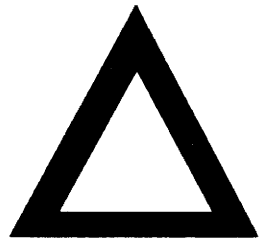

R&D on Telematic Systems in Flexible and Distance Learning

Workplan 91

DELTA

Background Material

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Preface

It is widely recognized that there is an increasing need of improving the training and retraining of the labour force. Furthermore, meeting this need is becoming a priority because it is considered as a key factor for the future competitiveness of European firms.

Information and Telecommunications Technologies are opening up new opportunities to meet the growing demand of learning services. They are giving rise to a new paradigm, that of flexible and distance learning, which will enable learners to access learning resources and expertise wherever they exist, and whenever the learners need them.

This main rationale underlay the adoption of the DELTA Exploratory Action by the Council in mid 88. The aim was to investigate the issues and potential of harnessing of technology to the problems of life long learning, and to consider if further actions were required. At this exploratory stage, it was necessary to assess the readiness of the main sector actors to join their efforts at European level to undertake research, to validate some initial assumptions and to identify the most promising future avenues, while providing some tangible results. These were the objectives laid down for DELTA by the Council Decision.

The DELTA Exploratory Action has succesfully come to an end, the findings brought about by the 30 projects launched and the accompanying actions that the Commission carried out in parallel, have provided a sound basis to undertake the future reasearch in this field. The Final Report on this action, drawn by a team of independent assessors has confirmed this view. It found that

'The Exploratory Action has clearly shown that there is a need, and a potential for further research and development in the area, and that there is a significant European dimension of added-value in the development of learning technology'.

Later on, the same report confirms that the experience and results of DELTA have been of value.

'The Programme has produced significant results and even led to to development of products or services that are at the point of immediate exploitation on the market. It has furthermore played a decisive role in focussing the future research and development effort in the area of learning technology on the most significant issues, and thereby fulfilled the central role of an Exploratory Action'.

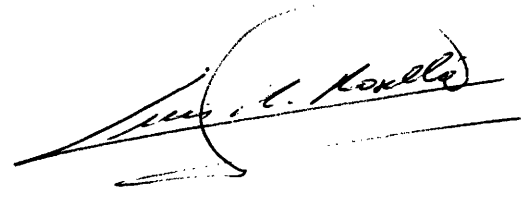
Now, the time has arrived to take a step forward and to undertake research aiming at paving the way for the implementation of trans-European flexible and distance learning services and infrastructures. This goal has to be reached by undertaking the development of systems and technologies tailored to learning purposes and driven by the users' requirements; by pilot experiments of systems and learning

services in order to validate their appropriateness and cost-effectiveness; and by drawing up implementation scenarios. These actions will facilitate the emergence of the required infrastructures enabling implementation at sufficient scale and with a long term commitment to networked training services.

The origin of the workplan presented here was an investigation carried out in parallel with the Exploratory Action in order to identify the strategies and main thrusts of the future research tasks to be adressed. The findings of the investigation have been put within the context of the III Framework Programme for R&D, and the specific Programme of 'Telematics Systems for Flexible and Distance Learning'. The result of this exercise, done in close concertation with the DELTA Management Committee, is the Workplan described in this document. It gathers the views of the experts, takes account of the findings of the projects and lays down the priorities and strategies as identified by the key sector actors in the domain.

For the purpose of getting the users' perspective on this work, cooperation with the related Commission and Member States initiatives addressing the training issue should be set up in order to obviate the technology thrust and ensure wider acceptance.

The achievement of the envisaged goals and specific objectives described here would represent a major step forward towards the realisation of the Internal Market in an important aspect: access to expertise and learning services Europe-wide. But this is not only a market related concern, but an essential ingredient providing a cultural dimension to the post-92 future. Training delivery thoughout Europe is now feasible, do not forget that satellites and other communication technologies are not constrained by national borders. Furthermore the joint dissemination of training through these technologies provides Europe with an excellent tool to improve cohesion and share knowledge.



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Chairman of the DELTA Management Committee

Acknowledgements

The research and development plans described in this document were initially provided by experts on the DELTA Technical Panels working in conjunction with the DELTA Requirements Board during 1989, whilst the Strategic Review Board members provided an orientation for the future. These plans were supplemented by further material from contributors who responded during a consultation exercise, 'Operation 92'. Account has been taken of the opinions of representatives of professional and administrative interests in two main strands: the 30 projects participating in the DELTA Exploratory Action and the Assessors of the Action. The latter identified the opportunities for further research in the light of the findings of the projects.

The DELTA Management Committee members contributed to the entire planning exercise and particularly to the consolidation of the work through their involvement in a consultation exercise.

RATIONALE

1.0. Rationale

1.1. Introduction: Relation to Community Policy Objectives - Responding to the learning needs of Europe

1.1.1. The learning needs

Modern society is undergoing a profound and rapid technological change. Explosive developments in information and telecommunications technology, and their use in ever more complex systems, are already having an impact on every aspect of life, for individuals, undertakings, institutions and governments. They are affecting the very nature of human activity and the modes of communication between such activities.

The legal basis for Community action in R&D derives from article 130F of the Single European Act, which requires that the Community strengthens the technological base of European industry in order to attain global competitivity.

Furthermore the Commission policy objective of a social Europe[1] highlights the crucial role of education, and the use of new technologies to achieve a high level of appropriate capabilities amongst the workforce.

The social dimension explicitly recognises the need for better retraining and more cross-border recognition of the skills so attained. The European Parliament conference "A Strong Europe - A Competitive Industry"[2] explicitly singled out education and training as an area where the electronics industry must react to the external competition threat in a strategic, collaborative, and above all, in a unified manner.

Education[3] is one of the few processes every citizen is exposed to. In Europe, 22% of the population are in some form of full time education at any one time, and more than 10M undergo some form of training or retraining every year. This amounts to 85M people in education or training each year[4]. This accounts for just under 1/3rd of the EC population.

The training and retraining need is a growing problem, with Community undertakings looking for higher skilled workforces, and needing to adopt massive training and retraining programmes to keep step with technological change.

A recent IRDAC[5] (Industrial Research and Development Advisory Committee) report states that 'increased use of technology ... requires a serious reconsideration of the use of the resources... The basic education system can only deliver part of the required qualifications em-

ployees will need during their working life. Hence, it is evident that the pace of the technological change puts an increased responsibility on enterprises to make sure the workforce has the right qualifications and skills. Inevitably, this means a rethinking of the human resources and training strategies in enterprises, large and small, in manufacturing or services, which should result in increased efforts for training'.

The perspective of the requirements and objectives identified in the report is related to the impact of the Internal Market. To realise this market, it is necessary to focus the work towards new European qualifications. Consequently, the nature of the market of training services will change in order to fit with those new qualifications. Several segments of this market are likely to achieve the critical mass leading to economies of scale which, until now, they did not have. This is now justifying investments in tools for learning which were previously impossible.

1.1.2. The potential solutions provided by learning technologies

The same IRDAC report concludes that 'therefore, a structural effort in distance and flexible learning is required in Europe. Traditional distance learning systems (such as those of the open universities in Europe), should be assisted in redirecting their actions more towards industrial environments. In addition, more technology itself should be used in the production and delivery of training materials to allow for individualised learning and to increase the efficiency of the training process'.

Education, as a science, has lagged behind in terms of adopting these new technology developments, and their deeper penetration could lead to a qualitative leap in the cost effectiveness of learning. Instead of learning taking place in a rigid structure, the flexible and distance learning paradigm permits learning to take place when the pupil is most receptive, and allows tutors to monitor more effectively the learning processes.

The early findings of the Commission[6] which led to the Exploratory Action are being confirmed, more clearly identified and better understood by the 'training community'. Open, flexible and distance learning are methods of teaching that extend the capabilities of the tutor, and enable the tutors to support more learners. The proposed solutions must be capable of supporting the learner, just as a tutor would in his physical presence. Therefore technically, it must have many of the characteristics of adaptability, reliability and interactivity given by the human dimension.

Advanced Learning Technology based on Information Technology, Telecommunications and Broadcasting (ITT&B) is a new and powerful tool for education and training, and it must be placed intelligently in the hands of the tutor, whose capabilities will be extended. It is not a

replacement option for traditional teaching methods or skills. It merely extends the ways to teach. Furthermore, it provides an efficient solution to special groups, such as isolated people or SMEs which need more flexible learning facilities and cannot reach them by traditional means.

1.1.3. European R&D in Learning Technologies

Europe's research in the domain should position the Community in the emerging market for technology based flexible and distance learning. The market has hitherto been fragmented due to a large number of factors, eg. the lack of professional mass production of advanced learning materials, lack of interoperability of systems and portability of advanced learning materials, lack of well defined learning systems aimed either at different market sectors or at overcoming the challenge of cultural and language barriers.

All these factors are currently impeding the delivery of advanced learning materials on a European scale. The DELTA Exploratory Action has already addressed such topics as regulatory issues, transferability of resources, cross-cultural problems and market fragmentation. It has put forward some recommendations to find at least partial solutions to overcome the various barriers. Further research is needed to reduce production costs of learning materials, to make them more efficient on the one hand, and, on the other hand to foster interoperability and portability of these resources to enable their distribution through the appropriate networks.

The avenues explored under DELTA EA showed that there is a need to focus on real users' requirements, which brings about the necessity to set up close cooperation with other European Commission initiatives dealing with the users, such as Task Force of Human Resources and DGs on SMEs and Structural Policy. Cooperation with the latter could be particularly crucial for peripheral regions, rural areas, SMEs and other special needs groups. The research must assess solutions tailored to these populations, and thus their involvement in this research should be encouraged. Although this is a general concern for the whole framework programme, this particularly applies to education and training.

There is a need to focus on new R&D which, taking a mid to long term view, will lead to the setting up of infrastructures to foster investments. This has so far been hindered by the lack of clear perspectives on lasting technological solutions. At the same time we need to increase our practical knowledge of the potential of educational technology through research which is based on sound state of the art pedagogical principles and validated in real settings.

There has been a gap in the Community initiatives in Distance and Flexible Learning. There is R & D on infrastructures for ITT&B (RACE),

there has been an Exploratory Action on new learning technologies (DELTA) and a programme for the development and delivery of training courses (COMETT). Now the time has arrived to prepare the emergence of common services and infrastructures.

The follow up of the R&D in this field should, therefore, provide a framework for carrying out pilot tests related to feasibility studies for trans-European infrastructures. This would make possible the drawing-up of implementation plans for future services. Such plans of course depending on the outcome of the pilot experiments.

European-wide cooperation is a must, not only because of market related considerations such as broadening of scale or avoiding penetration by our competitors in a so far weak market, but mainly because of the necessity to provide a cultural/educational dimension to the post-92 future. Training delivery throughout Europe is already feasible. One should not forget that satellites and other technologies are not constrained by national borders. Furthermore the joint dissemination of training through these technologies provides Europe with an excellent tool to improve cohesion and share knowledge.

Joint efforts undertaken by DELTA and other Commission or non-Commission initiatives, show the willingness of the key players to cooperate at transnational level. They are aware of the joint responsibility to meet the challenge we are currently facing. It is not only a matter of technology and investments, but also of research enabling us to identify how best these networks and technologies can convey not only information but training services as well. The way in which this information is converted into knowledge is the main challenge.

1.2. Expected benefits of Telematic services and infrastructures for Flexible and Distance Learning

The expected results of moving a step forward towards **European infrastructures and services for Flexible and Distance Learning** can be seen from a double viewpoint, as advantages for the users and as strengthening market competitiveness, a prerequisite if the intended users are to use services, technologies and infrastructures available in the market.

Networked training offers the long-term possibility of significant cost savings and widespread use of training services. The main factor for success is a long-term commitment to service infrastructures, standards, protocols, technological evolution, tariffs etc. coordinated European-wide. Although networked training is in its early stages, technologies and telecommunications networks are mature enough to both convey training applications and to meet the increasing demand for flexible learning services. Many organisations need to access train-

ing services and skills as and when they need it. This is particularly the case with SMEs. Nevertheless it is necessary to develop a clear market rationale and long term planning in order to promote investments leading to the establishment of stable, while expandable, infrastructures.

These infrastructures will permit the setting up of an experimental environment (test-bed) in which trainers and technologists can experiment with or 'pilot' new techniques as the telecommunications infrastructures and learning technology evolve.

1.2.1 Added value for the users

The actions envisaged should facilitate future trans-European services for flexible and distance learning based on telematic infrastructures and should improve the access to and performance of training in Europe.

The added value that new technologies can bring about for meeting the challenge raised by the growing training needs in Europe is threefold:

- First and foremost, in terms of **flexibility**, making possible the adaptation to meet very different and ever changing training needs, learning patterns and settings (multi-strategy), and media combinations (multimedia).

- Secondly, in terms of **accessibility**, enabling remote or local access to training materials whenever and wherever required by the learners, putting at their disposal the know-how and the expertise wherever they exist.

- Finally, an adequate service infrastructure providing an **optimum support** to the users, learners, trainers and course producers. This should encompass the different processes involved: information to trainers and trainees on educational resources available tailored to the specific needs, their delivery, the monitoring and tutoring of the learners and the facilitating of access and usage of basic tools and materials required for the designers and producers.

1.2.2 Added value for the market

Besides advantages for the users of these services, the market factors involved should be addressed if these advantages are to be taken up. These market issues equally suggest taking a step forward towards the establishment of interoperable infrastructures conveying distance and flexible learning services.

Evolution might be hindered by the use of incompatible systems. There is a risk of spreading too thinly the scarce resources for distance

learning by developing competing schemes which later on will not have any significant impact on the market. Thus, there is an added value in combining forces to define a long-term planning based on these common infrastructures of training services.

The potential advantages of the availability of a learning services infrastructure for telematic services in distance and flexible learning are as follows:

- Offering **common opportunities and strategies** for the different training market sectors, such as producers, publishers and learning services' providers, with an optimum support to address learning needs of the home user, the corporate user and European organisations;

- Creation of **mass volume** markets able to meet the demand of flexible learning. Many organisations need to access training services and skills as and when they need it. This is particularly the case for SMEs;

- Providing **mid to long-term planning** in order to promote investments leading to the establishment of stable, although expandable, infrastructures conveying training services;

- Providing more **cost-effective** means to produce and deliver learning materials and services, because of the better performance of the technologies and the market scale;

- Fostering the **best cooperation of the public and private sectors** of the market, through providing infrastructures which enable the educational system to offer vocational training to adults at work;

- Providing an **evolutionary strategy** allowing the adaptation of the training market to the rapidly changing training needs and technologies;

- Fostering **innovation** by using these infrastructures as test-beds to pilot-experiment new techniques, as the telecommunications facilities and learning technologies evolve.

1.3. The DELTA Exploratory Action

It is beyond the scope of this document to cover all the results arising from the 30 DELTA projects, a more detailed account can be found in the DELTA Final Technical Report and in DELTA 90[7].

However, the results can be classified in three broad categories. First are those concerned with the understanding of the various facets of the market and users' requirements. The second consists of specifications and prototypes of enhanced training tools using emerging technologies, in this category special emphasis was put on shorter development times, higher quality, and reduced costs. The relevance of emerging technologies like AI expert systems, hypermedia and the use of satellites was also investigated. Finally some projects assessed the training delivery with different contexts and some of them launched pilot tests of specific new technologies and methods, contributing to their assessment and to the understanding of possible implementation strategies. For illustration purposes some examples of the results in the three categories are given below.

1.3.1 The flexible and distance learning market and user needs.

DELTA actions deal with an extensive set of actors. These actors have been categorized. The requirements of the users have been analysed taking into account their different training contexts. The needs of the producers of multimedia materials have been investigated at a regional, national and European level. Existing trends regarding the telecommunications applications have been analysed. A catalogue of good practices and a who's who of producers have been produced. Intermediate results have been broadly disseminated through the program-supported newsletters. Some examples of the work are as follows:

- A network of courseware producers has been set-up, the largest of its kind in the community.
- Various studies contributing to the understanding of the social, organisational and cultural factors inhibiting the use of advanced learning technologies, from cross-cultural and multilingual barriers to the telecommunications tariffs.
- Several market studies are available: on the SME segment, on the transnational services with special emphasis on the special needs of peripheral regions.
- Analysis of the training pattern of apprentices in the manufacturing industry.

1.3.2 Application and systems developments.

Design and production of learning material

- A full multimedia authoring system featuring a simple but effective learner modelling. A full set of media editors has been developed allowing the teacher to define a course in terms of pedagogical

objectives and not in terms of computer frames, to the student it offer some "guided discovery" facility.

- Learner modelling is a corner stone in flexible learning systems, it has therefore been addressed by many projects; eg a system by which the collection of student errors and the use of inverted dialogue allows the development of sophisticated learner models.

- Methods and tools are now available to put a tutoring system on top of any existing computer applications.

- Hypermedia technology is very promising. Extensions needed to fit the learner needs such as "Conceptual mapping" were developed; investigations were made into learning styles whilst using hypermedia .

- To the design of an architecture for distributed authoring made possible that the development of multimedia courseware become no longer a single person's task.

- The development of high quality multimedia material is very expensive; re-usability of units of learning material is a key concept and a conceptual model of a multimedia database of learning material has been developed with a prototype being developed to validate the concept.

Training information system.

Several developments are available in the domain of course material storage and distribution :

- An intelligent interface to give the learner an easy and consistent access to training information and services plus a prototype to help the learner select courses and build his/her own curriculum.

- A database of video sequences and still images and a mechanism to distribute this material via satellite link or broadband cable

Training services.

- A computer conferencing system able to handle text, graphics and still pictures and an electronic blackboard system allowing full duplex communication between a teacher and a remote classroom has been designed

- An encryption system conforming to various statutory regulation, allowing maximum security for closed user/subscription market was developed.

- A dedicated front-end for a distributed virtual class-room

Standards and methodologies.

The Final Report of the Exploratory Action made clear that the training industry should not develop specific technical standard but select among the existing "de jure" or "de facto" standards a coherent set that will fulfil the present and foreseeable future needs; the focus within the DELTA EA shifted on software interoperability in order to allow the learner to access the widest range of training services.

- Some progress was made towards the portability of courseware and the interoperability of services; the feasibility of a common platform has been demonstrated.

- Functional and technical specifications of ALT standards and methods validated with leading users across Europe.

- An inventory of telecommunication services and related standard protocols relevant to flexible and distance learning including standards for multimedia transmission by satellites is available.

1.3.3 Methodologies for delivery of training

The pedagogic and organisational aspects related to the delivery of training have been investigated. Some studies addressing these issues and some real life experiments, although at limited scale, have been carried out. Both are providing a basis for future testing and further research on the delivery side. Some examples are described below.

- Experiments on computer aided teleconferencing and on video-conference systems, with assessment of the various aspects involved, such as interactions (tutors-students, between peers) and didactic strategies.

- Experiments on the utilisation of multimedia materials, on the use of broadcasting and cable networks, with assessment of the organisational aspects involved

- State of the art studies on the added value in distance learning of new communication systems in which video, audio and data processing equipment are combined, including methodologies for delivery.

- Studies on specific related topics, such as decision making in adaptative learning and other new learning approaches and users' patterns using CAI.

- Extensive case studies of successful distance and flexible learning products and services, and their cost-effectiveness, have been gathered and assessed in order to identify the critical success factors and guidelines for future applications.

1.4. Orientation for the follow up of DELTA

The independently written Final Report[8] confirms that the experience and results of the DELTA Exploratory Action have been of value.

'The programme has produced significant results and even led to development of products or services that are at the point of immediate exploitation on the market. It has furthermore played a decisive role in focussing the future research and development effort in the area of learning technology on the most significant issues, and thereby fulfilled the central role of an Exploratory Action...'

They provide the basis upon which the R&D in the Framework Programme on Telematic Systems for Flexible and Distance Learning should build. It is an essential element of telematics to focus on the domain of flexible and distance learning in order to help the development of compatible systems that:

- are capable of meeting the needs of the ultimate customers, ie those who train and the trainees, with special emphasis on identified acute needs Europe-wide;
- can easily be adapted to meet the specific requirements of particular industrial sectors or regions and local areas;
- can be developed further in the light of further research results;
- reduce the costs of training compared with traditional education;

The follow-up of the DELTA Exploratory Action within the Third Framework Programme will enable the exploitation of results from other actions, including RACE and ESPRIT. It will retain a clear view of the purpose for which technological advance in the domain of flexible and distance learning is needed. It should not seek to develop technology for its own sake, and without a clear purpose.

Four points to stress with regard to the management of this action are the needs for:

- effective coordination with other initiatives;
- effective management of the action including monitoring and overall evaluation;

- adoption of detailed criteria for the selection of projects to ensure that the Community added value is maximised;

- arrangements to disseminate the results of both the DELTA Exploratory Action and the results from the new action.

1.5. Objective of the workplan

1.5.1. Overall goals

The incremental R&D in the area of technologies for flexible and distance learning has as long-term goals:

- Improving the access and performance of learning services in Europe based on the optimum use of ITT&B technologies, in terms of:
  - **Flexibility and interactivity**, enabling multiple didactic strategies and media, adaptation to multiple learning needs and patterns;
  - **Remote access** to learning resources;
  - Providing an **optimum support** to the users (learners, trainers, producers of learning materials and providers of learning services).

- Improving the **market competitiveness** of the training industry, in terms of:
  - Better **economies of scale**;
  - Provision of **more effective services** and learning materials in terms of costs, quality and performance;
  - Providing an **evolutionary strategy**, enabling the adaptation of the market to the changing training needs and technologies.

Both aims are converging to pave the way to the future implementation of trans-European distance and flexible learning services and infrastructures.

1.5.2. Specific objectives

The above stated overall goals lead to the following more specific objectives for DELTA '91:

1. *To develop technologies and systems tailored to the design, distribution and delivery of learning material in terms of:*
   - meeting the users' requirements

- learner acceptance
- multiple and integrated media usage on- and off-line
- interactive learning strategies
- adaptability and transferability to different needs and cultures

2. *To harmonise technologies, systems and infrastructures, and their adaptation to convey learning services European wide in terms of:*
   - interoperability and connectivity
   - portability of learning materials

3. *To use pilot experiments to validate technologies, systems and infrastructures, usage patterns, methodologies and guidelines for the design, distribution and delivery of learning based on ITT&B technologies in terms of:*
   - technological appropriateness
   - enhancement of learning possibilities
   - investment, organisational and pedagogical effectiveness
   - uptake of the integrated services by users and market

4. *To develop implementation plans for technology-based learning services and infrastructures European-wide in terms of:*
   - an impact assessment and forecasting of the market (user needs, infrastructures, services)
   - an analysis of the training services required by different users
   - different implementation scenarios with their advantages and disadvantages
   - time and finance planning

5. *To raise awareness and foster consensus on the usage of learning technologies in terms of:*
   - setting up frameworks for discussion and communication between the actors
   - testing telecommunications networks for information exchanges
   - general dissemination of information
   - dissemination of standards and guidelines

References

[1] Declaration sur les Orientations de la Commission des Communautes Europeennes, Speech of President Delors to the European parliament 17.01.1989.

[2] Report from the EP, Chairman Mr. Poniatowski, Feb 1989.

[3] Education, where not specifically referenced is used to cover the expression 'education, training and retraining' in the context of this paper.

[4] Eurostat 1989.

[5] IRDAC Working Party 11 Report on skills shortages

[6] Comm (87) 353

[7] DELTA 90, DE1858, July 1990

[8] DELTA Final Report DE2500, December 1990

SCOPE OF THE RESEARCH & DEVELOPMENT WORK

2.0. Scope

The tasks of this workplan are described in the task description part of this workplan. They constitute a vast framework for further R&D in this domain, building on existing results of the DELTA Exploratory Action and enabling the exploitation of developments from other programmes.

The overall approach of this workplan is to enable a structure that manages the entire training process in its different configurations with optimum use of advanced learning technology for the benefit of the learner and with a view to the market uptake of the services. Thus, it will provide the mechanisms to stimulate the market and to optimise the basis for user-oriented developments.

The actions envisaged should facilitate the emergence of trans-European services for flexible and distance learning based on telematic infrastructures and should improve the access and performance of learning throughout Europe.

The future availability of real services will be a consequence of market forces, and the establishment of human networks and procedures to manage consensus. Therefore, fostering the implementation of these services through these means is another key issue in this workplan.

Although implementation of these services is beyond the scope of this research programme, their planning, the likely scenarios and the awareness and consensus management actions for reaching trans-European networks and services for Flexible and Distance Learning are an integral part of the workplan.

2.1. Objectives

The scope of each specific objective in point 1.5. is described as follows.

2.1.1. Objective 1: To develop technologies and systems tailored to learning purposes

R&D as an intecept strategy

This initiative seeks, via applied and incremental R&D, to harness and harmonise advances in information technology and telecommunications in order to serve identified requirements for flexible and distance learning. It represents an intercept strategy. That means R&D is not an end in itself, but should provide the means to support early and effective uptake of ITT&B developments for the benefit of flexible and distance learning services. Therefore, the proposed R&D aims to:

- have to bridge the technology push and the market pull. Technological developments should be pedagogy driven and user-oriented.

- take into account existing and de-facto standards and conventions and strive to identify and develop high level standards that relate to the use and application of learning technologies for flexible and distance learning.

- be incremental in its kind, exploiting the result of the DELTA Exploratory Action, and building on identified advances in on-going ITT&B research (especially under ESPRIT and RACE).

- address the full R&D life cycle and result in prototypes and methodologies with real market potential, despite being pre-normative and pre-competitive in kind.

R&D for improving performance

This R&D should result in significant advances in the quality and performance of the services that technologies and systems will convey. Therefore, this action will:

- address the development process of learning materials and services, reducing costs and improving their efficiency;

- prioritise the developments of new systems for flexible and distance learning; technological development should be undertaken only when necessary to aid the development of improved systems for flexible learning;

- address the tools required to enable cooperative learning, improve interactivity and provide monitoring facilities for trainers and assistance systems for learners.

- receive feed-back via real life tests of services addressing real learning needs and validated through pilot applications.

- lead to technologies and systems flexible enough to enable their adaptation to the specific requirements of different categories of users, industrial sectors, regions, local areas and to support different didactic strategies and media.

- reach solutions offering added value compared to existing and proposed alternatives, making available technologies and systems able to create and fully support easy to use flexible and

distance learning systems, in terms of advanced technologies support and high quality, fully user friendly interaction.

