



# **Evaluation of alternative training provision for local authority health and safety enforcement officers**

Prepared by:  
**School of Environment and Life Sciences**  
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for the Health and Safety Executive

**CONTRACT RESEARCH REPORT**  
**312/2000**

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First published 2000

ISBN 0 7176 1913 3

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# Evaluation of alternative training provision for local authority health and safety enforcement officers

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Local Authorities (LAs) often experience difficulties in providing the specialised training required by their health and safety enforcement staff and this is further exacerbated by the constraints of limited training budgets and geographical dispersion. This report outlines research which investigated the acceptability of computer based training (CBT) and the role emerging technologies can play in assisting LAs to meet the training needs of their health and safety enforcement officers.

Three computer based training packages were developed and piloted within LAs. The packages were delivered through different forms of computer technology, namely floppy disk, CD-ROM and the Internet. A total of 96 trainees from 23 LAs participated in the evaluation programme. Fifty nine trainees piloted the packages and 37 acted as controls. The trainees were asked to evaluate the packages in terms of their usability, flexibility and effectiveness. In addition, line managers from 12 of the LAs which had participated in the pilot were questioned regarding the acceptability and economic viability of delivering health and safety enforcement training by computer.

All three packages were enthusiastically received by both trainees and managers and the results confirmed that CBT has the potential to augment the range of training methods and media currently employed. The findings also highlighted some important issues around the way in which CBT is introduced and the factors which need to be considered for its successful implementation.

This report and the work it describes were funded by the Health and Safety Executive (HSE). Its contents, including any opinions and/or conclusions expressed, are those of the authors alone and do not necessarily reflect HSE policy.

**HEALTH AND SAFETY EXECUTIVE**

**RESEARCH STRATEGY UNIT (RSU 3619/R67.121)**

**EVALUATION OF ALTERNATIVE TRAINING PROVISION  
FOR LOCAL AUTHORITY HEALTH AND SAFETY  
ENFORCEMENT OFFICERS**

**JUNE 2000**

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## **Acknowledgements**

This research was initiated and funded by the Local Authority Unit of the Health and Safety Executive.

We would like to thank all those who took part in the study by participating in interviews, reviewing the training guide or attending the knowledge elicitation session. We are grateful to Graham Covell for his assistance with the case studies, to Philip Tutty and Andrew Stevenson for their technical expertise in the software development of the training packages and we are particularly appreciative of the time and effort spent in the evaluation stages of the project by Local Authority representatives.

We are especially appreciative of the support and guidance given by the Local Authority Unit and the time afforded to us by Nigel Hammond, Terry Woolmer and Peter Coyle.

The project was undertaken by Helen Casstles, Norma J. Ford and R. Gai Murphy with support from Lindsey M. Green and Denise M. Rennie.

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## EXECUTIVE SUMMARY

Local Authorities are required to make adequate arrangements for the enforcement of health and safety within their area of responsibility (HSC(G)4, 1996). A trained and competent inspectorate is an essential component in providing adequate arrangements. Local Authorities (LAs) often experience difficulties in providing the specialised training required by their health and safety staff and this is further exacerbated by the constraints of limited training budgets and geographical dispersion. In response to these difficulties the Local Authority Unit (LAU) of the Health and Safety Executive (HSE) commissioned research to prepare guidance to assist LAs in managing their training of health and safety enforcement officers and to evaluate the effectiveness of different training media for inspector training. An early outcome of the project was the preparation of a training guide for line managers of LA health and safety enforcement officers (Casstles, Ford, et al 1998), the production of which was informed by a literature review and case studies of LA training practice. This final report focuses upon the potential of Computer Based Training (CBT) to resolve some of the current difficulties experienced by LA Environmental Health Departments in providing training for health and safety enforcement officers to ensure a trained and competent inspectorate as per the Health and Safety Commission (HSC) Section 18 guidance (HSC, 1996).

