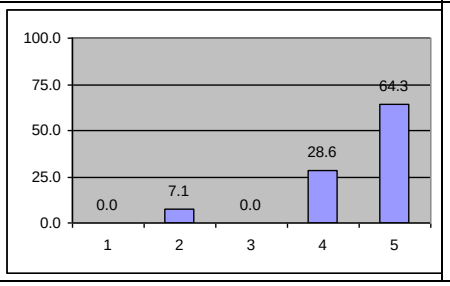
Television genres	**#Res**	**1= useless ←→ 5=useful**	**Mean**	**St Dev**
News	14		4.7	0.5
Dramas	14		3.8	1.1
Documentaries	14		4.8	0.4
Soap Operas	14		4.1	0.9
Reality Show, e.g. Big Brother	14		2.1	1.6
Lifestyle programme, e.g. Relocation, Relocation, Relocation	14		3.7	0.8

Television genres	**#Res**	**1= useless ←→ 5=useful**	**Mean**	**St Dev**
Chat show, e.g. Trisha	14		3.6	1.3
Sport	14		3.8	0.9
Musical Talent Show, e.g. Pop Idol, Fame Academy	14		2.7	1.3

Perceived usefulness of the TAMALLE system in supporting different area of language skill

Language Skills	**#Res**	**1= useless ←→ 5=useful**	**Mean**	**St Dev**
Spelling	14		3.6	1.3
Fluency in writing	14		3.1	1.3
Reading	14		4.1	0.8
Pronunciations	14		4.1	0.9

Language Skills	**#Res**	**1= useless ←→ 5=useful**	**Mean**	**St Dev**
Fluency in speaking	14		3.9	1.2
Learning new words and phrases	14		5.0	0
Making out what people are saying on television	14		4.6	0.9
Making out what people are saying in ordinary life	14		4.6	0.6
Understanding the meaning of what people are saying on television	14		4.6	0.9

Language Skills	**#Res**	**1= useless ←→ 5=useful**	**Mean**	**St Dev**
Understanding the meaning of what people are saying in ordinary life	14		4.5	0.9

Appendix F: Desirability evaluation: learners' comments

This section provides the participants' comments and the cards that they selected in their final review of desirability evaluation study.

Cards	**Comments**
Accessible	• *"The software is very accessible as long as you have the time to sit and watch the TV. Sometime it could be difficult to access TAMALLE at home when you have family and children around. The mobile phone is much better because you can use it at anytime"* • *"It is easy to understand, to use and as TV is so present in our ordinary life it is a great medium to help learning"*
Advance	• *"It is new and using advanced technology"*
Attractive	• *"Liked the programme on the phone, very good menu and attractive to use"*
Comprehensive	• *"I found it easy to comprehend the software and the programme I was watching".*
Complex	• *"I guess it is complex because it is high technical s/w, but time can overcome that complexity"*
Connected	• *"My TAMALLE could become like my own dictionary of information storage accessible at or away from home"*
Consistent	• *"The consistency of the system makes it easy to use"* • *"It has a very solid design with very intuitive navigation"*
Creative	• *"It has lots of original feature"*
Convenient	• *"You can use the service at home or on the go*"
Easy to use	• *"I found the software really easy to use and that made the navigation a natural process"*
Effective	• *"I understand words that I didn't know the meaning before and memorized some"*
Efficient	• *"The system is efficient and made it easy to deal with it"*
Empowering	• *"Learning in this way is very empowering to understand not only the language but the culture as well"* • *"Will allow me not to look stupid when words which are used daily by others and which you do not know (slang,…)"*
Energetic	• *"If I feel I'm spending time on something and knowing I am learning things, gives me energy and inspire me to do more"*
Engaging	• *"It makes you engage better with the programme you are watching"* • *"The 'Words in action' feature is very engaging you can feel the difference the application makes on learning"*
Entertaining	• *"It is fun to work with TV and mobile. It is a better way to advance students that at that point are tired of books and teachers"*

Cards	Comments
Fast	• *"Very fast when choosing the options makes it fun and effortless to use, it flips quickly between options"*
Flexible	• *"I have two choices, iTV or mobile putting my new words in, going through my vocabulary"* • *"With the mobile you can use the software wherever you are"*
Fresh	• *"I consider it modern, fresh, 'in fashion' and if I use it, would improve my look, my confidence in speaking and communicating within my group or in the society"*
Friendly	• *"Easy to understand and use"*
Fun	• *"Storing odd quotes or expressions from show could be quite fun"*
Gets in the way	• *"Both reading and listening disturbing the process of watching TV. So probably I will learn a few words, but miss most part of the TV show and don't learn from that"*
Helpful	• *"It will help non native English speakers to learn the expressions"* • *"It makes easier and faster to learn new words and expressions"*
High quality	• *"Its functionality is so high; it's capable of loads of things, which I call it as a high quality device"*
Innovative	• *"It is an innovative idea of the technology which is already available"*
Inspiring	• *"Reading the words (on mobile) you start to imagine what the story will be about…"*
Motivating	• *"If I will have this, maybe I will watch more things on TV which I don't understand (soap-operas, documentaries)"* • *"The best thing about TAMALLE is it makes the user to want/learn more just but watching or typing a word on keyboard (Dictionary) without getting up and go to find a dictionary back on shelf"* • *"Encourage learning while you are entertaining yourself"*
Not secure	• *"While watching East Enders…Am I still at the right 'place' with the recommended word list (I was following what was said)"*
Novel	• *"It is new idea and will be helpful for the industrial companies"*
Personal	• *"I can choose my words and go back to them cause I can make my own vocabulary list"*
Powerful	• *"With the current popularity of mobile devices, digital and interactive TV this idea software is very powerful to be executed in many ways"*
Relevant	• *"Summaries of News are very useful"*
Simplistic	• *"It is easy to use"*
Straight forward	• *"Just straight forward you learn it"*
Time consuming	• *"From my point of view sometime it can be time consuming going through pages to get what you want, imagine having*

Cards	Comments
	bad reception"
Time saving	• *"You can save words; you will read the summary and learn word via WAP. You have your words saved on your phone and be able to study at anytime"* • *"Very good service when watching TV can save time, rather than searching for the dictionary and wasting time looking for the word when it can give me the exact meaning in context"*
Understandable	• *"It is a easy software to use and manipulate"*
Useful	• *"It is very useful not only for non English speakers but I am sure for English speakers as well in a cultural sense"* • *"Useful because makes you read, listen and watch some programmes which creates you some English language environment"* • *"As whole the software is very useful for any kind of English level, from beginner to advance level or even to English speaker"* • *"Very good learning method. Makes learning interesting and helps improve the language vocabulary without any effort and while watching TV and having fun"* • *"Help you to learn words that you may not know that you don't know yourself"*