2.1.2. Objective 2: To harmonise technologies, systems and infrastructures and their adaptation to optimally convey learning services European wide

R&D providing common opportunities for the market

R&D in technologies and systems should offer opportunities and strategies to the actors involved in the European 'learning scene'. Thus, it will result in:

- harmonised technologies and systems conveying services for the various market sectors, home, corporate training in SMEs or large companies, trans-organisational and trans-European.
- harmonised systems for producers, publishers and training services providers.
- harmonised systems, technologies and networks, allowing interoperability, portability, interconnection by supporting communication, distribution and interaction between different environments, users and systems, through the usage of advanced telecommunication services, notably satellite technology and high capacity terrestrial networks.

2.1.3. Objective 3: The validation of technologies, systems, infrastructures, methodologies and guidelines for flexible and distance learning

R&D based on real life experiments

The applied R&D should be based on real life experiments, addressing real learning needs.

The DELTA Exploratory Action has resulted in a set of feasibility studies, specifications, prototypes or network configurations and systems for a range of learning technologies. Therefore, it is important:

- to carry out experiments on a sufficient scale to integrate the technologies and to field test the users' reactions to integrated systems;
- to test and validate different technological configurations for flexible and distance learning in order to identify technologies that provide the optimum support for the users;

- to validate the users' reactions and to assist uptake by the market. To achieve this, pilot testing and experiments need to be carried out on a European scale within a coherent evaluation framework. It is expected that the results of such testing will be usable in all parts of the Community;

- to analyse and evaluate what advanced learning technologies can bring to flexible and distance learning for different learning settings, target groups, content areas and didactic approaches;

- to address as the central issue a methodology on how to take advantage of the technological developments for the production and delivery of courses to the market, and their use at the learner sites. Evaluation of such a methodology shall be a key issue;

- to implement and test integrated systems of telecommunications in order to validate the "distance" facet of remote learning.

- to foster quality and high level non-technical standards driven by user needs, with emphasis on good practices and harmonisation/compatability concerning methods.

2.1.4. Objective 4 : To develop implementation plans for technology-based learning services and infrastructures European wide

R&D for the implementation of services

This action should strive to provide a harmonised European scene for the implementation of services and infrastructures for flexible and distance learning Europe-wide. It will:

- develop an evaluation and assessment methodology and a market assessment framework including procedures to monitor the likely success of products and services. The former will provide the criteria upon which experiments should be based, enabling the drawing up of coherent conclusions making it possible to steer the development of systems and services for learning and orientate implementation planning;

- provide an objective identification of the user base / state of the art in Member States and an assessment of added value from Community action, aimed at identifying linkages / complementarity between national and European projects;

- provide the implementation framework, by identifying the required infrastructure for the developments to be received in, and to ensure deep cost-effective penetration to the different markets;

- provide implementation strategies orientated to the specific national needs, identifying different user groups according to structural differences, special needs and learning experiences. Connected to this is the definition of different teaching and learning methods;

- bring about common mid and long-term implementation planning to the existing or future services based on evidences of uptake of real life experiments;

- develop evolutionary strategies enabling future extensions of the services provided, according to changing user needs and the new possibilities arising from the emerging technologies;

- take into account the barriers to the interconnection of European networks. Thus, tariff, copyrights and other regulatory issues should be borne in mind when drawing-up implementation plans, although they are not the core of this R&D and their resolution is beyond the scope of this action;

- have an approach which is neither top-down nor technology-driven to provide new infrastructures on top of existing ones. Rather, it should be a basis to support existing networks in order to facilitate both portability of the courses developed and interoperability amongst them.

- provide a user-oriented basis for the development of technologies and systems and a test-bed for emerging technologies and innovative ways of delivering distance and flexible learning.

- in addition to exploiting the human networks created during the DELTA Exploratory Action, be based on other existing networks.

- foster quality and high level non-technical standards driven by user needs, with emphasis on good practices and harmonisation/compartability concerning methods.

2.1.5. Objective 5: To raise awareness and fostering consensus on the usage of learning technologies

R&D to raise awareness

This initiative should raise awareness and disseminate information on the usage of learning technologies. Thus:

- foster consensus between existing services and those emerging within this research, enabling the development of services based upon compatible technologies and standards.

- the research should enable people to make better decisions about learning technologies. Information networks between actors, either based in conventional media or in ITT&B technologies, are essential in a programme based on concertation and collaboration;

- the private and public sectors of the training scene should be made aware and share views on the strategies and the outcomes of the research;

- the dissemination of the results of the DELTA Exploratory Action and of the follow-up to this research should be made available to the various interested audiences at the required level.

2.2. Learning targets and technology based delivery systems.

The basic assumption underlying this workplan is that Information and Telecommunication Technologies can provide and enrich training possibilities. The applicability of the different technologies and the configuration of technologies will depend on the situation of the learner (home based, company based or in a training centre) and of the content of the training (problem solving oriented or interpersonal/communication oriented).

The following sections will provide a set of examples of possible technology and configurations matching the different learning settings and content areas. These constitute a basis for a users' context to the R&D to be undertaken. They will permit a closer focus on the systems and technologies to be developed, they can help target the pilot experiments and they will serve as a first overview of the scenarios for implementation which are to be targeted.

2.2.1. Training settings

Flexible and distance learning can take place in different settings, each of which might imply different technological scenarios. Roughly a distinction can be made between:

- **Learning at home**

The home is normally an environment with limited communication facilities. The facilities available are, in ascending order: Radio, TV

(eventually with satellite receiving facilities either directly or through cable companies), telephone, fax, videotext terminals and PC with modem. Consequently home learning normally is an isolated individual situation.

- **Learning at the workplace**

The learning environment of the workplace is dependent on the size and branch of the company. Roughly a distinction can be made between large companies and SMEs.

In large companies many administrative staff work on computers. Normally the computers will be linked in a LAN with gateways to WANs. The large companies normally have separate training departments and allocate time to train staff. In larger companies training is arranged for groups of employees.

In smaller enterprises the environment is more diversified depending on the branch and the size. In very small companies it is possible to find on the one hand, an environment that is very close to the home, but on the other, an environment very close to that of a large company. In general, the difference regarding the training situation is that the SMEs do not have separate training departments and, due to scarce resources, find it harder to allocate time to training of the staff.

- **Learning at a training or resource centre**

A training centre is an external location dedicated to training on a professional basis. This training centre can be based inside a company, an institution or at an independent company providing training. Training centres normally have powerful multimedia and communication equipment.

A resource centre has the same facilities as the training centre but on top of that it provides access to information, help and advice services and can serve as a meeting place with experts, colleagues and other companies.

The different locations (home, workplace and training centre) may be connected through telecommunication facilities enabling distance learning provided by local, regional, national or trans-national institutions or companies. The different configurations and services offered by distance learning providers will be linked to the settings and content areas to present examples of possible system implementations linking the settings described above.

2.2.2. Skills and knowledge to be learned

Learners are not only located at different places but require also training in different kinds of skills and competencies ranging from well defined and measurable skills with a low complexity to more global and complex competencies.

Three main categories of competencies can be distinguished as being important for adult training:

- **Low complexity skills**

By this we understand skills which are well structured and have very targeted and quantifiable learning objectives. Training in technical and basic skills for occupations in the production world are often referred to as vocational training.

- **Medium complexity skills**

These are highly professional competences which are often gained on the spot. The work environment often requires that the employee, besides being skilled in a certain technique, even if it is highly specialized in nature, has broader competence. Multitasking, global insight, synthesis, ability to cope with complex situations, and flexibility are all characteristics of such professional competence.

- **High complexity skills**

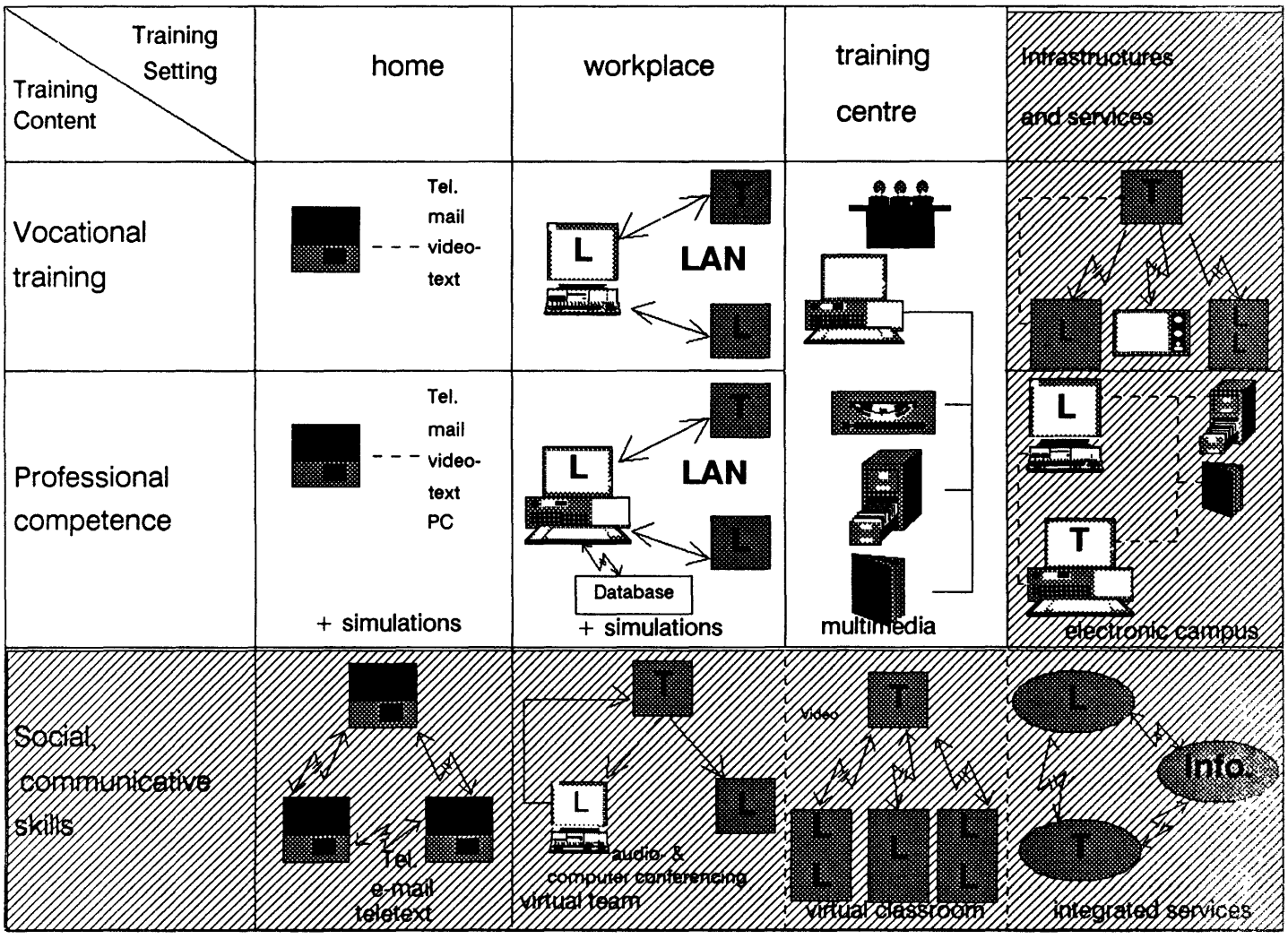
These are more social ability than technical skills enabling the person to participate in decision making. In more and more professions it becomes part of the job to master such interpersonal and communication skills and to participate in group decisions based on open discussions.

The way these skills are taught and learned are very different and consequently requires different technology configurations.

2.2.3. Technological and telecommunication configurations

Combining the different training settings with the skills and competencies to be acquired, a two-dimensional matrix can be developed that identifies which technological and telecommunication configurations will most effectively support or enable training in a certain skill within the given context.

The following descriptions of technological configurations should not be seen as exclusive. They are meant to be illustrations of how technology and telecommunications can provide effective solutions to training and learning. It should however be said that some technological or



T = Teacher/Trainer L = Learner

telecommunication configurations provide more effective solutions to a certain training problem than others.

Below the different technological configurations are described in more detail.

Home Learning

Providers of distance learning should take into account the low level of media and communication facilities available at home. This applies to correspondence courses with some feedback possibilities such as telephone, mail or videotext.

Drill and practice, tutorials and computer assisted learning are possi-

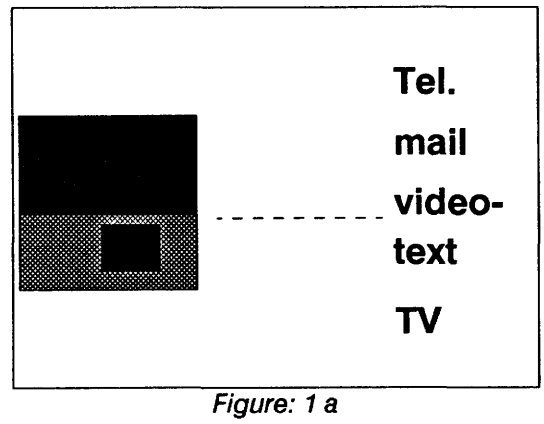


Figure: 1 a

bilities if a stand-alone PC is available or made available. These techniques are best suited for teaching basic vocational skills. Terrestrial or satellite broadcast educational radio and TV programmes can be used in most cases. Telematic links to other students or to the teacher is restricted to telephone, videotext or e-mail systems.

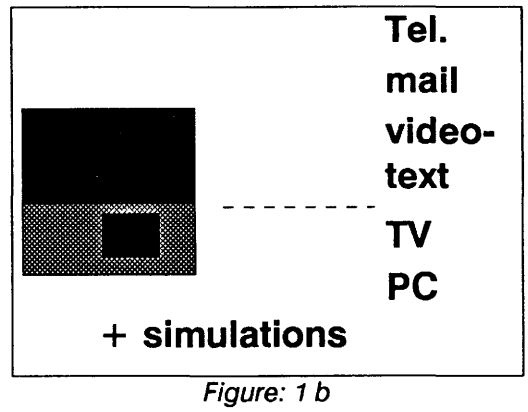


Figure: 1 b

Due to the isolated situation of a home learner, the exploratory environment required for learning all-round professional competencies can only be a possibility if the learner has a PC with a modem enabling connection to a wider computer environment.

Delayed communication through teletext or e-mail systems can be an effective way to train the more social and communication skills such as written expression in a foreign language. Negotiation or decision making within a group at a distance can be trained through the same communication configurations.

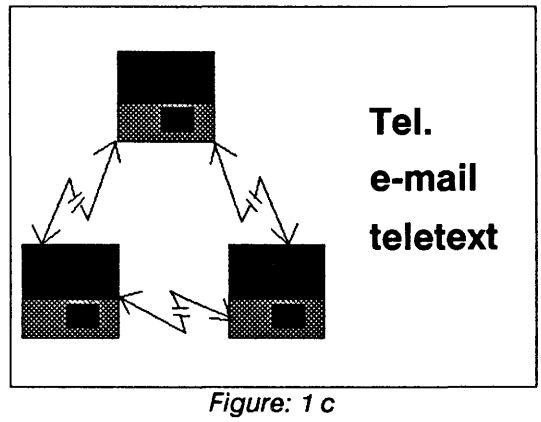


Figure: 1 c

Other media can be applied if they are made available by the training provider (ie home kits for natural science or engineering) or as they become available on a general scale as the price of technology drops (for example CD-I for language learning and simulations).

Workplace

In a business environment a trainee has at his disposal more technical facilities than at home. This enables participation in higher level computer assisted training either in stand-alone mode or through a local area network (LAN).

CBT is best suited for very structured and well-defined courses in technical and basic skills. Simple simulations, exercises or case-studies teaching how to apply and implement a specific technique are examples. Multimedia and hypermedia tools and intelligent tutoring systems may be added depending on the type of technique to be trained. Also interactive computer usage has proven to be a successful tool. Good examples are areas such as computer aided design, computer aided manufacturing and process control. These tools are most effective if feedback, help and tutoring facilities are available on-line.

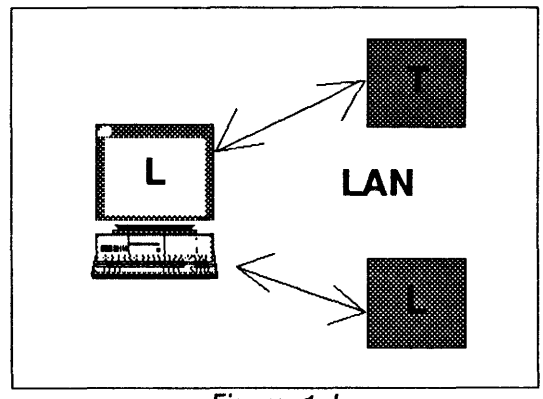


Figure: 1 d

For highly specialized professionals who have multiple tasks to perform and where ability to synthesize, adapt to changes, see relationships, etc. are important aspects of their jobs, individualised training with an emphasis on flexibility in time and content are core aspects. Work and training are often related: the trainee learns while working and he works while learning.

In this environment, a powerful personal computer can provide the trainee with:

- on-the-job-aids (expert systems, simulators...);
- search facilities (on-line access to information databases);
- access to a courseware library, downloading and running it in a local mode;
- access to audio-visual material be it on videodisc, or broadcast by network, cable or satellite;
- access to a training management and advice system.

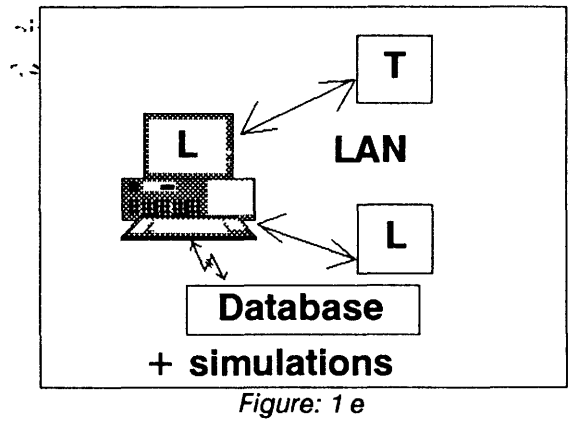


Figure: 1 e

The training of communication skills requires a high level of interaction between two or more trainees and between the trainer and the trainee. It is also essential that the learner is confronted with real-life situations (complex, multidimensional, dynamic).

Foreign language learning is an example. It is widely recognised that learning to speak a foreign language requires active practice, preferably in a natural setting with intense interaction and feedback in a conversational way. Generally this situation is only achieved by going to a country where the language is spoken or in small-to-medium settings under the direct guidance of an experienced teacher or native speaker. Advanced communication technologies - notably networked or satellite approaches - offer alternative solutions if this is not possible. Video can be used to simulate the natural settings either by presenting the teacher or by sequences in which the target language is an integral part. Conversation, correction and follow-up is possible through audio-links between the teacher and the students, who together can be said to form a virtual training team.

Such an infrastructure can be realised practically all over the Community by means of two-way satellite communication, with the help of earth stations which are capable of receiving complete video-signals and to receive and transmit audio-signals, or by using terrestrial networks for the audio-feedback. For less dispersed groups, terrestrial or cable-broadcasting of the complete video-signal could be used, in combination with audio-conferencing, or even two-way cable networking.

In the business environment language learning for special groups of professionals in written language competence combining stand alone CBT and interaction via e-mail or computer conferencing systems seems to be a specially promising configuration taking advantage of the availability of computers and network communication facilities at the workplace. The service should encompass stand alone CBT for training vocabulary, grammar and syntax. This could be combined with on-line group services by means of video-conference systems as tutorials and help services if the language learning related directly to the job.

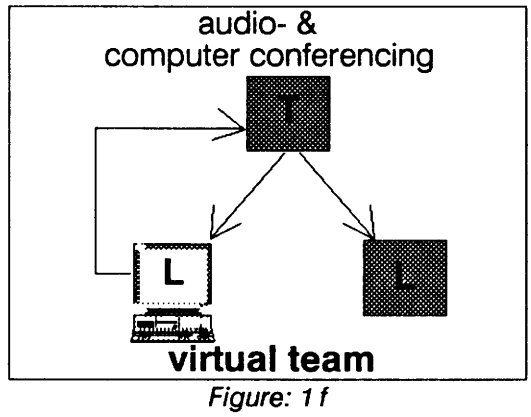


Figure: 1 f

Training or resource centre

A training centre provides more advanced learning technology facilities than the home or workplace as dedicated learning machines, interactive video, CD-I or DV-I and access to CD-ROM databases.

Adding a CD-ROM drive to existing equipment provides access to very large information banks, be it text, graphics, programmes, high quality still images (full screen) and crude part screen moving pictures with high quality sound. The CD-ROM technique enables companies to distribute and deliver a wide range of courses to a single workstation.

Complex concepts which are difficult to train, simulations of real-life situations may be trained through CD-I. CD-I delivers sound, graphics, text, still images and limited moving images and is therefore a promising future training tool for flexible individualized learning.

Interactive multimedia training programmes delivered through personal computers and tailored to the specific requirements of the learner and the organisation are provided through DV-I. DV-I technology is still under development but provides more flexibility in the production of the material.

At a learning centre additional learning services are provided such as tutoring, information on learning possibilities, study guidance and traditional classroom learning. A training centre may be at the same time a place to meet and discuss, a place to receive advice, help and expertise and a resource centre. These multifunction facets of a training/resource centre makes it a favourable environment for training of professionals

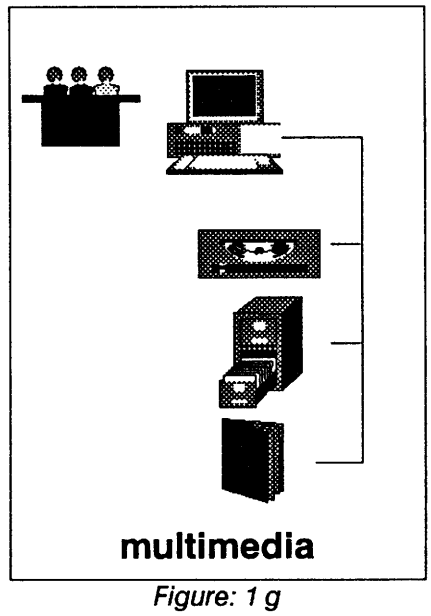


Figure: 1 g

of small and medium enterprises. This group does not have the same facilities as professionals of large companies in terms of training equipment at the office, support and tutoring by LAN, sophisticated software.

Collaborative training in communication and interpersonal skills can take place at a distance given that the persons can see each other and can interact in a flexible manner. The model of the virtual visual classroom between groups of learners at different training centres can be applied here as an example.

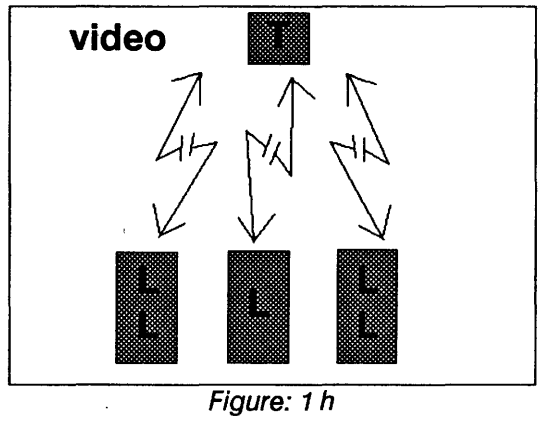


Figure: 1 h

The situation of a virtual visual-classroom envisages:

- either a two-point link, with a tutor at one location and one to twelve learners at the other location;
- or a multi-point link of a limited number of locations. This limitation on locations is due to the possibility of split screen simultaneously.

Three main communication components of the learner and tutor places will be essential for efficient corporate training using telecommunications, namely: video communication, audio communication and data communication between tutor and learner as well as between learners at different locations. For example the tutor may be in a training centre offering a distance learning course, in addition to traditional courses, and the learners at different company learner centres.

Two main technological configurations may be distinguished:

- one-way audio/video from the tutor and/or learner group to learner groups at other locations via satellite, feedback by two-way audio using ISDN, data transmission via ISDN;

- two-way audio/video from the tutor and/or learner group to learners group at other locations via B-ISDN, data transmission via ISDN.

This technological configuration enables collaborative learning/group training and computer based training using remote tutor support. A high level of bi- and multi-lateral interaction is enabled and enforced. The configurations are only effective for a small number of participants and locations. It is therefore best suited for training through learning centres. Courses which are characterized mainly by unilateral interactions could equally be offered to a greater number of locations. This configuration may connect individuals at home, workplace, local training centres.

2.2.4. Infrastructures and Services

The services and infrastructures are necessary to provide the settings with content from the providers' point of view.

This section will start with a simple set of services and enlarge the scope gradually to the more complex.

The whole lifecycle of a distance or flexible learning scheme includes the following functions: definition of training aims and objectives, decision on the methodologies, tools and media to be used, design and production of courses, information on the courses available, guidance of learners on the choice of curriculum, allocation of students and teachers to the courses, delivery and teaching support for the course, and in some cases monitoring of progress, assessment and accreditation.

The choices of technological infrastructures, tools and services for the different courses need to take into account the learner setting and the content and learning objective of the course.

2.2.4.1. Design and Production

Design and production of course materials is normally a process involving a wide range of actors: the learning requirements are defined by the learning department in companies or at faculty level in institutions, the breakdown of the learning objectives for courses and modules are then handled by course teams involving content experts and educational technologists with steady feedback to the strategic level, and finally when the course is approved handed over to publishers either in house or externally.

In most flexible and distance learning schemes the printed material still represents the core product. Therefore electronic publishing including word-processing and graphic packages are essential technologies to

the design and production process. For CBT courses, authoring languages including facilities for animation, simulation and incorporation of multimedia material are important features. In production of audio and visual components or modules content specialists need to work together with skilled producers in the two areas. As the design and production process involves coordination and feedback between the different actors at the different stages of production, communication and decision making tools are important as well.

The requirements for the design and production process can be summarised to need for authoring and communication tools supporting transfer of material and decision making.

As most authors and designers will be working from the workplace, the equipment available to the designers and authors can be assumed to be high performance workstations with facilities for multimedia handling and communication allowing use of high performing authoring systems. The systems for design and authoring should however have facilities for communication to home based users.

On the simplest level the same authoring system can be used at the design stage and in the actual authoring of the course. The authoring system must have facilities supporting the breakdown of the learning objectives to specifications for the author(s). This specification can then be transferred to the author(s) electronically, and the authors can feedback the results at the agreed stages to the designers using the same authoring system. The authoring system can be more or less sophisticated, encompassing facilities for text processing, electronic publishing to multimedia manipulation according to the needs. Such a system can work in stand alone mode allowing transfer of material between the actors involved via a diskette, or the transfer can be done electronically in LANs or WANs. The system can be expanded with on-line communication facilities to allow for use with widely dispersed course teams. The output can be CBT courses (data or multimedia) or text and graphics.

Eventually the output can be processed directly by publishers and the final course material made available either in traditional formats (study packages including printed material, audio cassettes, video cassettes or floppies). The system could include facilities for on-line delivery by request of the students.