Information on the potential for introducing CBT within LA health and safety departments was collated from two main sources. A comprehensive review of the current academic literature on CBT was carried out and case studies within a range of LAs were undertaken to establish the current range and scope of training undertaken and to establish the factors which influenced the choice of training adopted within these LAs. This data informed the development of two distinct outputs from the research project. Firstly, a guide for first line managers was produced to assist them in addressing the training and development needs of their staff. This guide was made available to all local authorities in Great Britain. Secondly, three training packages were developed, using different technological media and addressing three topics identified by the LAU as areas where training needs have been identified. The topics were: The Health and Safety (Enforcing Authority) Regulations 1998; Hotel Safety and Accident Investigation. The training media selected were all suitable for skill and knowledge acquisition and also had the advantage that they could be accessed by the trainees at times which were suitable to them and their employers. The subject matter of each medium both reflected and exploited the suitabilities and strengths of the particular medium. The Enforcing Authority Regulations training was mounted on floppy disk, the hotel safety training on CD-ROM and the accident investigation training on the Internet. The packages were developed and piloted within volunteer LAs. The evaluation considered three key aspects:

- **Effectiveness:** the ability of the media to convey the knowledge and deliver the learning outcomes (pedagogy);
- **Usability:** the ease of use, reliability and flexibility of the medium; (ergonomics) and
- **Cost:** the financial implications of using the medium (economics).

A total of 96 trainees from 23 authorities participated in the evaluation of the programme. Fifty nine trainees piloted the packages and 37 acted as controls. All trainees completed a pre-training questionnaire which sought information on their job title and health and safety experience, reasons for undertaking the training and

their previous general information technology (IT) and CBT experience. In addition they completed a 'learning styles inventory' to establish any dominant learning styles amongst the cohort. The controls completed pre and post-training knowledge tests for each of the three areas covered by the packages (without the intervention of access to the training packages), whilst those piloting the packages completed pre and post-training knowledge tests pertinent to the area covered by their training package.

The results from these trials confirmed that each of the three media is capable of delivering training and CBT has the potential to augment the range of training methods and media currently available to ensure a competent health and safety inspectorate. The packages were enthusiastically received by both trainees and managers and found to offer an innovative means to combine theory with worked examples in a software application. The assessments by both trainees and managers were very positive and suggest that CBT has a future role to play in local authority health and safety enforcement officers training.

Analysis of the pre and post-training knowledge test scores revealed that those trainees who had used the packages significantly improved their knowledge in the relevant subject area. Eighty three per cent of the trainees involved in piloting the packages increased their base line knowledge and 71% believed they had achieved the learning objectives specified for the package used. The knowledge gain achieved by trainees probably represents the minimum that could be expected since the training was imposed upon existing workload rather than integrated within it in a structured and systematic way.

Whilst knowledge gain is clearly an essential outcome of using a training package, other factors are also important in determining whether packages will enjoy widespread adoption within LAs. The evaluation confirmed that each of the packages had their own strengths and weaknesses in terms of usability.

The floppy disk package was the most straight forward to operate and all the trainees were able to use it. Seventy eight per cent of the floppy disk cohort enjoyed using the package, however, only 29% thought that their interest was maintained throughout the package. Whilst 86% of the trainees would be happy to receive further training in this medium, managers expressed reservations about its potential to enhance practical skills and could not identify any marked advantages over paper based training activities. Although significant knowledge gain was recorded, the results from the floppy disk pilot probably reflect the limitation of this technology and future developments in this medium are likely to be constrained for this reason.

The CD-ROM was without doubt the most enthusiastically received package with 88% of the trainees reporting they enjoyed using the package. Eighty four percent said it was easy to use and their interest was maintained throughout its use and 92% would like to use CD-ROM for further training. Managers believed that CD-ROMs could be used to develop technical knowledge, legal and procedural application and also, if augmented by other training activities, develop practical skills. Not only did the trainees demonstrate a significant increased knowledge gain but they were clearly engaged by the ability of the medium to present training in a visually attractive and stimulating format. The Internet package was technically the most sophisticated and complex package incorporating on line discussion facilities and hyperlinks to other related Internet sites. However only 30% of the trainees believed they had the necessary technical expertise and pre-requisite knowledge to undertake the training and this was probably reflected in the results of the knowledge tests which showed only a marginal improvement.