2.2.4.2. Information Services

Information about flexible and learning services need to be made available to the different actors involved in the teaching system, educational managers, producers and learners.

The training managers in private companies or in public institutions need to have easy access to updated information of which courses or modules are available in the different domains. This is especially important for SMEs which do not have in-house training departments. Information services on training materials for professional users (training managers, educational departments, training advisers etc) can be made available directly via public on-line databases.

The producers need to have access to information on existing courses to avoid duplication of effort. On top of that it can often be useful for the author of course material to have access to databanks of generic course material in raw form or as semi-fabricates, which can cost-effectively be reused in different courses.

The end users, learners or trainees, need to know which curricula are available, the specific requirements for entering the different courses, the level, objective and content of the course, the support systems for the teaching, the costs of the courses and the accreditation of the courses. The learners could have access to browse through samples of the courses and to test themselves against the courses. Facilities for ordering, downloading and paying for the courses could be provided.

Although the different user groups need access to differentiated information, some general requirements for information services can be defined: they should be easy accessible, reliable and the information should be constantly updated. If these systems are going to function adequately, it is important that the databases use standard query language(s) and have embedded guidance facilities for the different groups of users. The information could also be made available in local resource centres for example on CD-ROMs, where the embedded guidance and support facilities can be supplemented by discussion with experts.

2.2.4.3. Delivery and Support

All the functions in a traditional classroom teaching situation can - except for the actual physical contact - be simulated by way of telecommunication technologies, creating a virtual classroom electronically. A set of functions, which is common to all learning situations can be extracted (lecture, question-answering, exercises, explanations, corrections, discussions in classroom or in groups with or without guidance from the teacher, formalised or non formalised, getting help, submitting assignments and examinations and receiving feedback and finally being credited). For these functions it is possible to establish generic infrastructures and services which allow teaching at a distance. These generic infrastructures and services might need to be supplemented by dedicated tools to allow distance teaching of specific content areas or courses (lab tests requiring an experimental kit or simulation programme, language teaching requiring support tools, etc.).

Institutions or training companies provide individual distance learning to groups of learners remote from institutions and tutors in real- or delayed time. In its simplest form, which is applicable to very structured techniques, the configuration used is TV broadcasting with some feedback possibilities.

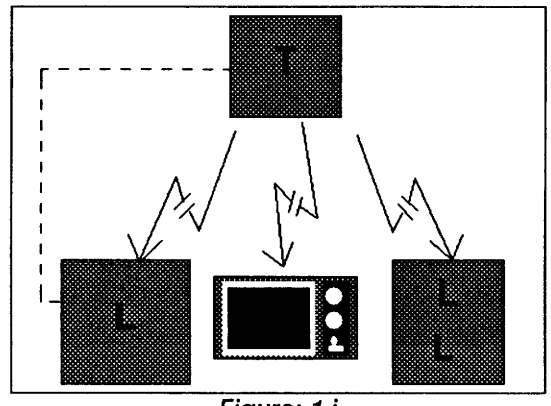


Figure: 1 i

The major problem lies in the feedback facilities between teacher and learner, and the communication possibilities between learners. Often this feedback is delayed and limited to conventional means such as telephone, correspondence and, sometimes, videotext.

In several member states of the EC the broadcasting of courses is widely applied to home learning. Cable networks for television are increasingly available, but these networks have limited possibilities for interactivity. Combinations with videotext (for example Minitel) are slowly penetrating the home environment and could in the future provide interactive communication facilities for training.

A particularly promising technology for creating effective communication facilities is computer conferencing. Combining traditional correspondence courses with computer conferencing facilities linking learners, tutors and the administration can create an 'electronic campus'. The basis of an 'electronic campus' is the print components of course material. These may be enhanced by a course reader, audio and broadcast media as is often the case in in-company training and in traditional open university courses. On a more advanced level one can add computer based software to gain practical experience.

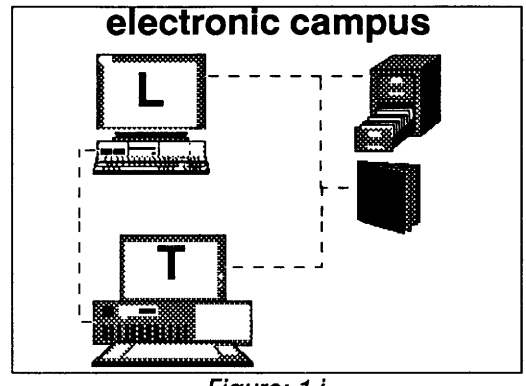


Figure: 1 j

An 'electronic campus' provides modalities for three different kinds of communication.

- personal letters
- discussions, structured or unstructured, formal or informal, amongst a few colleagues
- interaction among any number of participants.

The learner can partake in many kinds of interaction from the personal to the public, from the social to the content related, from the interactive to the purely informative.

The 'electronic campus' could be designed for individual learning at home, or at a local centre or for combinations of both. Group communication at a distance overcomes all negative aspects of the isolated situation of the distant learner and facilitates the learning of certain social skills. Electronic communication and remote access to multimedia information enables the learner to have the full advantages of tuition of peer learning and coaching. CBT tutorials make it possible to explore and apply certain techniques within exercises, simulations and case-studies.

The configuration of the 'electronic campus' as described so far has only encompassed delayed data communication facilities. If this configuration is extended with real time data communication facilities like access to on-line help and advice services, a broader range of learning scenarios are enabled. If the configuration is further expanded to incorporate voice and video communication (audio- and video-conferencing), learning scenarios for all kinds of settings and skills is enabled.

2.2.4.4. Integrated learning services

If the services for production, delivery and information are integrated into infrastructures enabling their interoperation at the different levels of requirements, the resulting system would allow the sharing of common

resources and would make possible an optimum support to the various users.

The actual configuration of integrated telematic learning services can vary. One scenario, which is used in Open Universities, is to have one central location where most of the administrative, technical and teaching staff are placed linked to local centres mainly serving the learners. Another scenario, which is used in large companies, is to have a central training department defining and specifying the curricula and course design and to have the actual production of the courses done by external producers. The teaching is carried out either at the workplace or in training centres.

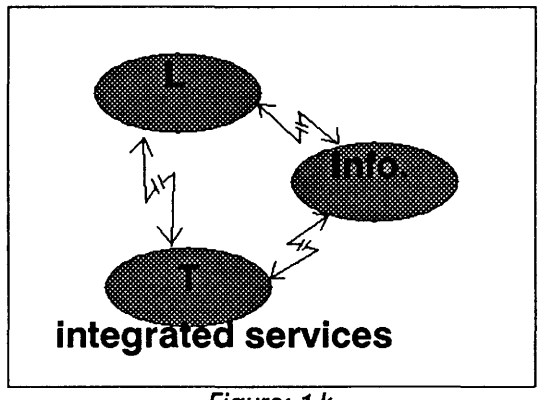


Figure: 1 k

In both scenarios it is possible to tailor the technological configuration to the specific user needs in the different content areas and to perform all the tasks normally executed on the spot mediated through electronic communication.

Telematic based learning services have no boundaries. It does not matter - except for the communication costs - whether the learner is next door or 1000 km away. He or she will still be able to follow the courses and to keep in contact with the learning community.

A transnational integrated learning service can be established when more training and education providers, be they educational institutions or training companies, on a transnational scale share the same infrastructures and networks for distance teaching. This will create a very rich learning environment where the learner can build a truly international curriculum by a pick and mix of the offers from a variety of different education providers.

The costs of the infrastructure, organisation and management of such a system should however be balanced against the pedagogical and economic benefits and outcomes. Only if a critical mass of providers jointly decides to establish and maintain such an infrastructure can an

economy of scale be reached which will make the infrastructure cost effective.

2.3. Inter-Programme Dependencies

This research and development is part of a larger framework attempting to realise the Community's policy objectives for ITT&B R&D. This involves inter-programme linkages, and the further exploitation of the work that is already underway. Thus, it will exploit mainly the outcomes of the DELTA Exploratory Action and the emerging technical potential of ESPRIT I, ESPRIT II, RACE I and RACE II. Links with relevant EUREKA projects will be of main interest because their more market oriented results can reinforce the basis for the research to be undertaken under this applied programme.

The DELTA Exploratory Action and its follow-up aim at providing a series of technology based solutions that are steered by learning needs, and it will then offer these to content oriented programmes such as COMETT I and II, LINGUA and EUROTECNET.

Other close related initiatives which should be borne in mind are the ones related to the Information Market, such as IMPACT I and II, and the Libraries Programme and its follow-up in the line 1c of the III Framework Programme.

EC Initiatives on quality and technical standards, and those related to copyright and other regulatory issues, should provide orientations to the relevant actions of this workplan, and conversely, the findings on the barriers found to the market uptake of training services should be made available to them.

As the context of this programme is applied research, with some distinct regional and/or sector flavours (special needs groups, isolated areas, SMEs, etc), it is natural that a number of Community based financial instruments may be considered appropriate for the further exploitation of the results of the research, where the nature of the work has "local" characteristics, or investment required is outside the scope of traditional R&D funding. Main actions to be considered under the European Social Funds and the Structural Policy of the EC, are FORCE, STRIDE, TELEMATIQUE, LEADER.

Generally speaking, the use of technology in education and training is in an area which covers many different disciplines and application domains, even outside the Community Framework Programme for R&D. It cannot afford to be independent of the final customers/users; therefore it needs close liaison with strategic initiatives in the various domains to which DELTA supplies a new capability.

A closer coordination should be sought with those Commission initiatives more relevant to this action. The objectives of coordination are better use of resources, the avoidance of duplication of efforts, and the achievement of syndergy. The main initiatives which should be coordinated with the programme are ESPRIT, RACE, EUROTECNET, COMETT, LINGUA, TEMPUS, VALUE, CEDEFOP, EURYDICE, IMPACT, MEDIA, ORA, other DG V programmes, the Library programme and the European Nervous System (ENS).

Coordination should also be sought with EADTU, Saturn, EUROPACE, EUROSTEP, etc., and also with the non-EC initiatives in the EFTA countries and in the light of the current political developments with the East European countries.

The coordination is best carried out by exchange of information through the current committees like common coordinating bodies, ongoing exchange of information between the project coordinators and in as far as possible through meeting at the project level.

The work should take into account the actual experiences at local, regional, Member State and trans-European level, with the objective that the work contained here seeks to support some national and regional problems, whilst adhering to the principles of subsidiarity and aiming to enhance eventually the Community's social and competitive dimension. Existing experiences, human networks and infrastructures should provide a basis for the research to be undertaken.

Dissemination actions which will be carried out by the different projects involved in this research, should be in close connection to the EC's VALUE Programme, the horizontal action dealing with dissemination of the whole Third Framework Programme. The actions envisaged under this scheme are support mechanisms for the exploitation of results, seminars, conferences and information materials to reach broader audiences or specific target groups, such as decision makers, training managers or specialists in a related relevant field. They could include fact sheet form or state of the art reports, inventories of resources or dissemination of case studies showing good practices.

2.4. Possible links with other programmes

Task	DESCRIPTION	Possible links
I	**Implementation strategies and scenarios**	
110	Market analysis and implementation planning	Comett II Lingua
120	Assessment and evaluation of learning technologies	Comett II EUROTECNET
130	Awareness infrastructures and information dissemination	VALUE
II	**Technology and systems development**	
210	Common training architecture	Esprit OBS RACE
220	Design and production of learning material	ESPRIT OBS
221	Multimedia integrated simulation system for learning	
230	Training information system	IMPACT ESPRIT OBS LIBRARIES
240	Training delivery systems and services	ESPRIT OBS
250	Learner and teacher support tools	ESPRIT IPS/OBS
260	Advanced interactive communication systems	RACE ENS
III	**Pilot testing and validation**	
310	Systems for joint course development and production	RACE APPL PILOTS
320	Systems for European course delivery	COMETT II EUROTECNET LINGUA RACE APPL PILOTS STAR TELEMATIQUE
330	Systems for remote access to training resources	ERASMUS II EURYDICE RACE APPL PILOTS STAR TELEMATIQUE

STRUCTURE OF THE WORKPLAN

3.0. Overall structure of the workplan

3.1. The R&D areas

On the basis of the results of the DELTA Exploratory Action and in close cooperation with other Community initiatives such as COMETT and EUROTECNET, work in this domain will be carried out in three interdependent strands of research: the elaboration of implementation strategies, the development of technologies and systems, the validation and integration of services.

3.1.1. PART I: Implementation strategies and scenarios (Part I)

Strategies for the definition of common functional specifications and the optimum implementation and usage of flexible and distance learning services; An on-going iteration process of users needs' identification, evaluation, consensus building and information dissemination is a key to this part.

3.1.2. PART II: Technologies and systems development (Part II)

The work will focus on the technology required for achieving a telematic service for flexible and distance education and training, which has to be flexible, efficient, modular and interoperable;

3.1.3. PART III: Pilot testing and validation (Part III)

Experiments on the validation and integration of services will be aimed at assessing the performance of the different services and technological configurations, the validation of technological and pedagogical adequacy and their related market issues.

The different parts can be related to the overall objectives as follows, numbers refer to tasks (see task descriptions) and blank boxes indicate no direct correlation:

	Part I	Part II	Part III
Objective 1: To develop technologies and systems tailored to learning purposes		All	All
Objective 2: To harmonize technologies, systems and infrastructures and their adaptation to optimally convey learning services European wide	120	210 260	
Objective 3: The validation of technologies, systems, infrastructures, methodologies and guide-lines for flexible and distance learning	120		All
Objective 4: To develop implementation plans for technology-based learning services and infrastructures European wide	110	260	All
Objective 5: To raise awareness and fostering consensus on the usage of learning technologies	130		

3.2. PART I: Implementation strategies and scenarios

3.2.1. Description

This part of the research deals with identification of users' requirements, implementation strategies and potential scenarios for market uptake. Activities aim to identify common requirements and to provide a bridge between the market and appropriate solutions information technology and telecommunication have to offer. This will be achieved through the development of methodological frameworks for implementation planning, evaluation and assessment and information dissemination.

3.2.2. Objective

To develop the strategies and scenarios and to foster the adequate conditions required for the optimum market uptake and implementation of distance and flexible learning technologies and telematic services at trans-European level.

3.2.3. Scope

Part I should provide the user, market and pedagogic drive. It monitors the technology potential and represents the needs of the learner to the actors active in R&D. It offers to the pilot experiments the infrastructure for evaluation, assessment and dissemination. It makes explicit contexts for R&D in terms of users requirements, markets, standards and implementation plans.

Activities will relate to:

- the analysis of the learner requirements, in order to specify the context of the technical and experimental work;
- the analysis of the user needs and market requirements and opportunities in order to prepare implementation plans for trans-European learning services and infrastructures;
- the identification and the development of a common framework for the evaluation and assessment of technology based learning in order to put forward concrete recommendations and guidelines;
- the setting up of human networks in order to provide an input to technical developments, to raise awareness of the potential users, to help building consensus between the key actors and to disseminate information and standards.

Those activities will converge to provide implementation strategies for the development of technology-based training services for Europe.

3.3. PART II: Technologies and systems development

3.3.1. Description

The work will focus on the required technology and strategic systems development for achieving a telematic service for distance education and training, which has to be flexible, efficient, modular and interoperable.

3.3.2. Objective

To develop technologies and systems making possible cost reductions and to improve performance of technology for flexible and distance learning. To allow portability of courseware products, interoperability of training services, interworking of courseware production tools.

3.3.3. Scope

This part aims to identify the key technologies and systems required, and, by adapting and integrating existing communications and information processing technologies and systems, to harness them for educational purposes. The main objective is to achieve interoperability of services and portability of learning materials and the selection of specific standards to fulfil the functionalities required by the users: tutors, producers, distributors and, mainly, the learners.

Technical work should exploit emerging technologies and harness their ever increasing capabilities to the purposes of creating a Common Training Architecture (CTA). This open design will allow a similarity of "look and feel" to emerge, thus enabling designers, distributors and learners to become more efficient at the creation, transmission and use of high quality courseware. Economy of scale is introduced effectively this way.

The systems and telematic services to be developed should serve different market suppliers (eg. learning material producers and distributors) and facilitate different distance and flexible learning scenarios (eg. trans-national, corporate, and home).

This development of services and systems should meet the needs of the ultimate customers and the end user, to meet the specific requirements of particular industrial sectors or regions and local areas.

All projects will go through the full R&D life cycle from requirements specification to pilot testing. In this process they should take advantage of knowledge and experience obtained in Part III through concertation and by providing prototypes for testing.

Furthermore all the projects should contribute to the horizontal actions through the mechanisms set up by Part I projects: they will provide an assessment plan and input on achieved results and pilot tests and will contribute to various concertation activities and information dissemination on a regular basis.

Specific workpackages will be defined to allocate resources to those concertation activities.

3.4. PART III: Validation and integration experiments

3.4.1. Description

To set up a range of pilot projects of different scale permitting the assessment in real conditions of the cost-effectiveness, pedagogical efficiency and market uptake of flexible and distance learning technologies and telematic services.

These experiments will allow the testing of the added-value of new technologies for flexible and distance learning for different categories of users.

3.4.2. Objective

The objective of the pilot experiments is to test and validate IT & T based experimental services for integrated European flexible and distance learning systems. The pilot projects aim to validate, within a coherent evaluation framework, the technological approach of the projects, the logistical and managerial implications of the approach, the applicability and efficiency of the didactic approaches and technologies, the cost factors involved and the uptake of the integrated services by the market.

3.4.3. Scope

The work in Part III will form an assessment of the feasibility of setting up trans-European learning services. The pilot experiments will serve as a testbed for available learning technology and future prototypes. They will also provide input for directing and focussing system development on existing and future market requirements.

Pilot projects of different scales are foreseen:

Larger scale projects will:

- be oriented towards implementation of services;
- have a wide geographical coverage;
- use stable state of the art technology;

- integrate upcoming technologies.

Smaller scale projects will:

- be innovative or
- address special needs or
- apply innovative developments coming from Part II;
- have a more limited coverage.

The assessment of the feasibility of setting up trans-European electronic services for distance and flexible learning will be one of the main goals of these experiments.

This implies the validation of methodologies and integration of technologies in different contexts: course design and production; course delivery, tutoring and monitoring; remote access to learning resources.

An assessment and evaluation framework will permit cross evaluation and coherence of methodologies in pilot application experiments and ensure that conclusions on the technical standards, networks and protocols will be drawn up within an integrated approach, leading to common functional specifications.

A market impact assessment, a validation of didactic approaches based upon different technological configurations and cost analysis should be an integral part of these experiments.

All pilot experiments should cooperate with Part II projects by testing available prototypes and providing feedback.

Whilst the larger scale experiments will initially be based upon state of the art technology to identify and evaluate the appropriateness of systems and services, later on they should introduce in the experimental design the emerging technology developed under Part II. The smaller scale projects can also pilot testing the technology developed under Part II.

All pilot experiments will cooperate with the projects active under Part I by contributing to the implementation framework, the implementation plan, to the development of an assessment and evaluation framework and to the development of an information dissemination framework by contributing to various concertation activities and providing information on a regular basis.

3.5. Interrelationships between the three parts

Parts I, II and III provide an intercept strategy between R&D and the actual implementation of infrastructures. The different parts are interrelated, each one aiming at fulfilling with complementary approaches the different elements required to reach a significant improvement in the domain of flexible and distance learning services at European level.

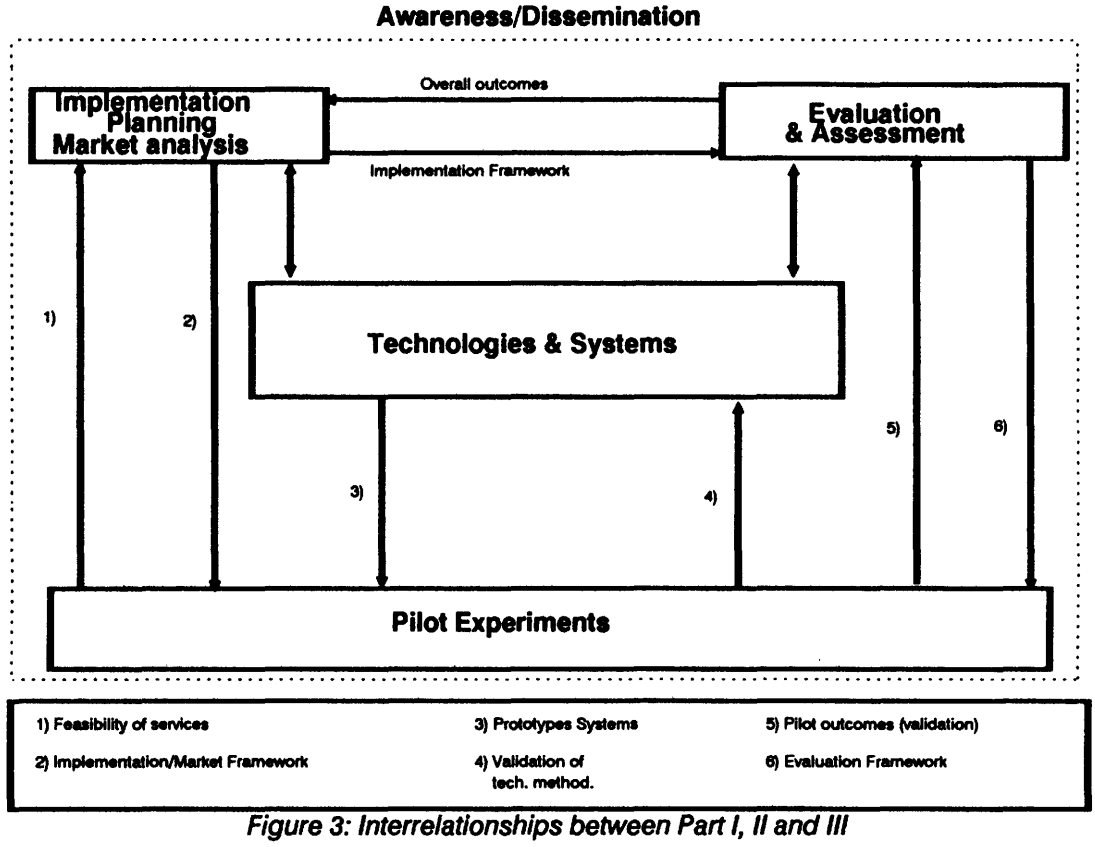


Figure 3: Interrelationships between Part I, II and III

It is not possible to consider the three parts of the workplan in isolation. All the tasks are closely related. Thus, the need to simultaneously consider the R&D in technology and systems (Part II), the pilot experiments (Part III) and the Implementation Strategies and Scenarios (Part I), necessitate a clear management structure, with projects coordinating R&D within a specific area and projects addressing common issues of the three parts and so providing horizontal integration.

3.5.1. Actions envisaged

Projects belonging to Part I of the workplan will address horizontal issues. As explained below, they will coordinate each of the three actions which are described under the heading 'horizontal actions'.

The projects working within Part II will be mainly focussed on the development of systems and technology. Most of them (see the 200 series tasks' description in Vol II) should contribute to the Common Training Architecture, as laid down in Vol II (task 210). Though those projects will concentrate on technology research, they will be contributing to the full R&D cycle from the market studies and the identification of users requirements to the validation through pilot tests.

The projects working for Part III will mainly address experiments dealing with the integration of technology and the implementation of services. Those projects will address the three areas of systems for:

- course development and production,
- course delivery, tutoring and monitoring,
- remote access to learning resources,

or they may address more than one topic in view of an integrated service.

Although those projects will focus mainly on experiments, they should address the user requirements and market issues; eventually, they may address specific technology and systems development in relation to the innovative nature of the services to be launched.

3.5.2. Horizontal actions

In order to ensure a coherent approach, some actions of a horizontal nature should be tackled in close coordination with the Commission and with liaison with the pilot experiments and with the technology and systems developments. These actions are listed below, and they could be carried out at different levels and coordinated by independent consortia in charge of the corresponding tasks of the workplan. Each consortium will be coordinating the various developments in the different projects which will introduce the specific workpackages required to undertake the work needed.

The tasks dealing with the coordination of these actions are described in the task description section of this workplan. Some specific actions are summarised in the following pages to clarify the relationships between the tasks.

3.5.2.1. Market analysis and implementation planning of telematic services for flexible and distance learning

The project addressing task 110 will be in charge of the coordination of this action and will, in concertation, draw-up an implementation framework and collaborate with projects active under Part III (and partially

Part II) in order to reach a coherent implementation plan for the different developments and experiments.

Projects active under Parts II and III will contribute to implementation planning. Projects active under Part III will further actively collaborate with this horizontal action in setting up the methodological implementation framework.

	HORIZONTAL ACTION **Market assessment & implementation planning**
PART I	**market assessment & forecasting** → **infrastructures**, **services**, **needs** **overall strategy for implementation** **monitoring of implementation plans of the pilot projects** **implementation plan for Trans-European learning services** **evolutionary strategy**
PART II	**user requirements for the systems** **market assessment for the systems** **exploitation plan**
PART III	**market assessment full impplementation of services** **implementation into Trans-European Training services**
	OUTCOMES **State of the art reports** **Assessment and forecasting of the market** **Phased implementation plans**

Figure 4

3.5.2.2. Evaluation and Assessment of learning technologies

The project addressing task 120 will be in charge of the coordination of this action and will operate basically on two levels:

- the production of an overall strategy for the evaluation and assessment actions within each pilot experiment (Part III) in order to ensure that the evaluation produces coherent results and to manage the consolidation of the evaluation process and results.

- furthermore the action should assemble input from the different pilot experiments (executed under Part II and III) and make them available in a concise manner that allows for the drawing up of coherent conclusions and the provision of guide-lines.

Projects under Parts II and III will define a workpackage on assessment and evaluation and actively collaborate with this horizontal action.

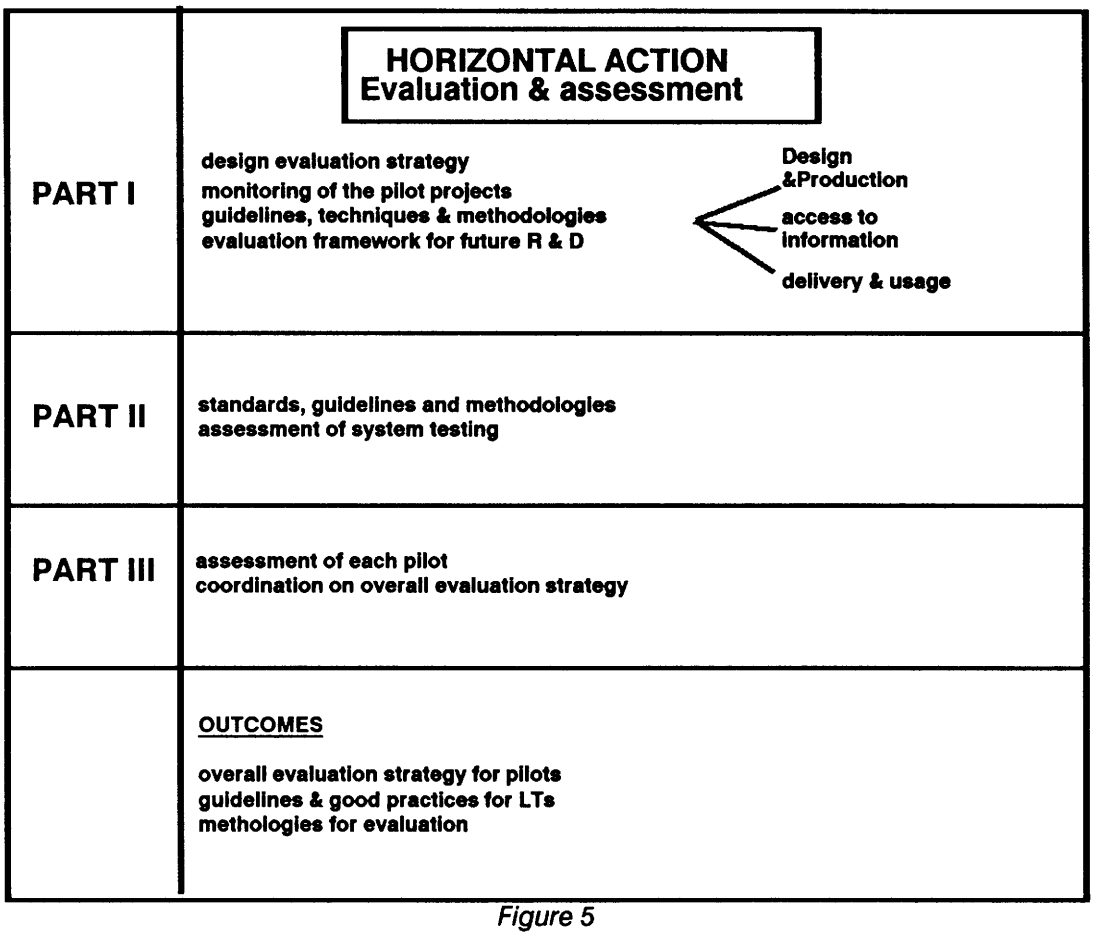


Figure 5

3.5.2.3. Awareness infrastructures and information dissemination

The project addressing task 130 will be in charge of the coordination of this action and will produce an overall strategy for the dissemination of results and awareness actions in order to ensure that the results of R&D projects and the pilot applications are presented, analysed, agreed and enriched in a coordinated way.

It should provide the mechanisms to set up human networks for discussion, consensus formation and the dissemination of information and standards or guide-lines.

Furthermore this horizontal action will manage and coordinate the external dissemination and awareness actions to the public.

All projects involved in the programme will contribute to this action, through their involvement in the awareness activities.

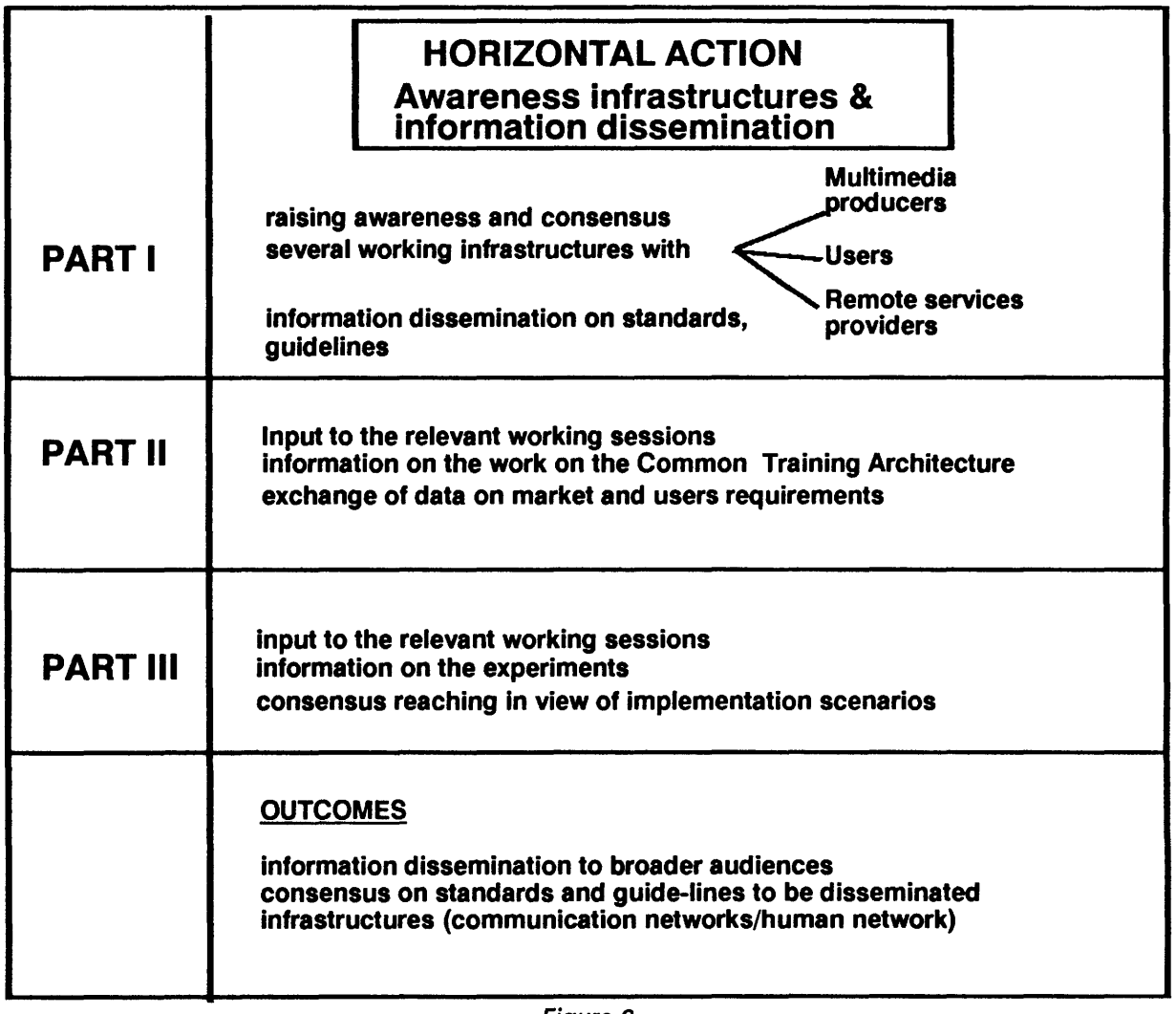


Figure 6

3.5.2.4. Common Training Architecture

In order to foster the development of coherent and integral services and systems, a horizontal action has been defined that will lead to the development of a Common Training Architecture (CTA). This CTA will provide a framework, allowing for portability, interoperability, the inter-connection of distributed systems and services and a common 'look and feel' for the end user.

The CTA will not be developed by an individual consortium, but will evolve in close collaboration between the projects active under Part II. Therefore each project will introduce a workpackage on CTA related to their R&D area.

The different projects will negotiate a workplan for the CTA and in concertation they will set up a task force, which will coordinate and monitor the development of the CTA and draw up specific recommendations on standards for distance and flexible learning systems in the various domains (information systems, design and production, delivery) and those of more general nature brought about by the Common Training Architecture.

The concertation meetings, which will be held on a regular basis by the projects in charge of this research, are important steps to be taken into account by all consortia. In this context there are many relationships between project officers (from the Commission) and prime contractors (or other representatives of the projects). Many interrelationships between will be managed at this level.

Due to the highly critical nature of the CTA task, a specific project monitoring will be put in place.

3.6. Timing and Preconditions

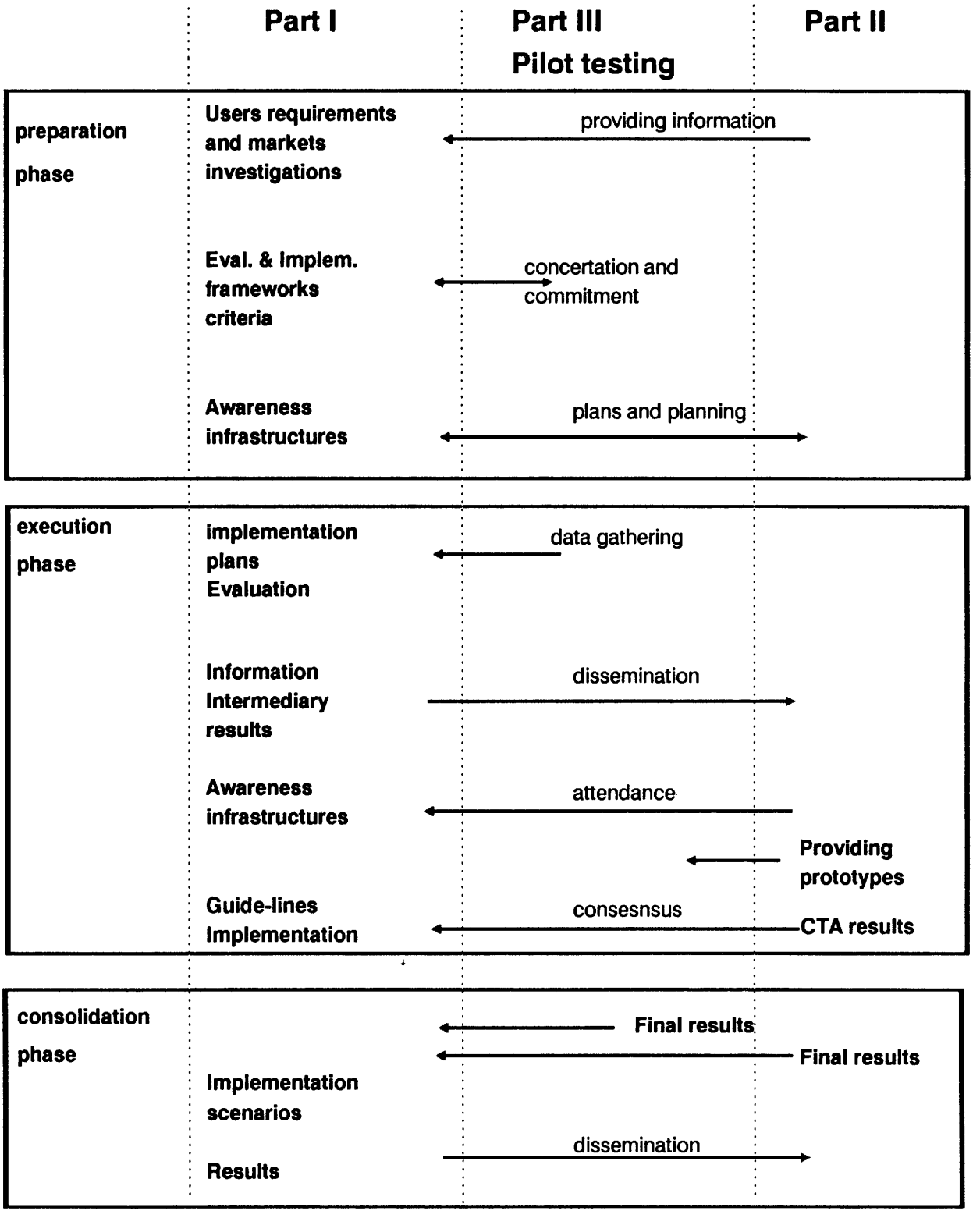
The proposed Community initiative is likely to have a life span of 3 to 3.5 years. The three parts of the workprogramme will be launched in parallel and the initial planning for the development as a whole is described below.

Part II projects are likely to be able to produce prototypes in the 3rd year of the programme. As a consequence Part III projects will in general not be able to test these prototypes on a full scale. However, more limited tests and experiments can be conducted at the final stage of the pilot projects and provide valuable input for the Part II projects. In order to achieve this it is critical that Part II and Part III projects agree on field testing of prototypes in the first half of the projects' life cycle. Furthermore the assessment methodologies for the testing of prototypes should be on-line with activities executed under the work on market assessment and implementation planning.

Part I projects prepare the methodological frameworks for implementation planning, assessment and information dissemination.

In order to ensure effective collaboration with Part III and with some Part II projects the following time schedule is foreseen.

Figure 7: Time schedule for cooperation between the three parts



Timing and preconditions

4.0. List of Abbreviations

AI	Artificial Intelligence
ALT	Advanced Learning Technology
API	Application Programming Interface
B-ISDN	Broadband Integrated Services Digital Network
CAL	Computer Assisted Learning
CBT	Computer Based Training
CD	Compact Disc
CD-I	Compact Disc Interactive
CD-ROM	Compact Disc Rom Based System
CEDEFOP	Centre Europeen Pour le Developpment de la Formation Professionelle
CLI	Convergent Learner Interface for Technology
COMETT	Community Action Programme for Education and Training
CPI	Common Programming Interface
CTA	Common Training Architecture
DBS	Direct Broadcasting by Satellite
DG	Directorate General (of The European Commission)
DG V	Directorate General V of the European Commission
DG XIII	Directorate General XIII of the European Commission
DV-I	Digital Video-Interactive
E-mail	Electronic mail
EADTU	European Association of Distance Training Universities
EC	European Community
EFTA	European Free Trade Association
ENS	European Nervous System
ESPRIT	European Strategic Programme for Research and Development in Information Technology
EUREKA	European Research Coordination Agency
EUROPACE	European Programme of Advanced Continuing Education
EUROSTEP	European Association of Users of Satellites in Training and Educational Programmes
FORCE	Community action programme for the development of continuing vocational training
EUROTECNET	European Technologies Network
GUI	Graphical User Interface
I/O	Input/Output
IBC	Integrated Broadband Communication
IMPACT	Information Market Policy Actions and Development in Europe
IRDAC	Industrial Research and Development Advisory Committee
ISDN	Integrated Services Digital Network
ITS	Intelligent Tutoring Systems
ITT&B	Information Technology, Telecommunications and Broadcasting
LAN	Local Area Network
LEADER	Liaison Entre Actions de Developpment de l'Economie Rurale
LINGUA	Community action programme to promote foreign language competence in the EC
MEDIA	Mesures pour Encourager le Developpment de l'Industrie Audiovisuelle
OCI	Open Communication Interface
OODBMS	Object Oriented Data Base Management System
ORA	Telematic Systems for Rural Areas
PC	Personal Computer
PETE	Portable Education Tool Environment

PTT	National telecommunications network provider
R&D	Research and Development
RACE	R&D in Advanced Communications technologies in Europe
RB	Requirements Board
SME	Small and Medium Enterprise
SRB	Strategic Review Board
STRIDE	Science and Technology for Regional Innovation
TP	Technical Panel
TV	Television
VALUE	Valorisation and Utilisation for Europe
WAN	Wide Area Network
WIMPS	Windows, Icon, Mice, Pointers

TASK DESCRIPTIONS

PART I - Series 100 Implementation Strategies and Scenarios

I.0. Introduction

I.1 Rationale

Technology in isolation cannot provide solutions to the many requirements of the actors involved in technology based learning. Nor can traditional market investigation anticipate new emerging markets. Work on copyright regulatory issues has to be taken into account although their resolution is beyond the scope of this action.

Implementation strategies and scenarios will build on an approach aimed to bridge the gap between the technology and the users' requirements, between the technical and the market issues. They will propose paths from the research to the market, through implementation planning scenarios based on real experiments, through the results of evaluation and assessment tasks and through the active involvement of the actors.

I.2 Objectives

The work outlined in this part aims to develop strategies for the optimum implementation of information and communication technologies in flexible and distance learning. It aims to build realistic scenarios of use.

The following objectives must be met for trans-European learning services and infrastructures:

- the analysis of the user needs and market requirements and opportunities to prepare an implementation plan. This analysis will help provide a broad view of the market, to investigate the users requirements, to assess the possible synergy between the existing training needs and the technology potential.

- the identification and the development of a common reference model for the evaluation and assessment of technology based learning in order to define concrete recommendations and guidelines. This model will allow consensus on common tools, assess the relevance of technology for learning, identify the costs and evaluate the investment factors.

- the setting up of the actors' networks in order to develop cross-fertilisation between researchers and potential users. This cross-fertilisation aims to technically develop the awareness of the

potential users, to reach consensus on a European scale and to disseminate information and standards.

I.3 The tasks

To fulfil these objectives, a set of tasks has been drawn-up as follows:

Market analysis and implementation planning of telematic services for flexible and distance learning (task 110)

This task is related to two sets of activity. On one side, it involves the identification of users' requirements and the analysis of the market. On the other, it builds on this work to carry out implementation planning work with inputs from the pilot experiments and from other relevant sources. It will provide an estimation of medium and long term market opportunities in order to develop future implementation plans for trans-European learning technology services and products. It will build scenarios of use based on relevant applications of technology.

Assessment and evaluation of learning technologies (task 120)

This task will evaluate and assess the contribution that advanced technologies and telecommunications can make to the effectiveness of learning services and systems in satisfying the learner demand. It will gather the results of the pilot experiments in terms of evaluation, usability, interactivity, technical appropriateness and user acceptance. The task will provide guide-lines and a coherent evaluation model for future developments and implementation.

Awareness infrastructures and information dissemination (task 130)

This task will be based on the development of infrastructures for discussion and dissemination. The hypothesis and results of the research will be described and discussed with the relevant sector actors. The actors' requirements will be analysed within those forums. The results of this consensus-reaching activity will be fed back to the research on technology and systems development and to the setting-up of implementation scenarios. The outcomes of this activity will be disseminated to a wider external audience.

I.4 Scope of R&D

I.4.1 Relationships between the Series 100 tasks

The three tasks will converge to provide implementation scenarios for the development of technology-based training services for Europe. A profound analysis of the actual and future market versus learning demand will provide requirements for the development of a general evaluation and implementation framework. Assessment of the effectiveness of training systems and services in real contexts will in their turn provide guide-lines for future implementation. As such, it will be possible to develop implementation scenarios for future training services across Europe on the basis of a sound market rationale, evaluation framework and users requirements' analysis, with the active participation on a European scale of all professionals.

I.4.2 Approach

The development of services and systems should meet the needs of the ultimate customers (eg. trainers and trainees) and meet the specific requirements of particular industrial sectors or regions and local areas. Implementation of new systems and services should optimise the synergy between the actors on the market and the technical work in Part II and III of this workplan. It should take up the results of future research. It should be efficient and reduce the costs of training compared with traditional methods.

In this process, the value added from Community action and the exploitation of existing resources are crucial.

Application of the subsidiarity principle requires objective independent identification of the user base/state of the art in Member States and an assessment of added value from Community action. Links/complementarity between National and European projects should also be assessed and evaluated and specific requirements identified. In addition to exploiting the human networks created during the DELTA Exploratory Action, there is also a need to base research on other existing networks.

Each project in Parts II and III will provide concrete input on market assessment, an implementation plan, evaluation and information dissemination, within its specific development or field test. The inputs from the different projects will then be gathered and processed by the horizontal projects in order to build an overall strategy in each task: implementation (110), evaluation (120), awareness (130).

With the current perception of a highly fragmented market and many small scale suppliers in Europe, consensus formation needs careful attention and further development. This will be the main concern of task 130 on awareness.

I.4.3 Relations with other Community actions

The links with other existing Community actions have to be given a special emphasis. This Part I aims to provide bridges between traditional services and future technology-based ones, to fill the gaps between the research and the applications. Effective coordination with relevant Community frameworks will then have to be taken into account. Content oriented programmes such as COMETT II have stimulated networks of University/Enterprises Training Projects, whose experience is of relevance to the work under this Part. LINGUA will support similar initiatives in the area of language learning. EUROTECNET contributes to some innovative infrastructures and builds human networks. Work with small and medium enterprises has been done under DG XXIII.

Research work done under DGXII and DGXIII should also be taken into account, such as the work on evaluation under MONITOR, the work on technical standards and guide-lines under the Framework Programme for Research and Development (RACE, ESPRIT). Other initiatives in the field of information services market (IMPACT I and II) within DGXIII should also be considered, such as the work for overcoming legal and administrative barriers and for supporting strategic information initiatives.

I.4.4 Relationship to CEC's VALUE Programme

Besides the specific task on awareness in Part I, a set of 'concertation actions' for all projects will be managed by the Commission.

Other specific actions may also be considered under the VALUE programme, to disseminate the results of both the DELTA Exploratory Action and the results from the new actions under this programme, such as:

- exploitation and dissemination actions via case studies, seminars, conferences and exhibitions,
- information products targeted at different audiences from specialists of the domain to general public or decision-makers, such as inventories, catalogues of good practices, state of the art overview, guide-lines for work in the field.
- fact sheets in several languages, in order to provide periodical summaries of the results of the programme's contractors, through their public deliverables.

I.5 Relations with other parts

Implementation strategies, as described through the three tasks in Part I, are strongly related to all the work done under this programme. They must be considered as horizontal issues working across the projects developed under technology (Part II) and under pilot testing (Part III) as described above.

The tasks will provide the breadth of view necessary to carry on the tasks under pilot experiments and technology development.

The task on market analysis and implementation analysis (110) will reflect the state and the forecast of the relevant markets in order to provide the general context for technical development. It will gather the relevant inputs from the pilot projects in terms of needs' analysis and proposed solutions for overcoming tariff and regulatory barriers. It will provide a concerted framework for the implementation plans done by the pilot experiments. It will gather the feedback from projects so as to facilitate building implementation plans for trans-European learning services.

The task on assessment and evaluation of learning technologies (120) will provide the context for a systematic investigation of the outcomes of the pilot experiments in terms of efficiency for the user, cost effectiveness of the systems and economic performance on the market. From the results gathered on the test fields, they will draw conclusions, guide-lines for the information, production and delivery of learning materials and services. These should be further disseminated. The results will also serve as a basis for the development of common evaluation models for future pilot applications and further R&D.

The task on awareness infrastructures and information dissemination (130) will set up infrastructures for discussion and communication with the pilot experiments and in relation to the broader concerned community of users, producers and providers of technology-based learning. All projects selected under the programme should participate in these actions. In this context, they will discuss the main results from the pilot experiments and other research projects. These groups will provide the strategic human resources in order to put the implementation scenarios into action, in the areas of design and production, delivery infrastructures and information and delivery services. It will provide also a basis to discuss and disseminate standards and guide-lines emerging from other tasks (eg. the Common Training Architecture, task 210, or Evaluation and assessment of learning technologies, task 120). Dissemination of key information from the pilot experiments and from the technical research projects will also be made under this task.

Task 110: Market analysis and implementation planning of telematic services for flexible and distance learning

Background

Effective implementation of training services and infrastructures through Information & Telecommunications Technology in Europe requires research on several key issues: users' needs and requirements including pedagogic requirements in different training settings; producers and providers requirements; adequate technologies and telecommunication infrastructures to convey training services. Appropriate solutions and strategies must be proposed in order to overcome the obstacles to the uptake of learning technologies (tariffs, lack of standards, market fragmentation, etc).

Preliminary work on these issues has been done within the DELTA EA. However, the need has been identified to continue and intensify this research. This should be done with more emphasis on implementation plans which are actually feasible. Potential scenarios should be assessed and lessons should be drawn from the scaled experiments. Conclusions will be drawn in view of the uptake of large scale services of trans-European nature.

Guidance and orientation through **an overall implementation plan** describing strategic goals, standards, integration and market strategies is needed. It will address several issues.

The **market targets** should be clearly identified, in view of a global implementation plan. Pilot experiments may address authors, producers, providers or users of learning materials as well as network operators and information service providers. Within those categories, they can address different levels of qualification, type of sectors, size of organisation, public or private context.

The **considered set of technologies** should be also clearly defined in order to propose a common strategy agreed by the pilot projects under this specific task.

The **identified settings** considered for implementation, within the pilot projects, should be taken into account in order to draft scenarios. Those include the 'home situation', the workplace mode etc (see task 320 within Part III).

The **identified needs** should also be stated in view of an implementation strategy. From a specific need, they should assess the possibilities of generalisation to cross-discipline applications.

The **identified services** should be defined with precision, with eventual reference to 'services backbones' at local, regional, national level, and trans-European level. Copyright problems are not resolved, neither is tarification clear. The interconnections of European networks is also unresolved. Therefore, work done on these issues under other initiatives should be taken into account in the implementation strategies.

The general implementation plan will map the specific plans of the potential pilot test experiments against a common framework.

Objectives

To build an **implementation framework** in concertation with the pilot projects, and as an input to their specific implementation plans.

To build **implementation scenarios** for the development of technology based learning, taking into account the selected pilot projects, the relevant market trends, and the path from traditional training services towards better performing technology-based ones. Particular consideration should be given to learner needs.

To design a coherent **implementation strategy** based on the use of information, telecommunication and broadcast technology for supporting networks of local, regional, national learning and trans-European services.

To provide an **evolutionary strategy** building on the results of the DELTA Exploratory Action, on complementary forecasts of the market, on the inputs from the pilot experiments.

Technical approach

Market analysis

Gathering of quantitative and qualitative data in relation to the analysis of the existing state of the relevant markets and to available forecasts. It aims to identify practices, services and infrastructures based on technology. This should take into account the conclusions of the DELTA Exploratory Action and of other relevant sources, regarding market identification, needs' analysis, favourable conditions to the uptake of the market (in terms of legal, economic and regulatory issues), the overcoming of the barriers to the implementation set by PTT tariffs and standards in view of the implementation.

Specific investigations must be envisaged. These could include the strategic markets for flexible and distance learning, such as language learning, training in high technology, training in European management,

law, economics. The needs of specific target groups such as Small and Medium Enterprises, rural areas and 'isolated' individuals may also be specifically investigated. Traditional training services, eg. those delivered by 'traditional' means, could be improved by the use of new technologies. Such trends should be investigated. Areas of investigation will be open for discussion. It will then be discussed with the managers from the Commission in order to evaluate the potential inputs from other projects and to avoid duplications.

As another complement to the materials issued by the pilot projects, some specific investigations could also be made on all aspects relating to the creation of favourable conditions for the uptake of the market. Those include research on public and private procurement policies, tariff policies and copyright issues, building on Community and national initiatives carried on. These issues should be taken into account in the implementation planning exercise, in case they are not addressed by the selected pilot projects.

Implementation

This specific task addresses the requirement for a coherent implementation strategy. Specific work will be done in order to draft scenarios for a European infrastructure for telematic training services. Such scenarios will have to integrate and synthesize the specific contributions of the pilot projects. They will also build on relevant experiences in the Member States and at trans-European level. The integration and globalisation work will be done in close and ongoing concertation with the pilots.