Nevertheless 80% of the trainees enjoyed using the package and 70% thought it was a good medium for the training material. Sixty five per cent of the trainees reported that their interest was maintained throughout the use of the package and 80% would like to use this medium in the future. Managers acknowledged the effectiveness and usability of the medium; however the evaluation did highlight the critical importance of managing the introduction and implementation of web based training within LAs.

Economic considerations may ultimately determine whether different forms of training media are widely utilised within a training framework. In addition to the provision of appropriate hardware there are costs attaching to the purchase of each of the media. Purchase costs of £100 for the floppy disk, £400 for the CD-ROM and £100 for the Internet training were calculated on the basis of the development costs and an estimation that approximately 50% of LAs would purchase a particular training package. Managers were asked to comment on whether they felt that at these prices the packages were economically viable, assuming that appropriate equipment and support were available in the workplace. The responses indicated that the managers believed that Internet training represented the most economically viable of the three options and whilst the CD-ROM package was the most popular the managers responses suggested that financial constraints may prevent its widespread adoption as a training medium.

The research highlighted a number of issues which LAs would need to address before choosing to use emerging technologies within their training framework.

- Managers who are tasked with integrating CBT into an existing training programme need to be provided with training opportunities to learn about the implications of using CBT and the management of its use.
- Identifying the training needs of health and safety inspectors is a crucial first step in ensuring the successful introduction of CBT within the workplace. A computer literacy inventory undertaken before the introduction of CBT will assist managers in identifying potential areas of weakness in using the technology amongst their staff. This process should help those who are unsure about the use of technology to become more comfortable with the concept of replacing more traditional training delivery methods with novel delivery via CBT.
- LAs need to confirm that the computer hardware they currently have available has the capacity to meet the technological demands of the packages being considered for training use. It is inevitable that some technical difficulties will arise during use of technology and LAs must have systems in place to ensure these problems can be resolved promptly and that technical difficulties will not thwart the learning experiences of those being trained.
- Marketing of CBT should be undertaken before it is introduced so that staff are aware of the underlying rationale and the potential benefits that may ensue. Managers need to recognise that moving trainees towards self directed learning may influence the motivation of trainees and this will need to be kept under review.
- Means by which the suitability of a particular CBT package can be assessed will need to be developed. A matrix or set of criteria should be developed incorporating factors such as the ability of the package to provide feedback, etc.
- Systems to track progress through packages will need to be implemented so that the effectiveness of time devoted to training can be assessed and regular feedback can be given to trainees.
- Evaluation of CBT packages should be conducted to ensure that training resources committed to instructional media produce tangible results.

# 1. INTRODUCTION

## 1.1 BACKGROUND TO THE PROJECT

The training of health and safety enforcement officers has been the focus of much debate, for example, in its effect on the appropriate implementation and enforcement of European community law (DTI, 1993). This review suggested that one of the reasons underlying inappropriate enforcement decisions was inadequate training of enforcement staff, particularly those employed by Local Authorities (LAs). The Department of Trade and Industry Review (DTI review) and the subsequent Health and Safety Executive (HSE) Review of Regulation made recommendations regarding the need to improve training for enforcement staff (HSC, 1994).

Research conducted by the Institute of Local Government Studies (INLOGOV) (Prince, 1994) investigated the scope and nature of training for LA health and safety inspectors and highlighted problems in its provision. The two major difficulties identified by those interviewed were resource limitations and inappropriate content of available courses. Training provision for LA enforcement staff was said to be subject to the vagaries of local financial policies and politics, and the lower priority often afforded to health and safety compared to food safety. Core training was criticised for being too theoretical and for placing insufficient emphasis on the practicalities of enforcement. An absence of courses addressing the development of practical skills, such as risk assessment and interpersonal skills, was also reported. Evidence suggested that technical officers (TOs) with health and safety enforcement responsibilities received only patchy training provision, due to poor availability of suitable courses, whilst environmental health officers (EHOs) were seen to suffer from a lack of "update" training. The latter was seen to be of particular concern, given the speed with which legislation can change.

The research revealed a great enthusiasm for training amongst environmental health managers (EHMs) and officers and the availability of a wide range of training but it also identified a lack of integration between training effort and departmental and functional objectives (Prince, et al 1995). It concluded that training practices were inadequate not because of an absence of training opportunities but because training was poorly managed. Effective means of identifying training needs and priorities at a departmental level, in order to remedy any gaps in essential knowledge and skills within the department as a whole were recommended. The importance of training evaluation (i.e. assessing the improvement effected in staff knowledge and performance after a particular training programme) was also emphasised. Moreover, it was suggested that proper management of training might offer scope for savings on the cost of piecemeal and unintegrated training which could be redirected to more focused training activity. The report also recognised that due to the independence of LAs it was difficult for them to organise a co-ordinated response to identified training needs.

The Health and Safety Commission (HSC) is committed to consistency of enforcement by HSE and LAs. In response to some of the difficulties identified by local authorities in providing training for their health and safety inspectors (such as small training budgets and geographical isolation) and to assist in addressing some of the shortcomings identified by INLOGOV (such as ineffective management of training and selection of inappropriate training media) the Local Authority Unit (LAU) of HSE commissioned research to:

- evaluate the effectiveness of different forms of training methods and media for health and safety enforcement officer training;
- prepare guidance to assist LA employers in managing and implementing their training and developmental activities;
- investigate the application of emerging and novel technologies to training delivery and the potential for utilisation in health and safety enforcement training;
- develop, pilot and evaluate a selection of alternative training media for LA based health and safety inspectors.

This project had several component stages namely:

- a literature review which focused upon the issues likely to influence the effectiveness of training including an exploration of the interrelationships between training content, methods and media plus an assessment of the strengths and weaknesses of different approaches to training;
- the conduct of twelve case studies to determine the range and scope of training (in terms of content, methods and strategies) utilised by LAs to train health and safety enforcement officers. The internal and external factors, which affected LAs in their choice of training and the opportunities and constraints which influenced training provision, were also investigated. The LA case study sites were selected to be representative of the different types of LA (e.g. rural, urban);
- exploration of the application of emerging technologies to training including both a review of existing literature and an investigation of the developments in the use of the newer technologies;
- preparation of a guide to managing health and safety inspector training which incorporated the findings of the literature review and the LA case studies;
- development and trial of three training packages for LA health and safety enforcement officers which were delivered using different media;
- evaluation of the different delivery media to gauge reaction to the training process and the knowledge acquired; and
- evaluation of the acceptability and utility of the training media to the employing LAs.

The research therefore had two distinct but interrelated strands. The first, aimed to provide guidance to first line managers to assist them in addressing the training and development needs of their staff in a systematic and cost effective manner, based upon established practice but tailored to the needs of the target group. The second strand focused upon the impact of training media in the training process and investigated whether the emerging technologies offered some solutions to the difficulties of securing appropriate and affordable training at the right time in the right place.

## **1.2 METHODS**

There were five stages in the project:

- Stage 1: Case Studies of LA Training Practices and Investigation of Emerging Technologies
- Stage 2: Literature Review and Analysis
- Stage 3: Development of a Training Guide

Stage 4: Development of Training Packages

Stage 5: Piloting and Evaluating the Training Packages

### **1.2.1 Case Studies of LA Training Practices and Investigation of Emerging Technologies**

The first stage of the project sought to determine the range and scope of health and safety enforcement training presently utilised by LAs including content, methods and media as well as the opportunities and constraints influencing training practices. Twelve case studies were conducted comprising in-depth interviews with representatives from central personnel departments with responsibility for training, managers responsible for the environmental health service and line managers of health and safety inspectors. Discussion focused upon the means by which training needs were determined, the internal and external factors which influenced training decisions, including the opportunities and constraints which presently effected or were likely to effect training provision. The LA managers were also questioned about the health and safety training recently undertaken by enforcement officers and the methods and media employed for training and staff development activities.