The following steps should be taken:

1. Concertation with the different pilot projects in order to build an implementation framework for the implementation tasks. The implementation issues to be tackled by each pilot project within Part III is described in the introduction of Part III.

The projects should also come to an agreement on the content of the implementation plans. Definitions of criteria should be discussed and agreed in order to get to a common grid including, for example:

- market rationale,
- investments,
- cost of infrastructures,

- cost of maintenance,
- cost of multilingual/multicultural approaches,
- human resources management,
- pricing and tariffing schemes,
- mechanisms for the creation and updating of learning materials,
- authors' remuneration and copyright,
- incentives for the adoption of networked learning systems.

2. The results coming from the pilot projects should be integrated and globalised. This work should be done in close concertation with the pilot projects. But specific scenarios should be prepared under this task in order to 'map' the results.

These scenarios will address implementation plans in the three areas of:

- **delivery** of learning services. The implementation may be made according to different settings and their specific didactic approaches: eg. the 'home situation' / the 'workplace' mode. It could also be made by enhancing existing services which have local, regional, national or trans-European basis for traditional delivery.

- **information** infrastructure. The validation of the actual services provided on a European scale may lead to the identification of new services and information bases. Scenarios for enlarging and implementing information services on a European scale may be designed according to the different weight given to local/regional/national operators. The priority given to geographical, sector or institutional settings may generate different plans.

- **production** of learning materials. The implementation may take into account different hypotheses in relation to joint production, management of the creation process, nature of products, balance between on-line and off-line materials.

The potential role of resource centres within those different networks should be envisaged.

3. An implementation plan for the training services infrastructure will be drafted. It should cover the following issues:

- a market rationale for European training services in a phased approach,
- recommendations concerning further actions (required R&D, strategies, etc.) needed for full future implementation,
- description of different implementation scenarios in relation to different infrastructure models,
- an analysis of the training services required by the different markets (home, workplace and learner centre based),
- an analysis of the training services envisaged according to different production schemes,
- a market study assessing the technologies available and forecasting the future market,
- implementation time framework,

4. The final plan will be drawn-up following a concertation exercise to gather feedback from the projects working on technology development (Part II) and from the pilot projects (Part III) as well as from the broader Community.

Key results and milestones

State of the art reports on relevant infrastructures and services for learning and possible ways towards technology-based networks of services.

Assessment and forecasting report of the actual and future markets in view of scenarios for information, production, and delivery of new learning services.

A phased implementation plan describing the feasibility of technology-based infrastructures and services for Europe, taking into account:

- market rationale,
- different implementation scenarios with their advantages and disadvantages,
- time and finance planning,
- barriers and how to overcome them eg. regulatory and standards issues,

- future actions required.

All these key results should be published and disseminated towards the key actors in the domain of technology-based learning.

Task 120: Assessment and evaluation of learning technologies

Background

A severe problem in the market is the gap between the potential of learning technologies and its practice. The reasons for this gap derive from the absence of overviews of what is on the market and the lack of research into why some initiatives on distance and flexible learning are successful and some are not. The importance of technology assessment and evaluation is often raised but seldom executed. The few evaluation and assessment studies available are made after the implementation of the learning system on the market and not during the development or testing phase. The knowledge of European-wide training schemes is limited because almost no field tests with a large European scope have been made.

The evaluation and assessment of learning technologies is a relatively undeveloped and disparate field. At present two main questions regarding the impact of learning technologies remain unanswered:

- What is the actual contribution of technologies to distance and flexible learning?
- What are the potentials of learning technologies?

The answering of these two questions on the actual and potential impact of learning technologies requires more research. The actual impact of learning technologies can be measured through examples of good practices on the market today. The potential impact can be investigated through pilot tests validating innovative developments of systems for design and production, information and delivery.

For both questions the assessment of the technological appropriateness for learning should be dealt with in three areas (development, access to information, delivery) and from different viewpoints (pedagogical, organisational, economical).

For example:

In the area of design and production of course materials, relevant issues are: how technologies can improve quality, adaptability and effectiveness of learning materials, how technologies can facilitate interactivity and integration of different media; how technologies can speed up production and delivery, make transfer of materials and access to multimedia databases easier, how effective different scenarios are in terms of investment and commercial uptake.

In the area of information databases, relevant issues are: how technologies can enhance the usability and multilingual accessibility of databases, how technologies can reduce the costs in terms of establishing, administering, updating, speed, harmonisation, etc.

In the area of the usage and delivery of distance and flexible learning topics of importance are: assessment of the technological appropriateness of training schemes in terms of interactivity, support, flexibility, quality, adaptability, training content (interpersonal communication versus more technical skills); measurement of benefits and effectiveness of training schemes in managerial and administrative terms; cost and impact of the use of flexible and advanced training tools and eventually effects and consequences of implementing innovative training technologies.

To answer the question as to why some technology applications work and some do not, concrete data coming from field tests need to be assessed. On the other hand as no appropriate methodologies for evaluation and assessment are available, some work must be done in this domain.

Objectives

To develop methodologies for assessment and evaluation of design & production, information and delivery systems for learning.

To analyse and evaluate what advanced learning technologies can bring to distance and flexible learning, taking into account the different learning settings and target groups, the content and didactic approach.

To provide guide-lines on how to improve the effectiveness, quality and uptake of learning technologies.

Technical approach

The technical approach should consist of information gathering, processing and analysis of evaluation and results of pilot tests in order to develop guide-lines and a coherent evaluation framework for future developments and implementation. As such an answer will be provided to the two questions, namely what are the actual and potential impact of learning technologies?

The evaluation and assessment questions will be addressed in two ways:

- by the pilot projects during their field testing. The evaluation work requested from each pilot project is described in more detail in Part III.

- by a separate project that will generate from the data collected by the pilot projects guide-lines and methodologies on design, information and delivery systems.

The approach for the separate projects, working under this Part, can be seen in several phases:

1. State of the art overview of evaluation results of distance and flexible initiatives (qualitative analysis of practices). Such an overview will put the evaluation results of each pilot project in a broader perspective.

2. Concertation of the evaluation actions of the different pilot projects in order to derive data on assessment and evaluation in a coherent way within a common timeframe.

3. Information gathering of relevant data from each of the pilot projects. Every pilot project is an intensive case study and provides detailed and qualitative information on market assessment and possible uptake, pedagogical and organisational efficiency, quality, cost effectiveness, technological appropriateness, cultural and language barriers, user acceptance etc.

4. Processing of the data from pilot projects and other innovative practices on distance and flexible learning in order to derive guide-lines, techniques and methodologies for the design, production and delivery of new learning technologies. The intention is not to develop another theoretical model for Action Learning Technologies but rather a practical framework for training managers implementing new training schemes, producers designing new learning materials, etc.

5. Development of specific guide-lines for the design of technology-based learning materials regarding quality, media integration, adaptability to learner profiles, support, help and guidance models for tutors, interaction.

6. Development of guide-lines for facilitating the use of information databases for learning in different training settings (exploratory learning, networked learning, 'on-the-job' training) and recommendations for the communication between learners, tutors/teachers, and authors, etc.

7. Development of guide-lines for methodologies for assessment and evaluation of future testbeds including appropriate measurement tools, phases of evaluation and evaluation design. This will provide methodological consistency and contribution to quality for future experiments and developments.

The intention is to provide a practical guide to:

- how evaluation should be integrated in the life cycle of design and production of learning materials;

- how information databases can be assessed on their usability and interactivity;

- how to measure the technological appropriateness of delivery systems versus didactic scenarios, the content, the target groups and training settings,

- how to assess and forecast the user and market acceptance of design, production, information and delivery systems.

8. These results will serve as a basis for the development of common evaluation strategy models for future pilot applications and further R&D. All these key results should be published and disseminated towards training managers and providers, tutors/teachers, authors, designers and producers, publishers, etc.

Key results and milestones

- Description and analysis of the state of the art of R&D and ongoing case studies regarding the technical appropriateness of local and remote learning systems in terms of user efficiency, job performance, cost effectiveness, market uptake, cross-cultural and language barriers, quality of learning materials, new organisational models and the roles of tutors and teachers, etc

- Development of evaluation strategies, methodologies and tools for assessment as input for the pilot projects as described in Part III and Part II.

- Guide-lines for good evaluation and assessment practice of flexible and distance learning systems.

- Guide-lines, conventions and good practices for the design, production, exchange and management of high quality technology-based materials and processes.

- Design of new or revised forms of assessment and evaluation tools for measuring the impact and appropriateness of design and production, information and delivery systems.

- Design of methodologies for the evaluation of development, information and delivery systems.

- Identification of areas for further research and development for better creation, design and test of new tools and methodologies for Advanced Learning Technologies.

- Dissemination of results.

Task 130: Awareness infrastructures and information dissemination

Background

In order to achieve the objective of this programme, it is necessary to create certain material conditions which include trans-European human networks.

The challenge faced by this pre-normative research is twofold:

- on one side the development of common platforms, standards and guidelines for the design, production and delivery of learning systems and technology-based services.

- on the other side, the establishment of a scientific basis on which effective commonalities can be developed, the development of a market basis through which consensus could be reached and the development of a users' basis through which exploitation of results could operate.

The actors requirements and needs must be identified and taken into account. The term 'actors' used hereafter refers to the producers, training services' providers, network operators and users involved in the development and use of those new learning processes. The key actors have to be approached and, as far as possible, involved in the process. The participants of all relevant initiatives both within the Community and at national and trans-European level are to be taken into account.

Infrastructures for awareness and concertation will then be set up in each of the key areas of interest of the programme: the production of learning materials, the user requirements, the remote education and services infrastructures.

These will be focussed on the exchange between the DELTA community and the sector actors in the Member States, in view of implementation of those services. They will also serve for dissemination purposes between the DELTA projects.

Human networking should be encouraged to improve the potential paths from research to market innovations. Frameworks for dialogue should support concrete recommendations for effective implementation of learning technologies in the four listed areas. They should provide strategic inputs for future work in research and development. Good dissemination of information is an essential element in order to consolidate these advances.

One or several organisations (users organisations and scientific ones) should be in charge of the promotion of the interests of those networks. The relevant organisations should be contacted in order to disseminate the standards, guide-lines and principles on which consensus has been reached.

Objectives

To raise awareness and achieve consensus among the actors in the field of technology based learning.

To set up a scientific framework with the sector's actors for concertation on the technical work done under the programme, for bridging the gap between research and development and its use, for facilitating synergy between the public and the private actors, enlightening the existing human networks in Member States and at transnational level.

To create European consensus in the areas of production, information, delivery systems and users requirements for the implementation of technology-based learning.

To organise proper channels for information gathering and information dissemination, eventually through telecommunication linkages.

To set priorities for future R&D or implementation work in concertation with the actors.

To create ways for the dissemination of standards and guide-lines within the concerned groups of actors.

Technical approach

The approach will be based on several sets of actions, which will complement those already forecast in the context of the management by the Commission, and those undertaken under the VALUE programme. Those actions will take into account the existing frameworks developed in the context of all relevant Community initiatives, eg.: COMETT, EUROTECNET. They will be developed in close cooperation with the Commission.

The setting up of working infrastructures for communication, concertation and information dissemination will be the core of this task.

Four groups of actors are to be considered: a) the producers of learning materials , b) the users and the training organisations (addressing SMEs, corporate training, resource centres and home user needs), c) the institutions involved in distance education, d) the scientists.

One or several existing organisations may be in charge of disseminating the results of their work done by those forums.

1. The specific goals

Each of the groups will be working in the framework of a permanent working group, meeting regularly to become informed on, to analyse and to discuss the outcomes of the pilot experiments and other research projects in the programme.

a) *The producers of learning materials will work on the advances in 'design and production'.*

b) *The users of technology based learning (users representing the interests of SMEs, rural areas, corporate training, etc.) will work on the issues of use, technology-based services.*

c) *The operators of distance education networks and providers of information and remote education services will work on the delivery infrastructures, on the issues of 'delivery configurations', 'servers'.*

d) *The scientists will synthesise the information from the other forums and will address key issues for the programme, such as 'interactivity', 'human factors', 'the learner visual environment', 'the learner/workstation' or learner/learner dialogue'.*

The specific goals of each working group should be specified in agreement with all participants, including the other research projects under this programme.

The value added of addressing topics at Community level should be demonstrated.

The dissemination of agreed standards and guide-lines provides an obvious rationale to this task. The dissemination and exploitation of results from the project should not be left at the end, but should be embedded in this process.

Specific actions should then be proposed in order to disseminate:

- the standards emerging from the work on the Common Training Architecture,
- the outcomes of the pilot projects in terms of standards,
- the standards and guide-lines issued by the projects and under the task on evaluation and assessment.

Specific recommendations should be formalised for broader dissemination in view of the implementation of trans-European information and communication technology based training services.

2. The audience.

The identification of the audience has to fit with this focus. It should reflect the public/private balance (specially in the case of the producers), and, as far as possible, the country coverage, the main actors (in terms of financial involvement in the field), a coverage of several sectors (when relevant).

3. The inputs

General information will be disseminated to the forums' participants. They will include:

- regular reports of the results and advances in the projects, which could include their plans for the exploitation of their results. Those should be a basis for further awareness actions,
- the implementation plans,
- trends and scenarios of the actual and future markets,
- studies on impact assessment and forecast of learning technologies.

This information will be used for information dissemination purposes within the projects involved in the programme.

4. The topics

Topics for discussion will have to be further defined in relation to their strategic weight for further implementation. They mainly tackle the outcomes of the ongoing research programme but they also include eventual references to key outputs from the DELTA Exploratory Phase and from other relevant national or Community actions.

With reference to the ongoing programme, the development of technology under Part II should be considered, so as the standards emerging from the Common Training Architecture. This will contribute to the European dimension to harmonisation and standardisation. The more strategic orientations of the projects working on technology will be presented within the workshops. The work on evaluation and implementation, within Part I and Part III, should also be tackled.

As learners are not always the ones who decide and the purchasing power, specific links with the other 110 and 120 tasks should be made in order to analyse the users requirements.

Key issues, such as for example the user interface, the human factors, the user motivation, may be analysed and discussed in a first phase of the work by all forums. Key results of the Exploratory Phase of DELTA could serve as an input during the first six months of the programme.

5. The methodology

All projects in the programme should be involved in these awareness actions. It then includes the pilot projects working in Part III, the projects involved in technology development in Part II and the projects involved in the evaluation and assessment task.

As this task is partly building on other projects work, the methodology for involving them should be stated. There should be an overall planning for discussions within each forum. The final arrangements will be decided with the Commission representatives.

The meetings of each forum will be organised in relation with the Concertation meetings organised by the Commission.

Details should be given on the specific ways of working between the forums.

There may be testing of telecommunications networks support for conveying information exchanges.

European technical infrastructures for information and exchange could be used to support such networks. The availability of telecommunications networks could provide the opportunity for specific experimental work with the prospect of linking the existing human resources.

Reference to the existing networks or associations which operate in the field should be done, either to disseminate the results of the work, or to build the working infrastructures. Details should be given on the way such collaborations or participations will be ensured. The target audience should be specified and quantified.

Reference should also be made to the information dissemination channels to be used for disseminating in the different Member States the outputs of the work under this task. If national contact points are used, it should be stated the way those contact points may ensure further dissemination and awareness actions, through which information products.

Key results and milestones

Permanent working infrastructures.

Telecommunication networks supporting information dissemination and human networks.

Information products and strategic information dissemination.

Identification of strategies and agreement on them for setting up trans-European information and telecommunication technology based training services.

PART II - Series 200 Technology and systems development

II.0. Introduction

II.1 Rationale

The long term benefit of new information and communication technologies for training lies in the ability to create economies of scale for learning and thereby reduce the unit cost of training. Advanced Learning Technologies can provide for powerful systems for flexible and distance learning, improving the effectiveness and efficiency of the learning process by means of new learning approaches and thereby serving the continuously changing and increasing training needs.

However, in order to take full advantage of new information and telecommunication technologies and to accelerate uptake by the market, the harnessing of these technologies to learning needs and market requirements is critical.

II.2 Objectives

- The development of flexible systems allowing for:
  - > portability;
  - > interoperability and connectivity;
  - > multiple learning strategies;
  - > multiple media usage;
  - > adaptability and transferability to different needs and cultures;
  - > usability;
  - > cost-effectiveness.

The above will result in:

- The broadening of the user bases of courseware, by reaching portability of learning material between the major hardware and software platforms either currently in use or emerging.

- Improve the whole life cycle of professional design and production process by giving access to large data banks (multimedia) and analogue or digital libraries of raw material and half-products; allow cooperative development of courses.

- Improve learner acceptance by addressing the usability of flexible and distance learning systems in providing consistent and trans-

parent man-machine dialogue with local systems and remote services.

- Improve management acceptance by providing tools to select, tailor, control and measure the performance of the whole training process.

- Improve the uptake of remote education services for course delivery and distance teaching (tutoring and monitoring) by providing interactive added value services with existing telecommunication technology.

II.3 The tasks

These issues have been translated into 7 major interrelated tasks.

Common Training Architecture (task 210)

This task is directed towards a common platform for the development and the integration of information and communication technology for flexible and distance learning. The CTA task is central to all series 200 tasks and should provide common standards, formats and protocols in a manner that allows for future growth and extensions while allowing the training applications to exploit as much as possible the unique features of a specific system. This will require a constant dialogue with the other major tasks.

Design and production of learning material (task 220)

The development of a modular workbench integrating facilities, such as tools for knowledge elicitation, instructional design, support mechanisms for the different actors in the design and production process and multimedia (analogue as well as digital) editors, covering the full life cycle of the learning material design and production.

Multimedia integrated simulation system (task 221)

To develop a simulation sub-system integrated in a general purpose multimedia CAL system with a specific guidance system that will support exploratory learning.

Training information system (task 230)

To develop systems and services facilitating the accumulation maintenance and distribution of training material, ranging from source material to full scale learning applications, (eg. for information providers, publishers, corporate departments administering learning material resources, developers of new courses).

Training delivery systems and services (task 240)

To develop and provide an environment (in general network based in company- and institutional training centres), enabling flexible delivery of education and training. This environment should contain systems and tools on the management level (administration and organisation), trainer level (on-line tutoring and monitoring) and trainee level (learning support).

Learner and teacher support tools (task 250)

To develop and provide a suite of modular software (with a standardised "look and feel") on top of leading operating systems, serving the requirements for stand-alone flexible and distance learning (especially for the home and SMEs).

To develop and provide methods and facilities that support teachers accommodate to fast changing and increasingly complex training needs.

Advanced interactive communication systems for distance learning (task 260)

To develop functional specifications of a network architecture for Europe-wide distance learning and training telecommunication based services including development of concepts for organisational framework and integration of tools and facilities.

To develop and field test tools and facilities, recommend standards for Europe-wide distance learning and training services based on advanced telecommunication networks.

II.4 Scope of R&D

II.4.1 Approach

Incremental R&D encompassing a full cycle is required and it will have to ensure that the technology base for flexible and distance learning, and the thereby created learning opportunities, are based on valid and state-of-the-art pedagogical principles and a knowledge of the market status and trends.

II.4.2 R&D and target market sectors

The tasks as defined above, address a wide range of requirements and related systems functionalities, serving a European market for flexible and distance learning. However it is not likely that a common European approach facilitating all possible actors and potential learning strategies will evolve on short notice. Therefore each tasks is directed towards an identified area where systems development would accelerate market potential.

On the execution level of flexible and distance learning three likely scenarios, not necessary exclusive, for flexible and distance learning are envisaged, whereby the possibility to interconnect actors and exchange information and (resource) materials via (tele)communication is the key issue and sets the scope for R&D. The three scenarios are defined as:

Corporate (institutional) (re-)training - Task 240

Especially for corporate training there is a need for mechanisms to (re-)train large groups of learners, whereby cost-effectiveness, flexibility and effective management are key issues. Implementation of training centres or services providing flexible and distance learning based on dedicated training networks (LAN or potentially WAN based) would serve these requirements.

Local or stand-alone learning - Task 250

Distance- or home learning already has proven to be an effective mechanism for personal development and re-training of personnel. However there is a identified need to support and stimulate this market by providing:

- (low cost) mechanisms to interconnect individual learners (using PC based environments for learning) via PC and existing (and emerging) tele-services;

- harmonise different (low-end and stand-alone) target configurations (through CTA) in order create a cost-effective market volume for providers of training services and materials.

Cross-organisational and trans-national learning - Task 260

Relating to those markets needs, whereby organisations (like Open Universities or branch organisations) or large industries have to provide training to large groups of learners, or to high level specialist physically distributed over a wide area. Within such an scenario identified R&D requirements relate to the integration of (low cost) mass distribution mechanisms (such as DBS) with mechanisms for feedback and Eg. group learning.

By nature these scenarios (especially on longer terms) are related. Eg. local learning can become part of a trans-national scenarios, while corporate training can be further developed towards home learning.

Two additional areas for systems development, serving actors on the execution level are defined:

Learning material design and production - Task 220

In order to serve and even to accelerate a market for flexible and distance learning the cost-effective development of a wide range of learning applications should be facilitated.

Learning material publishing and distribution- Task 230

As far as the production of learning materials (in general) requires larger investment it is critical to provide for facilities and mechanism to create an off-the-shelf market for learning material and resource material (for production purposes).

The above identified areas represent the major elements of a European wide market for flexible and distance learning. Developments mustto interoperate and possibly be integrated. eg. a system developed under

task 230 should be able interoperate with a production workbench, while a stand-alone system as envisaged under task 250, could be linked to and even integrated into a training server (task 240).

The CTA task (210) should provide the common technology base that enables these different systems to exchange data (portability) and to communicate; and to prepare eventually interoperability and possibly integration.

The relationship between these tasks is clarified in figure 8 (see below).

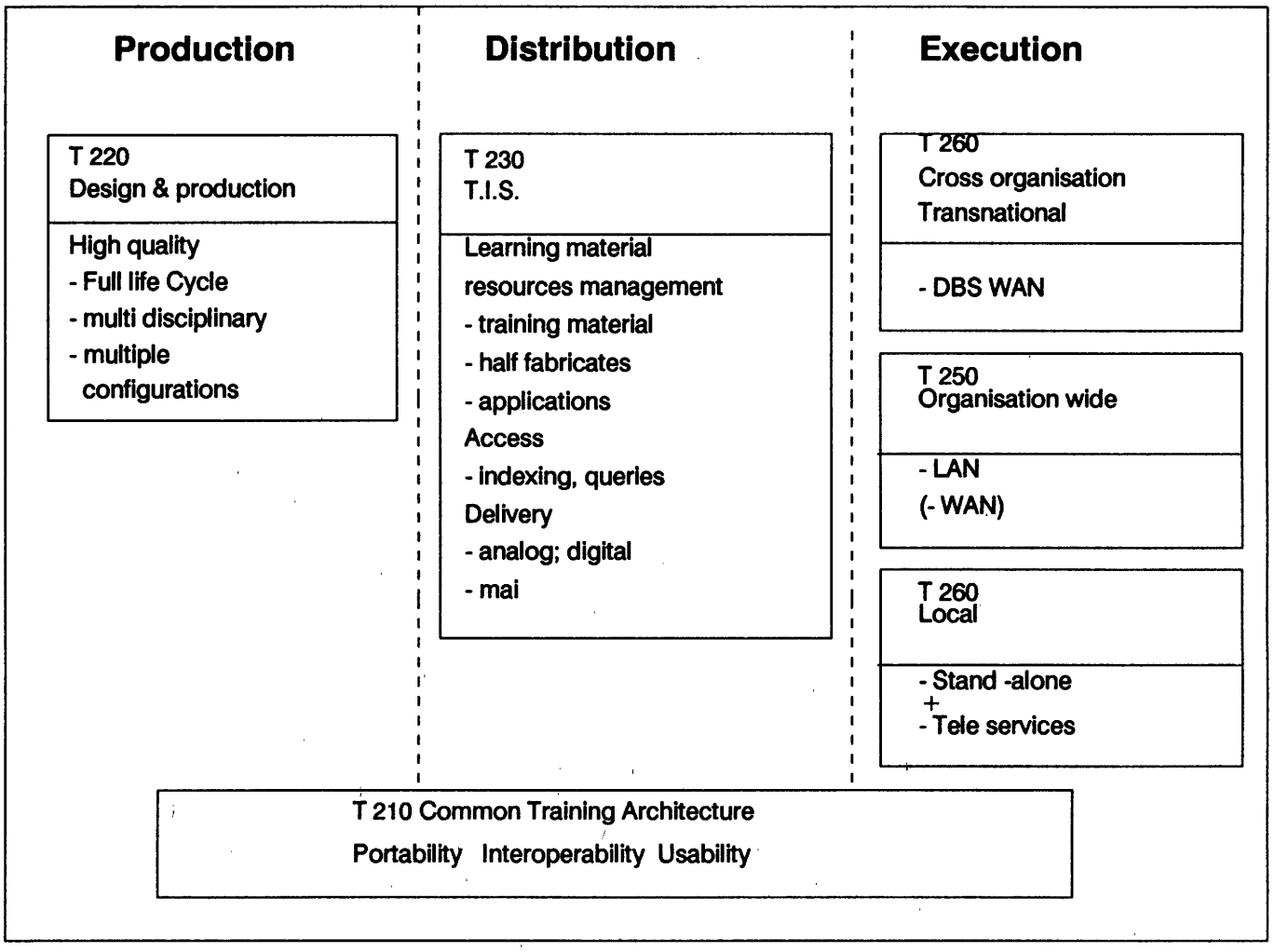

Production
Distribution
Execution
T 220
Design & production
High quality
- Full life Cycle
- multi disciplinary
- multiple
configurations
T 230
T.I.S.
Learning material
resources management
- training material
- half fabricates
- applications
Access
- indexing, queries
Delivery
- analog; digital
- mai
T 260
Cross organisation
Transnational
- DBS WAN
T 250
Organisation wide
- LAN
(- WAN)
T 260
Local
- Stand -alone
+
- Tele services
T 210 Common Training Architecture
Portability Interoperability Usability

Figure 8

II.4.3 Implementation of 200 Series R&D action

II.4.3.1. Incremental R&D

The Programme aims to build on existing technology and standards and therefore concentrates on the harnessing of technology to the learner needs.

Proposed work should be incremental in its kind, based on close to the market information and communication technology, and conform as much as possible to several developments in the IT&T sector and the educational field, such as:

- existing and 'up-and-coming' international standards (ISO, IEEE, CCITT, ETSI, CEPT) and de facto standards for communication and information technology
- outcomes of the DELTA Exploratory Phase;
- harnessing technical R&D to existing work in RACE and ESPRIT;
- providing input for and liaising with related Commission programmes, such as COMETT, IMPACT, LINGUA, Library Programmes and other initiatives in the field, especially projects as defined under the TASK Series 100 in this workplan.

II.4.3.2. Common R&D Approach

All projects addressing tasks as specified in the 200 Series of this workplan are obliged to implement a full R&D cycle.

Basic research background

Proposed technical work requires a solid research base. Not only state-of-the-art but close to the market technology will have to be addressed in an incremental way. Proposed work has also to be based on sound pedagogical principles and have a clear market strategy.

Technical work

The technical work is specified for each subsequent task (210 - 260). It should be recognised however, that the Programme as a whole aims

to implement an intercept strategy between advanced information and communication technology and a European market for flexible and distance learning. Technical work should therefore be aimed at the harnessing of existing and close to the market technology and directed towards exploitable products and services.

Pilot test and exploitation

All to be developed prototypes and methods will have to be pilot tested outside the laboratory environment. These pilot tests should validate technical deliverables (configurations, prototypes, methods and operational schemes) and provide three kinds of data:

- validation of pedagogical effectiveness, providing input for additional research;
- technical performance;
- market relevance and potential for exploitation.

II.4.4 Coordination of Action within the 200 series

It is of crucial importance that R&D action in this domain is complementary in kind and that different developments are harmonised and coordinated. In order to achieve this, the CTA-task (T210) has been defined. For this task no stand-alone proposal is envisaged, but all projects under the 200 series will contribute and collaborate in order to achieve the stated CTA objectives.

Coordination of action and contribution to the CTA will be organised in subsequent phases.

Phase 1

Each proposal will contain a section or workpackage defining work on the CTA-elements that are directly related to the proposed work. Moreover mechanisms for collaboration and concertation will be identified and planned. In addition the proposal will clearly identify the standards upon which the developments will be based.

Phase 2

Those projects that will be selected after the evaluation will, on short notice, define in concertation a workplan for the CTA. This workplan will not only address the development of a Common Training Architecture itself, but also further define for each project how proposed work will relate to the CTA. This workplan will be subject to negotiation with the Commission and a separate budget line will be available.

Phase 3

A CTA Task Force (composed mainly of representatives of the various consortia) will be installed. This Task Force will, in concertation with the relevant actors in the field, define a draft CTA. Furthermore it will be in charge of coordinating CTA developments.

Phase 4

A first prototype of the CTA will be developed and ongoing work under the 220 - 260 tasks will be tuned with the evolving CTA.

Phase 5

Integration of the different prototypes established with the CTA prototype. This integration will have to be pilot tested and specifications of the CTA will have to be made public.

Coordination of action not only relates to the CTA activities, but also involves collaborative development between tasks.

- The systems addressed under task 220 and 230 facilitate production and distribution of learning material and therefore are related to the tasks 240, 250 and 260 that address the execution of learning.

- Equally the tasks 240, 250 and 260 interrelate. The stand-alone environment (task 250) can become a target configuration for the system envisaged under task 240 or 260.

Through the CTA but also by means of exchanging workplans and prototypes harmonisation between developments has to be ensured and overlap has to be minimised.

II.5 Relations with other parts

The workplan is structured in three interrelated parts (I, II and III) that in combination serve an intercept strategy aiming to provide appropriate technological solutions for identified users and market requirements for flexible and distance learning.

Proposed work under Part II should take advantage of the interrelationship between these three Parts.

II.5.1 Coordination between Part I and Part II

The tasks as identified in Part I support R&D activities in identifying market requirements and informing the market of new developments and examples of good practice. Cooperation between Part I and II will have to be formalised and projects active under Part II will have to provide to the relevant Part I project(s):

- input on market rational and a report on the identified market requirements their work relates to;
- a report on executed pilot tests with developed prototypes and methodologies, assessing pedagogical, technological and organisational effectiveness;
- public information concerning objectives, status and deliverables on a regular basis. This would include a comprehensive summary of the proposal, a project brochure, a mid-term status report and descriptions of achieved results and prototypes.

II.5.2 Coordination between Part II and Part III

The pilot applications as defined in Part III offer excellent opportunities to investigate further and to assess the market potential and relevance of proposed work and (to be developed) prototypes. Coordination between Part II and III will be based on two mechanisms:

- concertation and exchange of information;

Complementary projects in Part II and III will exchange proposals, identify and report on commonalities and potential cooperation, and exchange progress reports on a regular basis.

- exchange and assessment of prototypes.

To be developed prototypes will have to be made available to complementary pilot application projects. In return these projects will apply and assess these prototypes and give input for improvement and further development.

Parts II and III's projects can be related and cooperate following two basic scenarios. Proposals can cover the two Parts and in parallel address R&D and pilot applications or independent projects (in Part II and III) can effectuate coordination and cooperation during the projects lifecycles.

Task 210: Common training architecture

Background

All previous attempts to develop a single workstation for educational use have failed so far. The actual education workstation is based essentially on "off the shelf" products and surveys show that this situation is not likely to change in the near future. As a consequence the education industry must prepare to produce training material running on a wide range of hardware and operating systems. The cost of porting training software from one environment to another represents a significant part of the initial cost. In addition the software producer needs to have skilled programmers in the different environments.

The need to interchange data and programs and to optimise the use of learning material developer (Eg. designers, programmers, film directors) skills, requires working standards and common protocols supporting the interactions with the user, the operating system, peripherals and with remote systems.

Directly related to this issue is the use of different communication systems for different applications on different sites. Technical standards and communication protocols will have to be harnessed to the learner needs and eventually an organisational conventions need to be established.

Objectives

Develop and provide an effective framework for building, managing, distributing, executing and maintaining training applications.

The CTA should enable learning applications to:

- be transferred easily across hardware and operating system platforms by adhering to high level procedures that can be executed on the target machine;
- be connected by adhering to methods for transferring information among a wide range of communication systems;
- interoperate intelligently by exchanging information and programs with other CTA compliant applications;
- offer a common look and feel to the learner by adhering to the rules of the "de facto" standard graphic user interfaces;

Technical approach

The CTA should be based both on a conceptual view of the industry needs in the foreseeable future and a pragmatic view composed of a suite of standards that should currently support the functional requirements.

Technical work should result in a software suite on top of leading operating systems, providing for portability, interoperability and eventually interworking between flexible and distance learning systems and applications.

The CTA development should address as priority the application execution environment (see tasks 240, 250 and 260). As such, the systems as defined under task 220 and 230, will not have to be based on the CTA, but will provide essential input for the CTA development and support applications adhering to the CTA.

The CTA architecture should be defined for different configurations, starting from the stand-alone workstation using text and graphics applications moving up to the full multimedia workstation connected to the ISDN network. For each CTA level the corresponding minimum hardware and software configuration should be defined and provisions should be made for the extension of these configurations.

Phased approach

In order to serve the market as soon as possible with a minimum CTA a phased approach is required. This approach would incrementally provide for portability (ensuring that various applications can run on different target configurations); interoperability (enabling systems and applications to interoperate and provide a consistent and transparent "look and feel"); and facilitating interworking (sharing of functionalities between systems and applications).

Next to collaborative work on the development of a Common Programming Interface, the CTA task should also provide for a concertation mechanism between projects. This should support the pre-normative process of defining common requirements and developing common functionalities at the training application level (for example monitoring of courseware usage, accreditation and billing, common data structures for units of learning material) and thereby stimulate interoperability and interworking between systems and applications.

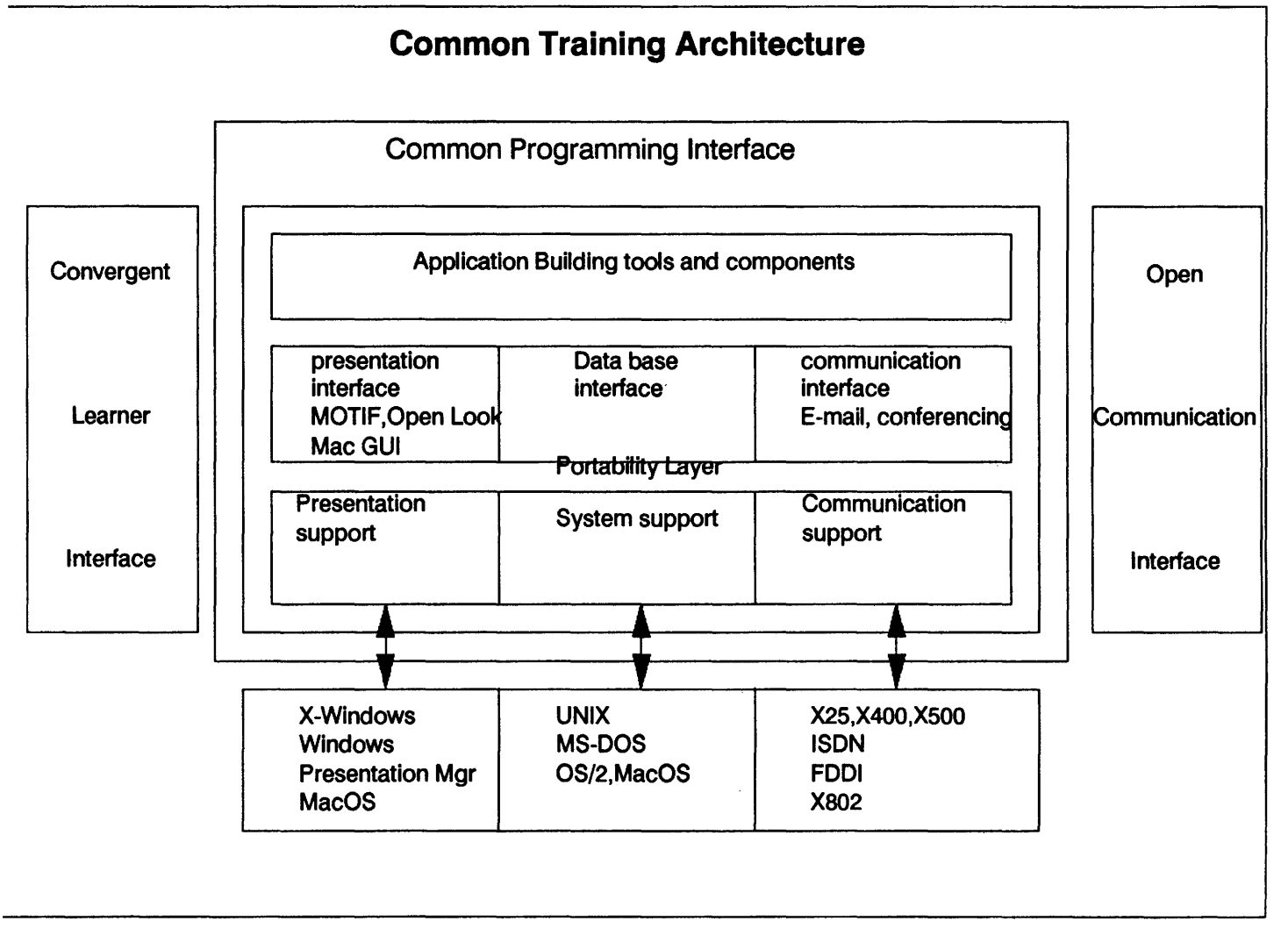

Common Training Architecture
Common Programming Interface
Convergent
Learner
Interface
Application Building tools and components
presentation interface
MOTIF,Open Look
Mac GUI
Data base interface
communication interface
E-mail, conferencing
Portability Layer
Presentation support
System support
Communication support
Open
Communication
Interface
X-Windows
Windows
Presentation Mgr
MacOS
UNIX
MS-DOS
OS/2,MacOS
X25,X400,X500
ISDN
FDDI
X802

Figure 9

Technical work should address the following areas:

1. Workplan definition and monitoring

Technical work will not be executed by an individual consortium, but will be implemented in concertation by all projects working for the 200 series tasks (see introduction).

A draft CTA has to be developed and a workplan has to be defined and negotiated, involving all consortia working under the 200 series. Due to the highly critical nature of the CTA task, specific project monitoring will be put in place by the Commission assisted by independent experts.

2. Selection of technical standards

Standards initiatives are wide-ranging and specific but are not necessarily integrated or driven from a conceptual view of integrated information systems. They are often a tactical response to a specific need; there are redundancies and sometimes incompatibilities between standards. In addition some standards do not define the application programming interfaces. To benefit from the standardisation effort it is of paramount importance to define a framework for the selection of the standards most appropriate to the needs of the training industry. This framework should represent the view of the different actors such as the developer, the publisher, the training department manager and the learner.

PETE (Portable Education Tools Environment) and some of the action line II, III and IV projects of the DELTA exploratory phase attempted to identify the issues in the fields of portability, interoperability and user interfaces. The Common Training Architecture is a concept for a series of incremental R&D projects to solve those issues for some strategic operating systems.

3. Definition and implementation of CTA

As defined above the CTA is likely to evolve incrementally, whereby each elaboration of CTA will combine three interface layers (see Figure 9).

The Common Programming Interface, CPI

The Common Programming Interface will specify how a programmer writes a new training application. It will consist of:

- a portability layer which will handle the low level protocols and system dependent services in a unified way;
- a set of application programming interface (APIs) supporting portability between operating systems:
  - > presentation interface;
  - > database of file management interface;
  - > communiction interface.
- a common set of tools facilitating the development of CTA based applications.

The Convergent Learner Interface, CLI

CLI addresses the needs of a consistent, transparent and easy to learn man-machine dialogue across applications and across systems. CLI should supply rules for designing the man-machine interface by using advanced techniques like windows, pull down menus, action bars etc, ie WIMPS.

CLI should establish clear design principles (for dialogue, screen design, I/O, user-support) and take into account existing 'de facto' standards like:

- Presentation manager (R)
- MS-Windows GUI (R)
- Mac Intosh GUI (R)
- MOTIF (R)
- Open Look (R)

The CLI architecture should determine the best approach, ie choosing one of the above for the CTA or providing a "portability layer" within the CPI to produce a "look and feel" consistent with the underlying GUI.

The following benefits are anticipated:

- better user interfaces;
- increased consistency;
- improved quality of software products;

- reduced development cost.

Open Communication Interface, OCI

The Open Communication Interface should specify a set of protocols for interconnecting between CTA sub-systems.

The goal of the OCI is to avoid exposing training applications to the details of OCI protocols and formats. The specifications should translate into a set of high level language interfaces or subroutines to be part of the CPI that, in turn, provide access to the selected protocols.

Furthermore the OCI should address the issue of interconnecting different communication links (cable, fibre optics, satellite) and define appropriate configurations for various distance teaching and training applications.

OCI should provide organisational conventions and define common working methods and communication protocols (on user level) for collaborative working of different users (learners, tutors, etc.) on different sites.

4. Documenting the architecture

The specification of the architecture and related tools should be made broadly available to encourage course developers and service providers to use it and possibly to contribute to its extension.

5. Developing a prototype for the selected operating system platforms

Technical work should not be limited to specifications as such, but result in prototypes of the CTA for different operating environments. Prototyping should initially concentrate on the Core CTA (portability) and incorporate additional functionalities resulting in an Abstract CTA (interoperability) and eventually an Application CTA (interworking).

As far as the technical work being executed by the consortia working on the tasks 220 to 260 is concerned, in order to be developed, prototypes should be pilot tested in accordance with the systems being developed under these individual tasks.

Key results and milestones

- Workplan for CTA development.
- Publication of draft specification of a Common Training Architecture.
- Development of the CPI layer.
- Development of the CLI layer.
- Development of the OCI layer.
- Distribute prototypes to other DELTA consortia.
- Report on pilot tests with implemented prototypes and the integration of dedicated systems and tools developed under the other 200 series tasks.
- Provide input to:
  - > Task 110: information on market rationale and market requirements being addressed;
  - > Task 120: report on pilot tests;
  - > Task 130: public information, such as project descriptions and progress reports;
  - > Related projects under Part III; exchange of proposals, progress reports and prototypes.

Task 220: Design and production of learning material

Background

Development of a European market for flexible and distance learning depends strongly on the availability of a wide range of portable and cost-effective high quality learning materials. Although currently many authoring languages, tools and systems are available for design and production, a series of shortcomings prevent the realisation of the required resources of learning material.

There is a need for tools and systems that cover the whole life cycle of learning material development for different target configurations. They must also support team work and cooperative working. These systems or tools should be flexible in terms of learning strategies and applied media, facilitate the (re)use of source material and the transfer to different languages and cultures.

Although dedicated authoring environments are still considered to be of relevance, there is a need to focus R&D in this area towards an open ended systems approach supporting the full development life cycle of (multiple media) learning material.

Such an approach should especially provide solutions for:

- collaborative working
- cost-effective development for a wide range of target configurations (portability)
- efficient re-use of educational source material
- consistency in man-machine interface in terms of "look and feel"
- the use of remote resources (data, images).

Objectives

To develop and provide systems and tools for the cost-effective production of high quality multimedia learning materials based on different instructional strategies for different target configurations.

Technical Approach

Within the development of a common framework or workbench for design and production, various software tools can be developed, integrated and exchanged so as to provide complete (in terms of full life cycle coverage, multiple learning strategy and multiple media capa-

bilities) environments for learning material engineering, as well as dedicated tools supporting various activities in the development process.

Technical work should be incremental in its kind, based on existing and up-and-coming standards and accommodate to the common R&D approach (see introduction). Special effort should be devoted to the development of CTA components and appropriate validation (by pilot testing) of achieved methods and results.

Proposed work should cover three main areas:

- development of a general methodology;
- specification and prototyping of a design and production workbench architecture based on a common methodology for learning material engineering;
- specification and prototyping of dedicated tools facilitating the different activities in the development life cycle.

Technical work should be accommodated to the common R&D approach (see introduction). Special effort should be given to the development of CTA components and appropriate validation of achieved methods and results.

General methodology

In order to allow cooperative development of course material, it is mandatory to share a general methodology covering the whole life cycle. This would not only include design and production of learning material, but also relate to requirements analyses, selection of appropriate learning strategies and media mixtures (Eg. combining classroom teaching, with video and computer based training). It should be implemented as a set of tools within the common workbench architecture, or at least the output of different tools should be shared by means of the common workbench architecture.

This methodology should not only relate to course development in terms of computer based material, but also relate to traditional material (books, video, slides) and a mixture of traditional and advanced learning material.

This methodology should be based on state of the art knowledge on the development process and on how learning occurs using ALT. Moreover validation (via pilot testing) of resulting methods and proto-

types will have to provide input for pedagogical research on instructional design, especially related to new instructional strategies that are facilitated by the use of ALT such as simulation, exploratory learning and group learning.

The evaluation system is a key issue in flexible and distance learning systems. It has to be addressed at an early phase in the design and development process and must be an integral part of the general methodology. This task has to take into account several factors of learning characteristics, new forms of assessment, assessment guidelines and tools. The objectives are threefold: provide feedback to the developers by measuring the didactic efficiency, provide feedback to the management through reporting in terms of learning achievements and to provide the basis for certification.

Common workbench architecture

Learning material development is regarded as a software (including audio-visual media) engineering process, based on the systematic transfer of information (data) from domain knowledge or experience towards an end product (learning material).

The technical implementation will have to accommodate some minimum requirements.

- Tool integration
  - > A workbench is merely a collection of different tools covering as much as possible the full life cycle of learning material engineering. However specific measures are needed to facilitate the integration and interoperability of existing and new tools, ranging from general purpose editors (idea-processors, word-processors, graphical editors, etc) to dedicated learning material engineering tools (see below).
  - > Integration however should not result in an integrated authoring environment supporting mainly one person in developing learning materials. It should be recognised that different experts (content matter expert, educational designer, design or layout expert, etc.) work together and have different requirements. For example, the full integration all possible editors (dialogue, text, graphics, animation, video, etc) will in many cases hamper different actors or experts working on the same material.
- Collaborative working
  - > The workbench will have to provide mechanisms to facilitate cooperative working. Therefore technical implementation will have to be oriented at a networked environment with a consistent "look and feel" for the different actors in the development process and facilities for (distributed) resource sharing,

dialogue management between groups of actors (collection of comments, version control, voting processes) and communications facilities (ISDN) for on-line access and or down-loading (on-line via ISDN and off-line via DBS) of remote resources (both analogue or digital stored). It should be taken into account that in practice not all actors work in the same (technology) environment. For example, a content matter expert is, in many cases, a computer illiterate, lacking computer facilities, but still contributing during the whole life cycle of learning material development.

- A wide range of target configurations

  > As far as no standard configuration for learning is likely to appear on the market, the workbench should cater for different target configurations. Possible solution would be to provide and use a common programming interface (See Task 210: CPI), which would allow applications to be developed independently from the underlying system as long as this common programming interface has been implemented on the target system and a minimum configuration is available.

Experience in software engineering shows that there is a trend towards open systems approaches, allowing for tool integration. This is based on a concept of common neutral (data) files and a database management system (DBMS). This approach will allow tools to interoperate in terms of input/output. Experiences in the DELTA Exploratory Phase show that this approach is also valid for learning material engineering as a specific instance of software engineering.

The design and production workbench as such integrates tools and handles the exchange of data or files between tools. A possible technical approach could be based on a object oriented data base management system (OODBMS), with distributed features. This OODBMS will capture, organise and provide data as generated during the development life cycle and make this data available to different tools to be used by different actors in the process.

Dedicated tools

In general the development process of learning material can be divided into phases involving different actors and activities. Dedicated tools or tool sets to improve productivity and quality for each phase are envisaged and to be incorporated in a framework or workbench as specified above. Special emphasis should be given to tools for more advanced learning applications, such as simulation (See Task 221), exploratory learning and group learning.

- Subject matter analysis and user analysis.

> Tools should facilitate requirements analysis, knowledge acquisition and elicitation, knowledge representation and user modelling. Especially the knowledge representation tools should allow for easy restructuring information in relation to different learning strategies. In this area tools possibly are not integrated as such in a common workbench, but the output of these tools should at least be portable to the workbench and shared with implemented tools.

- Design and specification.

  > Tools should support activities related to this phase:

  - instructional design (instructional mapping of objectives, sequencing and modelling, instructional strategy definition and media selection);
  - functional specification (flow definition, data and content definition, lay-out, man machine interface, dialogue, support, prototyping);
  - technical specification of software (data structures, protocols), audio-visual media (scenarios, scripts, shooting lists, editing manuals) and related material (such as documentation).

- Production.

  > Tools for software production as well as the production of audio-visual media and documentation. Special attention should be given to tools for:

  - intelligent support and Intelligent Tutoring Systems (ITS);
  - selection, down-loading and (re)use of source material (analogue and digital);
  - design for multiple language use;
  - portability or conversion to different target configurations.

- Implementation and maintenance.

  > Tools will relate to automatic documentation generation, reproduction and installation, updating and version control.

- Quality control and testing.

  > The engineering of learning material is in general a complex process, needing constant testing and prototyping (from an instructional as well as a technical point of view) in order to achieve the required end result. The tools to be developed should basically relate to all phases in the development lifecycle.

  > Identified areas are:

- tools assisting different actors, such as guide-lines or supportive expert systems for instructional design, man-machine interface, lay-out and specification;
- facilities for rapid prototyping in each phase of the development lifecycle. This prototyping should support different aspects (possibly even different actors) such as dialogue, instructional strategy, man-machine interface, layout, etc;
- facilities for printing and documenting the evolving design or application during the different phases, in order to allow effective dialogue between different actors;
- management tools for planning, resource allocation, cost and quality control;

Key results and Milestones

- Documentation for general methodology and the envisaged related support tools.
- Revised workplan based on the draft CTA (defined in concertation with other 200 Series project), specifying R&D activities related directly to the CTA development and specifying how proposed work (for task 220) will relate to the CTA.
- Specification, prototyping and pilot testing of a workbench capable of integrating a range of existing or to be developed tools for learning material engineering.
- Specification, prototyping and pilot testing of various tools covering the full life cycle of learning materials design and production.
- A demonstration facility based on the integration of a wide range of tools box in a workbench.
- Report on pilot tests with implemented prototypes. Pilot tests should give emphasis to
  - > full life cycle coverage;
  - > multimedia design and production;
  - > the design for more advanced learning applications;
  - > collaborative working;
  - > tool integration.
- Provide input to:
  - > Task 110: information on market rationale and market requirements being addressed;

> Task 120: report on pilot tests;

> Task 130: public information, such as project descriptions and progress reports;

> Related projects under Part III; exchange of proposals, progress reports and prototypes.

Task 221 : Multimedia integrated simulation system for learning

Background

Dynamic systems (electrical and mechanical networks, biological or economical systems etc) are playing an ever increasing role in science and technology. It is well accepted that only real life experiments will provide the learner with an in-depth understanding and therefore the possibility to predict the behaviour of such a system. This pedagogic approach is always expensive, sometimes impossible, sometimes dangerous. Simulation of a computerized model of the system is heralded as the only right approach to cope with the complexity of dynamic systems.

By interacting with the model, deep understanding and intuitive insight may be easily gained if the learner is "intelligently" guided. In addition when it comes to understanding, reasoning and learning to control and manage such a system, simulated experiments are even better than real experiments.

It is expected that the integration of advanced simulation tools in a multimedia CAL environment will provide the most efficient tool to teach conceptual knowledge and advanced skills to cope with the ever increasing complexity of the technical environment.

This approach will offer to the education community a qualitative jump in cost-effectiveness since the versatile intelligent workstation will replace expensive and rapidly outdated industrial equipment. To reach this goal, it will be needed to integrated outcomes of different research activities like Intelligent Tutoring Systems, semi-guided navigation in a multimedia system, Knowledge based CAL systems.

Objectives

Specify, develop and test a comprehensive simulation sub-system stand-alone or integrated in a multimedia CAL facility. It should be directed toward the needs of vocational and university level education in the field of dynamic systems learning and related advanced skills development.

Technical approach

Technical work should be incremental in its kind, based on existing and up-coming standards and accommodate to the common R&D approach (see introduction). Special effort should be given to the devel-

opment of CTA components and appropriate validation (by pilot testing) of achieved methods and results.

It is necessary to integrate simulation system into future multimedia based CAL systems. However the interactions with microworlds are so peculiar that simulation is best seen as a totally new interactive medium with its own capabilities, requirements and limitations. In addition the simulation facility must satisfy the specific requirements of its three potential users : the learner, the teacher or the lesson designer and a new actor, the modeller.

Student's requirements.

The students requirement can be split into 4 categories:

1. The design of experiments.

In addition to running predefined experiments with specific objectives like simple runs, worst case analysis, sensitivity analysis, parametric studies, optimisation.... the student must be able to specify its own experiment. Ideally this should be done with a graphics language.

2. The presentation of results.

To understand complex systems, a wide range of graphic tools are needed: plots in different formats, graphical animation controlled by the simulation and a way to store and recall information generated by other experiments.

3. The guidance system.

The number of simulated experiments on even a simple model is infinite, it is therefore impossible to foresee all situations and provide explanations. An expert system with a qualitative knowledge of the model should monitor the simulation and, at suitable times interact with the student, provide qualitative guidance and explanations of the current system's behaviour. In addition to this directive support (guidance), some learner tools should be provided like scratch-pads to keep track of the goals, noting hypotheses etc.

4. The model

Modelling is a very complex activity usually undertaken by a specialist. However an advanced student should be able to modify or even build a model and test it. This activity should be very beneficial from the pedagogic viewpoint. Simple model construction and modification must

be possible using well designed graphic editors, more complex model could even be specified using simpler models as building blocks.

Teacher's requirements.

1. On monitoring and tracking

The simulation system can only be one element of a complete course. A teacher or tutor requires facilities to monitor or even assess learner performance. Furthermore, if the simulation should become part of a more comprehensive learning environment, mechanisms are envisaged for integration and exchange of data on learner performance with complementary applications, such as an intelligent tutoring sub-system.

2. Experiment design

Equally as the learner could set-up specific instances of a simulation (see above), a teacher could prepare a simulation for specific learners or learning objectives. Facilities should support activities, such as setting parameters, preparing cases, or pre-defining traces.

Modeller's requirements.

1. The class of models and modelling facility.

A wide scope of models and modelling techniques could be used effectively in training. In fact most of the real life situations require more than one technique. It is suggested to concentrate the R&D effort on continuous systems coupled with limited stochastic and discrete-event facilities. Some research activities should also be devoted to ill-defined processes i.e. processes that cannot be described by equations or algorithms but by knowledge base representations.

2. The experiment design system.

A graphical language specifying simulation experiments must be designed in order to integrate the description of the measurements, the control and the presentation interface. Facilities should also be provided to include external equipments

3. The simulation facility.

Simulation can be very time consuming and, to be educationally acceptable it is mandatory that the results are presented interactively. Many

numerical methods should be available to the modeller so he will be able to make a trade-off between accuracy and speed, depending on the complexity of the model and of the target machine.

Pedagogical research.

The effectiveness of the simulation approach should also be measured and validated using the pilot experiments.

Key results and milestones.

- Revised workplan to define cooperation with at least one consortium in charge of task 220.
- Specifications, prototype and field test results of:
  - > graphical language to set up and run complex experiments;
  - > storage and presentation system integrating the various run of a simulated experiment's results;
  - > interactive expert system for explaining simulation in a qualitative language from an on-line monitoring of the simulation;
  - > teacher defined coupling to the intelligent tutoring and to the evaluation module of the parent system;
  - > domaine independent graphical modelling system for event directed and continuous systems with automatic code generation;
  - > systems to build knowledge based models of ill defined system integrated with classical models;
  - > simulation package with an extensive library of numerical methods.
- Report on pilot tests with implemented prototypes. including but not limited to the pedagogical experiment.
- Provide input to:
  - > Task 110: information on market rationale and market requirements being addressed;
  - > Task 120: report on pilot tests;
  - > Task 130: public information, such as project descriptions and progress reports;
  - > Related projects under Part III; exchange of proposals, progress reports and prototypes.

Task 230: Training information system

Background

Flexible and distance learning depends on the extensive exchange of various kinds of information, ranging from managerial information, to learning material and general purpose information. Simple and effective access to available information is critical for the development, delivery and usage of flexible and distance learning materials.

Typically for a European market for flexible and distance learning this information will be distributed over different locations and will have all possible media characteristics.

Developments in IT&T, especially ISDN (and future IBC), optical storage devices (Eg. CD-ROM, CD-I, smart card) and Data Base Management Systems, will allow for the exploitation and use of distributed and remote multiple media educational resources.

The use of these resources both for learning as such and for the production of learning materials is envisaged and requires added value services facilitating the easy maintenance, access, delivery and usage of educational source material.

Developments in this area are especially relevant for publishers or departments in industry and training institutes, who are in charge of collating, maintaining and distributing (Eg. by telepublishing) source material to a wide range of users.

Objectives

To develop and provide services (publishers, information 'brokers', learning material distributors) facilitating the accumulation, maintenance, distribution and usage of large resources of available (or to become available) learning material.

Technical Approach

Technical work should be incremental in its kind, based on existing and up-and-coming standards and accommodate to the common R&D approach(see introduction). Special effort should be given to the development of CTA components and appropriate validation (by pilot testing) of achieved methods and results.

Technical work should result in a Training Information System for the accumulation, maintenance and distribution of educational resource material, such as databanks, libraries of course material and information banks.

Core activity under this task will be the development of an educational resource service. This service would provide for a data base management system for learning material, incorporating facilities for access and distribution on a European scale.

Access and delivery can be established on-line (via different communication links) as well as by means of the distribution via mass storage devices (such as CD-ROM). These approaches are both considered relevant. However proposed work should be aimed at an environment supporting and eventually integrating both approaches.

Distribution via DBS is regarded as a separate issue and is addressed under task 260.

Specific educational requirements related to the envisaged services are identified, such as:

- storage and indexing of units of resource materials facilitating (re)use for educational purposes (i.e. learning and producing);
- the ability to handle different combinations of communication links available (mail, telephone cable, optical fibre, television cable and satellite);
- the provision of an user-friendly intelligent intermediate or generic front-end to a wide range of telecommunication services;
- the incorporation of multiple language query facilities;
- the transfer or adaptation of material to different language versions;
- facilities for the transfer and storage of multiple media data on different formats and storage devices;
- the availability of user support facilities for resource identification, access, query, evaluation and usage;
- management facilities for administration, billing, data- and privacy protection;
- a meta resource base, including references to sources of educational materials.

To be developed methods and prototypes will have to be based on an open ended architecture in order to facilitate incorporation of different dedicated tools available or under development.

Validation (via pilot testing) of results will have to provide input for pedagogical research on the use of large (multimedia) educational resources by learners as well as designers or producers. Special attention should be given to on-line navigation.

Key results and Milestones

- Revised workplan based on the draft CTA (defined in concertation with other 200 Series project), specifying R&D activities related directly to the CTA development and specifying how proposed work (for task 230) will relate to the CTA.

- Specification, prototyping and pilot testing of a multiple media data services based both on a networked environment as (stand-alone) databases on mass storage devices.

- Specification, prototyping and pilot testing of dedicated tools facilitating on line access and usage of educational source material.

- Report on pilot tests with to be developed prototypes. Pilot tests should give special emphasis to:

  > on-line access;

  > navigation in large databases;

- Provide input to:

  > Task 110: information on market rationale and market requirements being addressed;

  > Task 120: report on pilot tests;

  > Task 130: public information, such as project descriptions and progress reports;

  > Related projects under Part III; exchange of proposals, progress reports and prototypes.

Task 240: Training delivery systems and services

Background

Experiences with more comprehensive flexible and distance learning applications, involving multiple learners show the need for centralised facilities to take care of the learning process, the communication between actors and the management of such learning environments.

Networked environments for learning are being applied more and more particularly for in-company and institutional training. Learners have to be allocated to specific courses, learning material will have to be delivered, results will have to be assessed and made available centrally.

Such an environment moreover requires mechanisms for supporting learners during the learning process, to allow for human tutoring, to support management and to facilitate communication with the outside world.

Objectives

To develop and provide systems and facilities enabling organisations (industry and training institutes) in setting up network based training centres in order to accommodate effectively to constant changing and increasing training and retraining needs by means of flexible and distance learning.

Technical Approach

The development of an environment for in company- and institutional training centres, facilitating flexible delivery of education and training. This environment should support organisations on the management level, trainer level (on-line tutoring and monitoring) and trainee level (learning support).

Technical work should be incremental in its kind, based on existing and up-and-coming standards and accommodate to the common R&D approach(see introduction). Special effort should be given to the development of CTA components and appropriate validation (by pilot testing) of achieved methods and results.

Proposed technical work will have to address two main areas:

- specification, prototyping and pilot testing of a training server;
- specification, prototyping and pilot testing of dedicated tools for learning support, on line tutoring and monitoring and management to be integrated with a training server.

Training server

A training server should provide a minimum set of functionalities to facilitate and to manage the different communication and information exchange processes that can be identified in an integrated training environment. Identified processes are:

- resource allocation, delivery and management;
  - > learners have to be allocated to learning materials and eventually tutors (via LAN, ISDN and possibly DBS). This involves identification, authorisation, course selection, course delivery, communication, learner assessment, certification, resource management, possibly billing.
  - > learning material will have to be stored, maintained and managed (centrally or distributed).
- dialogue management;
  - > Different actors have to able to communicate to each other via different communication links. The dialogue management related to this communication involves messaging, group decision support and priority ruling, conferencing and on-line collaboration.
- communication;
  - > A server has to take care of the internal and external communication and information exchange processes. The system should incorporate facilities for on-line access of remote hosts, connection of different terminals and local configuration, transfer and conversion of information to different target configurations. Furthermore standardised protocols and man-machine interface are required to facilitate use of the environment by the different actors.

A server as envisaged will have to be open ended in its kind and facilitate the incorporation of dedicated tools. The work should also address the Open Communication Interface (OCI) as specified under Task 210 (Common Training Architecture).

Dedicated tools

In relation to the training server a variety of tools can be envisaged supporting different actors and activities. These tools can have relevance in their own, but proposed work should be directed to integrating tools in a more generic framework. Identified areas for development are:

- learner support tools;
  - > In an integrated training environment two types of tools are envisaged:
    - tools supporting a learner in using effectively the available hardware.
    - tools facilitating the learning process itself (intelligent help and guidance, navigation support, dynamic task sharing). This should use identifiable advances in Artificial Intelligence and ITS.
- tools for off-line and on-line tutoring;
  - > For tutoring facilities are required for monitoring multiple learners, screen-sharing, group decision and priority rulings, facilities for easy production of material by non-experts. Special attention should be given to distributed classroom applications via computer conferencing and video conferencing.
- tools for transfer, adaptation and maintenance of learning materials;
  - > A training server can amongst others serve as an intermediate between local or remote learning materials. There is a need envisaged for tools to facilitate transfer/conversion, adaptation and delivery of material to target learner configurations.
- facilities for learner assessment;
  - > Assessment techniques and tools have to be addressed for both product evaluation and process assessment. Further issues to be addressed are test construction and item banking.
- specific tools for management and administration.
  - > Distance and flexible learning requires special methodologies and tools for efficient management and administration. Issues are resources management, enlisting and accreditation, certification and cost analysis.

Although there is extensive experience with stand alone flexible learning applications and distance education via television and correspondence courses, limited knowledge is available on integrated training environments where multiple learners, tutors and other actors make substantial use of learning related services.

Proposed technical work should therefore not only be based on state-of-the-art principles (pedagogical, technical and organisational), but also provide additional input (via pilot testing of to be developed methods and prototypes) for research on:

- new learning, and didactic strategies, especially for exploratory, and collaborative learning;

- the design of man-machine interaction for integrated training environments;

- methods and tools for on line communication between various actors;

- requirements, methodologies and tools for monitoring, assessment and management in integrated training environments.

Key results and Milestones

- Revised workplan based on the draft CTA (defined in concertation with other 200 Series project), specifying R&D activities related directly to the CTA development and specifying how proposed work (for task 240) will relate to the CTA.

- Specification, prototyping and pilot testing of a training server in a networked environment.

- Specification, prototyping and pilot testing of dedicated tools facilitating the delivery of learning material and the collaboration between different actors (learners, tutors, managers).

- Report on pilot tests of to be developed methods and prototypes. These pilot tests will have to put emphasis, from a pedagogical, a technical as well as an organisational point of view, on:
  - > collabortive working or group learning;
  - > tutoring and monitoring;
  - > effective organisation and management.

- Provide input to:
  - > Task 110: information on market rationale and market requirements being addressed;
  - > Task 120: report on pilot tests;
  - > Task 130: public information, such as project descriptions and progress reports;
  - > Related projects under Part III; exchange of proposals, progress reports and prototypes.

Task 250 : Learner and teacher support tools

Background

One of the major critical success factor for the uptake by the learner and specially by the isolated learner at home or in the SMEs is related to the ease of use; it is of paramount importance that he/she can set up easily and quickly a full, consistent, user friendly integrated training environment allowing him to identify, access download and run a course, use training services and possibly local tools to manage his/her own training process

It is also essential that learners as much as possible concentrate on the learning process, without being distressed by operational activities.

State-of-the-art operating systems, general purpose facilities and applications already show a trend towards userfriendliness, consistency and transparency.

Nevertheless there is still a need for improvement, especially in those situations where users work extensively with different applications and media and eventually make use of remote services.

Although this task is related to the need to stimulate a market for stand-alone learning (eg. at home or in SMEs), corporate and institutional training will also largely benefit from the outcomes of this task.

The requirements for teachers and tutors supporting distance learners are to large extent similar and will also be addressed by this task.

Objectives

To develop a learning environment which will allow the learner to manage his/her training. This will encompass easy and consistent access to various remote resources and services and a set of local support tools, a similar environment and tools should also be developed for teacher and tutor use.

Technical Approach

Technical work should be incremental in its kind, based on existing and up-and-coming standards and accommodate to the common R&D approach(see introduction). Special effort should be given to the development of CTA components and appropriate validation (by pilot testing) of achieved methods and results.

Technical work to be proposed have to address two main areas:

Learner Support Tools

The development of a software layer that facilitates systems usage from a learning point of view, supports portability and communication with remote learning services.

Proposed work should result in a CTA based learner desktop or workbench and related dedicated learner tools on top of four leading operating systems (MS-dos, OS/2, MacOS and UNIX). This desktop and related tools should harness the operating environment to specific learning requirements in terms of:

- Man-Machine Interface;
  - > Building on top of state-of-the-art GUIs (Graphical User Interface) a dedicated user interface for learners has to be developed. Such an interface will create a syndergy between different learning environments and should facilitate ease of use for different kinds of learners. Technical work has to be closely related to the work as specified under Task 210: Common Training Architecture.
- Access and usage of learning materials;
  - > Facilities for local, personalised information resource management. Technical work should take into account the future availability of remote resources of learning material and provide for support tools assisting in identification, connecting and navigation on-line resources.
- Communications;
  - > The support tools will have to provide a transparent and easy to use front-end to various kinds of telecommunication services, such as messaging, conferencing and E-mail.
- Dedicated learning facilities.
  - > Learning is rarely limited to the dialogue as established within a learning applications itself. The learning process can be optimised if the learner has dedicated facilities for information processing and planning. A wide range of facilities can be envisaged, such as an interactive notepad, agenda, reference guide, dictionary, encyclopedia, etc.

Teacher Support Tools

In this area little research and development has been achieved so far. Identified areas for further research and development are:

- course preparation;

- multimedia presentation or demonstration facilities;
- tools for diagnoses and testing.

Key results and Milestones

- Revised workplan based on the draft CTA (defined in concertation with other 200 Series project), specifying R&D activities related directly to the CTA development and specifying how proposed work (for task 250) will relate to the CTA.
- Specification, prototyping and pilot testing of a CTA based learner desktop or workbench and related dedicated learning tools for different leading operating systems.
- Specification, prototyping and pilot testing of teacher support tools for classroom environments.
- Report on pilot tests with to be developed prototypes.
- Provide input to:
  - > Task 110: information on market rationale and market requirements being addressed;
  - > Task 120: report on pilot tests;
  - > Task 130: public information, such as project descriptions and progress reports;
  - > Related projects under Part III; exchange of proposals, progress reports and prototypes.

Task 260 : Advanced interactive communication systems for distance learnings

Background

Experiments and studies in distance learning and training have identified the requirements of the different user groups (managers, designers, producers, teachers and learners) in terms of communication equipment, tools and services. Extensive experiments have been carried out with different tools and media for one or two way communication, such as broadcast radio and TV, audio-conferencing, teletext, telewriting, video-conferencing, e-mail and computer conferencing. A limited number of experiments have integrated more media for different learning purposes, like broadcast transmission for delivery and feedback links via mail, telephone, teletext or e-mail systems.

Some specific tools have been developed to harness telecommunication facilities to learning purposes. These have addressed specific requirements, eg encryption, telewriting devices, computer conferencing etc.

The experiments so far have for the most part been limited to one country, although lately some services have been established for European-wide transmission of learning material by satellites. These experiments, albeit mainly in isolation, have established a solid knowledge base of the possible application in the learning situation of the different communication tools.

No attempt has been made yet to specify the network concepts, the configurations of the network infrastructures and tools and facilities needed to provide trans-European distance learning and training services which fully meet the users' requirements.

Development of network concepts are needed for bringing the tools together to constitute a rich learning and training environment that can serve as a backbone for providing telematic infrastructures for European-wide distance learning and training. The concepts need to be field tested to establish knowledge of the problems involved in connecting different tools and communication facilities and to identify the most suited configurations, standards and protocols for distance learning and training in a European context.

The technological backbone of distance learning and training infrastructures will be the telecommunications networks (ISDN and, in future, IBC) and the European DBS satellites, that are now becoming available.

Objectives

To develop functional specifications and the network architecture required for the integration and management of European-wide distance training and learning networks for different user groups and learning purposes.

To develop implementation concepts for integration of communication tools and facilities for distance training and learning.

To develop tools and facilities that will enable the integration of Advanced Communication Services for learning material distribution, remote tutoring, distributed design and production.

To develop or adapt existing communication tools or techniques to serve specific communication needs in distance learning and training networks.

Technical approach

Technical work should be incremental, based on existing and up-and-coming standards and it should follow the common R&D approach (see introduction). Special effort should be given to development of the communication components of the CTA and appropriate validation of results by field testing.

The core activity will relate to the development of functional specifications for a network architecture for distance learning and training services. Areas to address are:

- Identification of appropriate technical configurations and standards for interactive communication services for down- and up-loading of information such as, graphic material, CBT-programmmes, printed learning material, compressed audio and video;

- Identification of appropriate technical configurations and standards for multilingual broadcasting such as, switching between sound-tracks in different languages, subtitling in different languages, integration of videotext in the application;

- Identification of appropriate technical configurations and standards for on-line communication between various actors such as, telewriting, teletext, e-mail, audio-, video- and computer conferencing, screen-sharing, HDTV;

- Development or harnessing of methods and tools for;

> distribution (transparent or with encryption) and access to remote educational resource material (such as electronic- and video, audio libraries)

> remote tutoring via multiple feedback links (connecting a tutor with various learners at different sites at the same time)

> distributed design and authoring

> administration, operation and management of distance learning networks;

- Field testing of the methods and tools developed providing input on:

> pedagogic principles and instructional strategies for distributed classroom applications

> effectiveness in handling multiple feedback links in combination with tutoring

> cost effectiveness of configurations and communication links

> technical and operational issues with regards to distribution resource material and on-line communication facilities.

Key results and milestones

- Input to the CTA task especially with regards to the Open Communication Interface (as to be defined in concertation with other 200 Series project).

- Specification of R&D activities related directly to the CTA development and how proposed work (for task 260) will relate to the CTA.

- Recommendations for international standards in telecommunication networks adapted to learning needs. Services to be addressed are:

> broadcasting;

> interactive cable services;

> electronic mail;

> conferencing;

- Specification, prototyping and field testing of tools for the distribution and access of remote educational resource material

- Specification, prototyping and field testing of tools facilitating remote tutoring

- Reports on field tests

- Provide input to:
  - > Task 110: on market rationale and forecast and user requirements with a view to implementation scenario for integrated distance learning services using telecommunication networks;
  - > Task 120: report on field tests;
  - > Task 130: public information, such as project descriptions and progress reports;
  - > Related projects under Part III: exchange of proposals, progress reports and prototypes.

PART III - Series 300 Pilot testing and validation.

III.0. Introduction

III.1. Rationale

The DELTA Exploratory Action focussed on incremental R & D of basic learning technology. The outcome of the Exploratory Action will be a set of feasibility studies, specifications and prototypes for a range of learning technologies and a few pilot applications. However, as yet, there have been few experiments on a sufficient scale, time frame or with the breadth of view to integrate the technologies and to field test the users' reaction to integrated technology based learning systems.

To validate the users' reaction to learning technology and to assist the uptake by the market, a range of pilot testing experiments needs to be carried out on a European scale in three fields:

- systems for course development and production
- systems for course delivery, tutoring and monitoring
- systems for remote access to learning resources.

The aim of these pilot experiments is to test and validate ITT&B based experimental services for European flexible and distance learning. The pilot projects aim to validate, within a coherent evaluation framework (as described in task 120), the technological approach of the projects, the logistic and managerial implications of the approach, the applicability of the didactic approaches and technologies chosen, the cost factors involved and the uptake of the services by the market.

Pilot experiments should be established in each of the three fields on one or more networks, or interconnected networks. Proposals could cover one or more of the above mentioned fields.

The pilot projects should build on the didactic traditions of Europe, for example by using learning material and strategies developed under the COMETT, EUROTECNET or LINGUA programmes, and on the technological developments in telecommunications and information technologies in RACE and ESPRIT, as well as on the tools and standards for educational technology specified in the DELTA Exploratory Action.

The pilot projects should be user-centred and allow user participation in the technical and pedagogical design and development of the systems.

Eligible pilot projects proposals must have a European dimension. The proposals for pilot experiments must describe how the services and infrastructures they offer contribute to a European Electronic infrastructure for learning. The proposals must specify how they contribute to accomplish the overall objectives of the programme in terms of standardisation, integration, innovation and cost effectiveness of technologically based training services for Europe as well as how they contribute to the competitiveness of Europe by providing learning systems that can meet the training needs of Europe efficiently.

III.2. Objectives

The pilot projects should:

Test and validate different technology configurations for flexible and distance learning in order to identify technologies that provide the optimum support for the users (managers, designers, authors, teachers and learners) of the systems on a European scale.

Contribute to the implementation of infrastructures for flexible and distance training in Europe based on IT & T technology.

Increase cooperation between European educational institutions and enterprises in the provision of cost-effective and market driven distance and flexible training services based on ITT&B .

Enhance learning possibilities and bring added value to traditional open, distance and flexible training systems through validation of technology in different pedagogical scenarios (collaborative learning, exploratory learning, 'on the job training', etc.), in different learning situations (individual, corporate and special environments) and within different content areas (communication/interpersonal or problem solving skill oriented learning).

Explore market opportunities for flexible and distance training services based on ITT&B technologies through real life experiments.

III.3. The tasks

These issues have been translated into 3 main tasks.

Systems for joint course development and production (Task 310)

Pilot testing and validation of joint course development and production systems.

Systems for delivery of learning services (Task 320)

Pilot testing and validation of European course delivery systems for flexible and distance learning.

Systems for remote access to learning resources (Task 330)

Pilot testing and validation of systems for education and training information with remote access for course managers, producers and learners via networks or distributed systems.

III.4. Scope of the R&D

A range of pilot projects of varying scale are expected depending on the scope of the experiment. They will address different objectives depending on the size of the project.

III.4.1. Larger scale projects

These should mainly address the feasibility of value added services for flexible and distance training. They will be more market oriented and should pave the way for establishing value added learning and training services. They should be based on stable state of the art technologies and address well established learning needs (eg. language learning or 'on the job training') for different categories of users (producers, managers, learners) in one or more setting(s) (home, corporate or institutionally based). They should cover a wider range of countries and regions.

The larger scale pilot experiments should apply technology that is sufficiently stable to avoid any purely technological obstacles from interfering with the experiment. In the time of the experiment the pilot projects should validate the configuration, the technologies and the pedagogic approach through the users' reactions to detect shortcomings and identify technology developments that could enhance the service. These results should be fed to the 200 series R & D projects.

III.4.1.1. Approach

Each project should;

- Use ITT&B to improve the interactivity between the actors in the production, learning and administration processes in flexible and distance learning through either interactive stand alone tools or

communication facilities through networks (LANs, WANs, analog and digital networks, satellites, terrestrial broadcast) or combinations of both.

- Enhance the flexibility in the learning and production processes in terms of location, time and methodology.

- Be innovative and make advances in the field of flexible and distance learning either through integration of media, adding value to successful local, regional or national experiments in distance and flexible learning, or by testing technology or combinations of technologies that have not yet been used in training contexts.

- Use stable technology or more advanced mainstream (emerging) technologies which will be available European-wide within the next decade (ISDN, IBC).

- Be open to the uptake of emerging technologies and methodologies.

- Describe how the project contribute to European telematic training service infrastructures.

- Provide a plan for the full implementation of the service (cost effectiveness, management structure, performance, motivation of the learners etc) regarding the learning objectives and target populations.

- Show how they can fertilise European integration by providing technology that can help overcome learning and training as well as cross-cultural and linguistic barriers in Europe.

- Describe how the results of the experiment will be disseminated to other providers and user groups.

- Identify which learning needs or demands they are addressing and identify the current and potential market for the experimented service.

III.4.1.2. Outcome

The main objective of these projects is to validate the feasibility of future value added learning services. They will be expected, therefore, to produce the following key results and milestones:

- Assessment of the state of the art of technological and educational developments within the application.

- Reports validating and evaluating:
  - > the functional specifications for different flexible and distance training services using different organisational, technological and pedagogical approaches.
  - > the technological appropriateness of the application in terms of management, user acceptance, cost effectiveness, pedagogical effectiveness etc.
  - > the technical standards and guide-lines for production, delivery and information services.
- Scenarios for full implementation of the service and input to the over all implementation plan for an ITT&B training service infrastructure for Europe.
- Evolutionary strategy for uptake of further services and/or technologies.
- Assessment of market uptake of advanced value-added services including regulatory aspects like copyright, tariffing etc. in the training field addressed by the pilot experiments.
- Specification and validation of solutions for the implementation of the service at trans-European scale.
- Assessment of the influence of cross cultural issues, language barriers, needs of special groups on the service and specific solutions to overcome identified shortcomings

III.4.2. Smaller scale projects

These should test advanced technologies or innovative combinations of technologies and didactic approaches with very specific objectives. They should be more limited in size or could field test technology developed in the 200 series. They could also be testing systems harnessed for specific target groups be it in geographic, demographic/social or content related terms.

Smaller scale experiments should provide a long term view on how the service can be developed on a larger scale.

III.4.2.1. Approach

The smaller scale projects will address a specific subset of the topics described above for the larger projects.

III.4.2.2. Outcome

The main objective is to test innovative services or services harnessed for audiences with special needs. They will be expected, therefore, to produce the following key results and milestones:

- Assessment of the optimum matching of the technologies and the didactic approaches.
- Assessment of the learning results in the experiments.
- Functional specifications and implementation scenarios for a full scale implementation of the service(s) in the future
- Specifications of future R&D activities in learning technologies and configurations

III.4.3. Common Approach

Although the main objective of the pilot experiments is to test and validate users reactions to technology based learning systems a smaller proportion of the work can be dedicated to development of specific tools needed to integrate the technologies in the configuration or to enhance the functionality of a specific tool in the configuration. Development of tools should be clearly defined by the project.

Whatever their size all projects must

- Establish a demonstration facility for all the products and services developed in the pilot experiment in at least one location.
- Provide an implementation plan for the experiment and for a full scale implementation of the service (see below 3.5.1.1).
- Provide a plan for evaluation of the results of the experiment (see below 3.5.1.2).
- Provide a plan for dissemination of the results (see below 3.5.1.3).

III.5. Relations with other parts

III.5.1. Part I

There is a strong relation with Part I which affects both inputs from and outputs to the series 100 projects. All pilot projects must provide concrete input on market assessment, implementation plans, evaluation and dissemination of information to the projects in part I. The inputs from the pilot projects will be gathered and processed by the

horizontal projects on implementation (task 110), evaluation (task 120) and awareness (task 130) in order to build in close concertation with the pilot projects an overall strategy in each of the areas.

III.5.1.1. Implementation

Each proposal for a pilot project should provide a specific implementation plan.

The implementation plan should describe in detail how the actual implementation of the service will be carried out in the pilot experiment and outline the implementation of the full operational service. The implementation plan should outline which services could be provided by the project to other pilot projects and which additional services the project would like to have access to and that could be provided eventually by other pilot projects. The implementation plan should also outline how the project contribute to establish telematic training service infrastructures.

During the lifetime of the project the implementation plan for the future full implementation will have to be updated and refined in coordination with the other pilot projects and the separate consortium dealing with the overall implementation strategies as described in task 110.

The implementation plan for each project must contain the following issues:

- Feasibility study of available technologies and current methods of training using ITT&B.
- Identification of the training requirements of the target group(s)
- Market rationale and marketing plan for the experiment and for the full implementation of the service including the analysis of external market forces
- Ranking of feasible technologies and description of pilot strategy
- Identification of feasible standards, protocols and system components
- Specification of the timetable for the implementation of the project, purchase and implementation of systems and services
- Description of how the experiment will be conducted
- Specification of an implementation time framework for full implementation of the service(s) or systems

The implementation strategies within each project need to be coordinated with each other and with the overall implementation plan for the programme, defined in task 110. Therefore close coordination is required with the 110 task which will establish a framework for a global implementation strategy.

Implementation strategies include as a sine qua non evaluation issues. Therefore a close coordination is required with the 120 task on effectiveness and market impact of each project.

III.5.1.2. Evaluation and assessment

Evaluation is addressed at two levels, the level of the individual pilot project and at the program level as a horizontal action. The aim of the horizontal evaluation action is to produce an overall strategy for the evaluation and assessment actions within each pilot in order to ensure that the evaluation produces comparable results and to manage the consolidation of the evaluation process and results. The tasks of this separate project are described into more detail in task 120.

Each pilot project should focus part of their work on the assessment of their application and should report regularly on the results in order to enable comparisons between different applications, didactic strategies, delivery systems, etc. Each pilot project will have to define the strategy they will use to evaluate the results of the pilot experiment.

The larger pilot projects should address all of the following topics, while the smaller ones only have to report on the subset relevant to their specific objectives.

This evaluation strategy should contain the following issues:

- a clear definition of the set of variables that will be evaluated and assessed in accordance with the objective(s) of the project.
- a definition of the evaluation and assessment design and measurement techniques and tools and the timeframe for the evaluation.

The evaluation strategy will have to be regularly updated in coordination with the other pilot projects and the common evaluation plan as an evaluation strategy common to the whole program is developed in cooperation between the pilot projects and the project described in task 120.

The evaluation should produce the following outcomes:

- assessment of the feasibility of the technologies and configuration in the application, the acceptance of technologies and the configuration by the users and the market uptake.

- assessment of the user efficiency and performance (quantitative as qualitative) of the pilot projects in accordance with the specific objectives and target group(s). For example analysis of misconceptions, efficiency of support, help or guidance to the user, social and motivation aspects)

- evaluation of the cost effectiveness of the application

- evaluation of the impact of the application on the business performance

- evaluation of the short and long term effects of the training in terms of benefits for the company and the individual learner (including learning transfer to other areas or domains).

- evaluation of the cost factors in different training settings and didactic scenario's using dynamic models measuring the effects of distribution, support or technologies.

- analysis of the short and longer term consequences and effects of an implementation of a learning technology, often referred to as technology assessment. Tools and methods such as surveys, structured interviews, scenario-building, case-studies, forecasting techniques, modelling, etc are applicable.

The results of the evaluation will be reported regularly in concertation meetings with the other projects to identify effective models for local and remote learning.

The key results of the evaluation and assessment will be public reports on the topics addressed.

III.5.1.3. Awareness infrastructure and information dissemination

Awareness and dissemination actions are addressed at two levels, by the individual pilot project and at the program level as a horizontal action. The aim of the horizontal action on awareness and dissemination is to produce an overall strategy for the dissemination of results and awareness actions in order to ensure that the results of the pilot applications are presented most effectively and in a coordinated way. The horizontal task on awareness and dissemination will manage and coordinate the external dissemination and awareness actions to the public. The tasks of this separate project are described in more detail in task 130.

Each pilot project should focus part of their work on concertation and awareness actions and should report regularly on the current status and the results of the project at regularly concertation meetings as well as to the external public in the form of presentations, reports, demonstrations etc. Each pilot project will have to describe the strategy they will use for publication of their results.

The larger pilot projects should address all of the following topics, while the smaller ones only have to report on the subset relevant to their specific objectives.

The awareness and dissemination strategy should include:

- Regular participation in concertation meetings.
- Regular publication of the results.
- Plans for demonstrations of the application.
- Reports on identified barriers (technical/nontechnical) to the implementation and uptake of the application as input to task 130.
- Elaboration of guide-lines and standards in the application area.

III.5.2. Part II

The R & D activities in Part II and the pilot experiments in Part III are centred on the three phases of the life cycle of flexible and distance learning: Design and production, delivery and support and information systems. This ensures that pilot projects in Part III corresponds with one or more of the R & D projects in Part II.

Two scenarios are possible for the pilot projects in Part III: The pilot projects can either be very close to the market, building on stable technology and validating the users reaction to pre prototypes of value added services for flexible and distance learning, or they can field test innovative services or technological developments coming out of the 200 series projects.

In the first case the projects will evaluate users reactions to services build on technologies and methodologies that already exist. The emphasis in these projects will be on the evaluation of the acceptance of the technology to the users and the market. The evaluation of the acceptance is likely to identify technologies and tools that need to be developed in order to maximise the functionality of the services. These requirements will be fed to the R & D projects in the 200 series in the concertation meetings.

In the second case, testing of developments in the 200 series, the relation between the activities of Part II and Part III are very transparent, in the sense that the field test will provide direct feedback to the development team on the user reactions to the system. In this case the emphasis is going to be placed on questions like: Does the technology work? Is it the right technology for fulfilling the purpose? Does the technology really meet the user needs?

In either case it is of vital importance for the success of the programme as such, that the user reactions to the technologies and services are evaluated and that the user reactions to the technologies are fed into the development projects in the 200 series in order to ensure, that the technologies developed in the 200 series are in accordance with the user requirements and needs. Information exchange mechanisms and concertation actions should be put into force with the relevant projects.

The horizontal tasks in Part I are going to ensure that the correspondence between the development of technologies and user needs and requirements as identified in Part III are being ensured.

Task 310: Systems for joint course development and production

Background

Course production in flexible and distance learning is normally a group effort involving many actors from different fields. A group approach is especially needed in the development and production of multimedia learning material. It would involve managers, educational technologists, instructional designers, content experts, publishers etc. It is assumed that there will be a considerable saving in the cost of developing courses if it can be done on a European scale for the European market by course teams from different countries.

Developments in telecommunications and information technologies have made it possible to perform the course development and production at a distance. However, as yet, we know little of how to manage such systems, which technologies are suited for the decision making processes, which tools and systems are best suited for transfer of information and feed back within course teams, which problems arise for the development and production in multiple language and multi cultural teams, which communication systems are best suited for the joint approach and what costs are involved.

Objectives

The objective of the projects in this area is through the use of advanced IT&T technology to test and validate joint European course development and production systems in different domains in order:

To improve speed and effectiveness of the course development and production.

To improve the quality and efficiency of the learning material.

To facilitate the integration of different media.

To facilitate collaboration and communication between multi-disciplinary and/or multinational course teams.

Technical approach

A range of projects of different scales is expected:

Larger scale projects should be targeted towards networked solutions covering wider areas linking different sites via either ISDN or satellites. The larger scale projects should in the initial phase apply state of the

art technology. In the later stages technology developments under Part 2 can be integrated as shortcomings are detected or better equipment becomes available.

The larger scale projects should concentrate on the market uptake of joint production systems and on the validation of the appropriateness of the technologies used in the project and the effectiveness of the system regarding costs, speed, management and pedagogic results.

The smaller scale projects should not have as broad a coverage and should concentrate on exploiting the possibilities for joint authoring enabled by the more advanced technologies available on a broad bases in the future. They could also pilot test technology developed in the 200 series.

The larger scale projects should address all the topics covered in the technical approach, while the smaller scale projects only have to address the subset relevant to their objectives.

The projects should specify how they through advanced IT&T technology can improve collaborative design and production on a distance by the use of networks (LANs, WANs, Satellites)

A smaller proportion of the work can be dedicated to development of specific tools needed to integrate the technologies in the configuration or to enhance the functionality of a specific tool in the configuration. Development of tools should be clearly defined by the project.

The projects should:

- be based on systems allowing point to multi-point, distributed group communication as well as point to point communication.
- use communication systems which have facilities for real-time communication (video-/audio conferencing) and/or for delayed (computer conferencing/E-mail).
- include facilities for transfer of analog or digitised files, moving or still pictures as well as facilities for production of multiple language courses (translation systems).
- include facilities for electronic transfer of information between the actors involved in the design and production process.
- demonstrate how the technology chosen can improve the quality and speed of design and production on a distance as well as how the service can enrich the design and production environment in

terms of eg access to multimedia databases and easy transfer of material.

- Improve the cooperation between the multi-disciplinary design and production teams involved in production of multimedia materials.

- identify which tools or methodologies they will introduce in order to facilitate a more structured and standardised way of managing the design and production process.

- specify how the services experimented can improve the possibilities for easy update and delivery of coursematerials and how the system can be used for avoiding duplication of efforts in production e. g. through reuse of units of material between the courses

- specify which new design and production scenarios will be experimented through the service and how design and production costs can be reduced

- identify how the multi-lingual and cross cultural barriers in the design and production team itself can be overcome and how the system can facilitate the production of multilingual and cross cultural course material

- provide a plan for in the full implementation of the services (cost effectiveness, management structure).

- be open to the uptake of emerging technologies and methodologies.

- include an evaluation plan for each stage of the design and production processes and the project should validate the technical appropriateness of the media chosen in each stage in order to provide technical specification (minimum vs ideal) for a joint design and production environment on a distance (as well for the configuration of the user equipment as for the communication facilities).

- establish a demonstration facility for all the products and services developed in the pilot experiment in at least one location.

- provide a clear timeframe for the project.

- provide a plan for dissemination of the results.

All the pilot projects will have to provide concrete input on market assessment, implementation plans, evaluation and dissemination of

information. The inputs from the pilot projects will be gathered and processed by the horizontal projects on implementation (task 110), evaluation (task 120) and awareness (task 130) according to an overall strategy for each area which will be developed in close concertation between the pilot projects and the projects active in the tasks 110, 120 and 130.

Key results and milestones

Implementation of systems for joint European course development and production.

Specification of necessary technology development.

Evaluation according to the common evaluation framework of the technologies used and the integration of those technologies.

Evaluation of the logistical, managerial aspects of joint course development and production systems.

Detailed report on the cost effectiveness of the experiment.

Establishment of a demonstration facility for all the products and services developed in the pilot experiment in at least one location.

Implementation plan for the full scale service.

Guide-lines on good practices for joint design and production using telematic equipment.

Guide-lines for design and production of courses for the European market.

Implementation plan for the full scale service.

Specification of necessary technology development.

Task 320: Systems for delivery of learning services

Background

As the demand for updating the skills of the workforce of Europe has increased, it has become apparent that new communications and computer technologies can assist in the development of systems which enhance the capabilities of training services as telematic networks present the opportunity to increase the level of accessibility to knowledge, expertise and education in a cost effective manner.

Current flexible and distance learning normally use printed text as the principal teaching medium. Some institutions and companies use a combination of broadcast, text and correspondence and some use computer conferencing additionally. However learners at a distance are normally isolated and have little contact with each other and the teacher. With the existing and emerging developments in telecommunication and computer technologies it is possible to offer broader access to integrated services offering two-way communication and access to a wider range of educational opportunities.

Although experience has been gathered on mass delivery of training through systems such as broadcast satellites, low and high capacity cables, terrestrial broadcast and combinations of broadcast and computer communication, there is a need for the training and education community to be able to experiment with delivery systems based on the new technologies, in order to improve its own familiarity with the new media, to develop solutions to the didactic and managerial problems and to validate the cost effectiveness and attraction to the market of such systems.

In order to establish knowledge of these systems a range of pilot experiments projects of different size and scope addressing different training scenarios and target audiences using different technologies in different content areas need to be established.

At least three different training scenarios can be identified:

1. The 'classroom' situation, where the learners have access via the network to all other learners and the teacher either in real-time or delayed communication systems. This scenario requires facilities as: a registration system, a course delivery system suited either for the home learner or the corporate learner, learner equipment (individual or collective) with appropriate tools for the courses, communication tools for the teaching process (e. g. electronic blackboard, point to multi-point and/or point to point communication system(s), video-conferencing, direct broadcast, audio-conferencing, computer conferencing, telewrit-

ing etc..), tools for on line assignments and examinations, tools for accreditation and billing.

2. The 'cooperative' or 'seminar' type of learning where a relatively small group of learners work together on a project or course under the guidance of a tutor or field expert. This scenario requires facilities as advanced communication systems allowing point to multi-point communication (either real time or delayed) and facilities for access to remote information bases as well as to external experts.

3. The 'exploratory' type of learning where a learner explores learning material on his own either on-line in remote databases or by down-loading material. The exploratory learning scenario could include experiments with facilities as intelligent tutoring systems, problem solving tools, navigation tools, simulation systems and off or on line help facilities.

At least three different target audiences can be identified: The individual home based learner, that trainee in SMEs or large cooperations, and learners using local training or resource centres.

1. The home based individual learner will normally have access to basic level equipment: telephone, broad cast radio, broadcast TV. The systems for the individual learners will have to take these constraints into consideration when designing the functional specifications for the pilot applications. They must specify how they will combine the different delivery technologies in order to reach this audience and to motivate the learner and support the learning process. The solutions can be based on a mixture of central and local support, of on-line and off line services, of combinations of services provided in an institutional setting and on an individual bases.

2. The learner based in corporations, either larger ones or SMEs, will normally have a broader range of equipment available: telephone, fax, intelligent workstation, either stand alone or connected through a LAN and sometimes to a WAN. The systems for corporate training will therefore be able to utilise more IT based techniques for delivery and interactivity. The projects addressing these target audiences will have to specify which delivery technologies they will use, which interactivity they will utilise in order to support learning in these settings. Different organisational models should be experimented: training for SMEs connected to large cooperations with their own training department, training for SMEs through local training centres and training for SMEs organised through branch organisations. For training in SMEs special attention should be paid to establishing systems able to address the need for 'just in time training'.

3. The learner using training or resource centres. This training situation will often be applicable to learners in remote or peripheral regions, or learners with special needs normally have access to the same equipment as the home based users, but these groups need access to special equipment or facilities according to their needs. For instance support facilities for learning as access to libraries, a wide range of educational offers are not normally available in remote areas. Telecommunication is often expensive in these regions. Projects addressing these audiences should therefore pay special attention to provide cost effective technical solutions to the training needs compared to alternative ways of delivering training and taking into account the economic and social implications of the different alternatives.

The content of the courses and the teaching objective have great impact on the choice of technology. On the extreme two types of approaches can be identified: courses which place the emphasis on teaching of interpersonal communicative skills (e. g. language learning and marketing oriented courses) and courses which place the emphasis on teaching of specific skills (e. g. courses in maintenance of equipment, courses in natural sciences and in complex problem solving).

Courses aimed at teaching interpersonal communicative skills will have more emphasis on technical configurations and didactic strategies which facilitate the communication between the learners and teachers and among the learners. Pilot projects aimed at this type of courses will therefore have to place more emphasis on networked technologies (analog or digitised, real time or delayed, oral or written).

Courses aimed to teach specific or problem solving skills will address corporate environments. Courses in this area will tend to be more CBT based, using simulation techniques, intelligent tutoring and help facilities, drill and practice techniques. Pilot projects in this area will therefore have to place more emphasis on the design and delivery techniques for CBT-courses.

Objectives

To establish a range distance learning pilot experiments of different scale using IT&T technologies for different target groups and different technology configurations with the long term view to establish telematic training service infrastructures for Europe.

Test and validate different technology configurations for delivery and support services for flexible and distance learning on a European scale to identify technologies that provide the optimum support for the users (learners and teachers).

Increase cooperation between European educational institutions and enterprises in the provision of cost-effective and market driven distance and flexible training services based on IT & T technology.

Enhance learning possibilities through validation of technology in different pedagogical scenarios (collaborative learning, exploratory learning, 'on the job' training, etc.), for different learning situations (home, at the workplace, learning centres and special environments) and within different content areas (communication/interpersonal or problem solving/skill oriented learning).

Explore market opportunities for flexible and distance training services based on IT & T technologies through real life experiments.

Technical approach

A range of projects of different scale is expected:

The largest projects should address wider audiences and have broad geographical coverage. They should use stable technology. The focus of the large scale projects will be to test and validate the appropriateness of the technology chosen, the cost effectiveness and pedagogic effectiveness of the service and the user acceptance. The larger scale pilot projects should address on or more of the target groups, individual learners, corporate training and groups or regions with special needs. The larger scale projects should use different delivery technologies (ISDN and Satellites) and experiment different training scenarios (stand alone and networked). In the initial phase the larger scale projects should use stable state of the art technology. In the time of the experiment the pilot projects should validate the configuration, the technologies and the pedagogic approach through the users' reactions to detect shortcomings and identify technology developments which could enhance the service. These results should be fed to the 200 series R & D projects.

The smaller projects should test and validate more advanced technologies either coming from the 200 series or developed elsewhere. The smaller scale projects can address more limited target audiences and have a smaller geographical coverage.

The larger scale projects should address all the topics covered in the technical approach, while the smaller scale projects only have to address the subset relevant to their objectives.

A smaller proportion of the work can be dedicated to development of specific tools needed to integrate the technologies in the configuration or to enhance the functionality of a specific tool in the configuration. Development of tools should be clearly defined by the project.

The projects should identify:

- in which ways the proposed experiments will enhance learning in quantitative terms (enlarging the learner groups, helping to overcome geographical or social isolation) and in qualitative terms (new or better ways of teaching, open new possibilities of learning which can not be obtained by traditional ways of training).

- in which way they will facilitate interactivity (real time and/or delayed) between the trainees (collaborative learning, group work, peers reviews etc.), and between trainees and tutors (models of tutoring and monitoring etc.).

- new ways of interacting or improving existing models for interaction in one or more of the following learning situations: Home-based learner, corporate learner in either large companies or SMEs and institutional based learner

The projects should specify:

- how they will manage the services and how the communication on the administrative level is structured

- how they through advanced IT&T technology can enrich the learning possibilities for the given target group by providing access to a broader range of curicula and courses

- how the problems concerning multi-lingual and cross cultural barriers in the communication between trainees and trainees and tutors will be solved.

The projects should:

- prove their viability in the full implementation of the services (cost effectiveness, management structure) and identify main advantages compared to other possible solutions

- be open to the uptake of emerging technologies and methodologies.

- be based on stable technology or simulate emerging mainstream technology which will become available Europe-wide

- provide a clear timeframe for the project.

- All the projects should provide a plan for dissemination of the results.

The projects will have to address real training needs in areas with recognised training problems. This can be either in geographical terms

(for example remote and/or rural areas, peripheral regions), content related areas (for example language learning, IT-sector, engineering,) or in sectoral/social terms (for example SMEs, special needs groups, socially isolated groups, immigrants).

All projects must establish a demonstration facility for all the products and services developed in the pilot experiment in at least one location.

All the pilot projects will have to provide concrete input on market assessment, implementation plans, evaluation and dissemination of information. The inputs from the pilot projects will be gathered and processed by the horizontal projects on implementation (task 110), evaluation (task 120) and awareness (task 130) according to an overall strategy for each area which will be developed in close concertation between the pilot projects and the projects active in the tasks 110, 120 and 130..

Key results and milestones

Implementation of distance learning delivery systems for a variety of user groups using different didactic strategies and utilising different technology platforms.

Establishment of a demonstration facility for all the products and services developed in the pilot experiment in at least one location.

Evaluation reports according to the common evaluation scheme on the cost factors, didactic efficiency and the applicability of the different technologies. Especially the learners reaction to the systems in terms of motivation should be fully reported on.

Detailed report on the cost effectiveness of the experiment.

Validation of different methodological and technological approaches to meet the training needs for the defined target audiences.

Guide-lines on good practice for technology based training for the identified target groups and content areas.

Validation of the market uptake and potential market for the experimented training services in the different scenarios.

Implementation plans for full implementation of the services experimented.

Specification of necessary technology development.

Task 330: Systems for remote access to learning resources.

Background

In order to achieve economy of scale, information on the educational services and courses should be made available in an easy, standardised, comparable and cost effective way. This could be achieved by establishing information/documentation bases of multimedia items (both analog and digitised) on educational services. These information-bases should serve a wide variety of users ranking from the educational managers in the companies and institutions to the end users, authors, tutors and learners.

The common technological basis of these services are information bases with capabilities to store multimedia material of learning materials, which can be accessed and distributed on electronic networks or made available locally on the appropriate storage devices.

Learning often requires access to additional information, encyclopaedia, experiments, demonstrations etc. Informationbases of analog and/or digitised items serving the training and educational communities could be set up on a European scale. Such services and facilities would be needed particularly for the part of the European population living in remote areas with limited access to additional learning resources.

In order to achieve cost effectiveness in course production, access for authors of course material to multimedia informationbases of raw material or half products from other producers could be usefully established.

Experts and researchers are often called upon in the educational process, especially in advanced training and education. Networks of experts in the different fields could be established via electronic networks. Experiments with systems to call upon experts from the training community should be carried out.

The information systems will often be linked to or form an integral part in design and production or delivery systems. It is therefore expected that proposals in this task will have close cooperation with the pilot projects in production and delivery systems. The pilot projects in this area will also have to establish close links with the projects described in task 130 dealing with awareness structures and establishment of human networks.

Objectives

To test and validate through pilot experiments different configurations for information services (information bases on curicula, on available courses, on course modules, on experts in different content areas) and to supplementary training tools or supplementary general information services (on-line encyclopedia, libraries, translation services, etc) available Europe-wide for different user groups (trainees, tutors managers and producers).

To test and validate:

- prototypes of multimedia information bases for producers of course material consisting of raw material, half-products, modules of courses.
- prototypes of information bases for the professional users in charge of education in a company or organisation.
- prototypes of information bases for the end users of learning material.
- tools for accessing the information services (natural language query, multiple language interfaces)
- tools for managing and maintaining the information services.
- different configurations of information services on line databases or locally distributed (resource centres, information services and the links between them).
- design of on- and off- line information services.

Technical approach

A range of pilot projects of varying scale are expected depending on the scope of the experiment. They will address different objectives depending on the size of the project.

Larger scale projects

These should mainly address the feasibility of information services for the actors in flexible and distance training (authors, teachers and trainees). They will be more market oriented and should pave the way for establishing information services. They should be based on stable state of the art technologies. They should cover a very wide range of countries.

The larger scale projects should apply technology that is sufficiently stable, so that pure technological obstacles do not interfere with the experiment. In the time of the experiment the pilot projects should validate the configuration, the technologies and the pedagogic approach through the users' reactions to detect shortcomings and identify technology developments which could enhance the service. These results should be fed to the 200 series R & D projects.

These projects are expected to provide the background for implementing an integrated electronic based information system for European distance and flexible learning. Larger scale projects will therefore be addressing mainly on-line information services. They will take into account the overall architecture and design of the system, standards for design of information bases, standards for storage and retrieval of information, standards for queries, standards for updating the information bases, standards for re-routing of queries, standards for multilingual access to the information bases.

Smaller scale projects

These should test advanced technologies or innovative combinations of technologies with very specific objectives. They should be more limited in size or could field test technology developed in the 200 series. They could also be testing systems harnessed for specific target groups or content areas.

Smaller scale experiments should provide a long term view on how the service can be developed on a larger scale or be integrated into telematic training service infrastructures.

The smaller ones can have more specific objectives, be more locally based. The smaller ones will not have to be available on-line, but can serve the community by delivering their services on appropriate storage devices.

Approach

The larger scale projects must take into account most of the topics mentioned below in the approach while the smaller scale projects will address a specific subset of the topics.

A smaller proportion of the work can be dedicated to development of specific tools needed to integrate the technologies in the configuration

or to enhance the functionality of a specific tool in the configuration. Development of tools should be clearly defined by the project.

Projects should specify how the information can be made available in multiple languages.

Information services must be easy to use. Natural query language, help facilities for search, multilingual accessibility and userfriendliness must be included.

The information databases, that are used must have build in clear educational principles for information structures

The projects should prove the cost-effectiveness of the service in terms of establishing, administering, updating, speed etc.

Information services for more user groups must specify the help and support systems they will establish for the different user groups.

The pilot applications could be either stand alone systems with embedded help facilities or have integrated on-line help facilities.

All projects must establish a demonstration facility for all the products and services developed in the pilot experiment in at least one location.

All the projects should provide:

- a clear timeframe for the project.
- a plan for dissemination of the results.

All the pilot projects will have to provide concrete input on market assessment, implementation plans, evaluation and dissemination of information. The inputs from the pilot projects will be gathered and processed by the horizontal projects on implementation (task 110), evaluation (task 120) and awareness (task 130) in order to build in close concertation with the pilot projects an overall strategy in each task.

Key results and milestones

Implementation of on-line multimedia bases of raw course materials and half products for producers of courses for flexible and distance learning.

Implementation of public accessible information bases of course catalogues, courses and libraries.

Specification of necessary technology development.

Evaluation reports according to the common evaluation framework especially on market uptake of the services.

Detailed report on the cost effectiveness of the experiment.

Establishment of a demonstration facility for all the products and services developed in the pilot experiment in at least one location.

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