### **1.2.2 Literature Review and Analysis**

A literature review was undertaken to underpin and inform the development of the training guide and the design of the training packages. It examined the published information on training identified from printed abstracts and indexes, and from on-line (World Wide Web) and CD-ROM searching. The review also explored the design of training programmes including training methods and media and the developments in CBT.

### **1.2.3 Development of a Training Guide**

A guide to managing training for health and safety enforcement officers was developed for first line managers incorporating the information gathered from the case studies and literature review. Information on identifying training need, planning, implementing and evaluating training were incorporated along with a description of various training methods and media and their suitability for use in training programmes for health and safety inspectors.

The draft guide was reviewed by twenty officers from a number of LAs to ensure that the content was well focused and applicable. These officers attended a one-day workshop to express their views on the relevance and applicability of the guide. The feedback was reviewed and incorporated into the final draft of the guide.

### **1.2.4 Development of Training Packages**

The information gathered during the literature review and investigation of emerging technologies was used to identify three different training media suitable for use by LAs for training their health and safety enforcement staff. Information derived from the case studies was also used to determine the acceptability of various types of training media and identify those which were perceived as offering most benefit to LAs. The project team endeavoured to utilise current developments in information technology in the selection of training media and the application of the following were considered: the Internet, video conferencing, computer conferencing, CD-ROM, multi-media, video on demand, interactive television. Information about the constraints placed upon LAs was influential in determining the final choice.

Three different subjects were selected to test three different techniques as follows:

<b>SUBJECT OF TRAINING</b>	<b>MEDIUM</b>
Accident Investigation	Internet
Health and Safety (Enforcing Authority) Regulations 1998	Interactive (Floppy) Disk
Hotel Safety	CD-ROM

### **1.2.5 Piloting and Evaluating the Training Packages**

The piloting and evaluation stage comprised several components.

- a) Completion of a pre-training questionnaire by participants, to establish their learning styles and personal details.
- b) Allocation of participants to one of the three training packages (disk, CD-ROM or Internet training) or to the control group.
- c) Completion of pre-training exercises to gauge the trainees pre-existing knowledge and awareness in the subject of their training package.
- d) Completion of 'user logs' detailing use and initial reaction to the package;
- e) Completion of a post-training exercise to measure knowledge changes and a postal questionnaire to explore the acceptability and usability of the training package.
- f) Telephone interviews with the managers of the trainees to investigate the acceptability of the training media to employers and its potential for future health and safety enforcement training.

Research instruments are contained in Appendix 1.

A request for volunteer LAs to participate in the study was published in the LAU newsletter. Representatives of twenty eight LAs responded and indicated that their LA would be willing to participate in the project. Initial discussions with the health and safety line managers at these LAs suggested that this would yield at least 150 trainees. The target was for at least twenty officers to evaluate each training package with an additional forty individuals in a common control group.

#### *a) Pre-training Questionnaires*

Batches of pre-training questionnaires were dispatched to the line managers within these 28 LAs with a request to distribute the questionnaire to all staff who were able and willing to participate. The purpose of the questionnaires was to gather information to enable the training packages to be allocated so that they were tested by a representative group of individuals in terms of experience, age and job title. The pre-training questionnaire consisted of three sections (Appendix 1(i)). Section one sought personal information such as date of birth, job title, health and safety enforcement experience, qualifications and details of other health and safety training undertaken. Section two focused on the trainees' reasons for, and anticipated benefits of participation, and their previous general information technology CBT experience. Section three was concerned with establishing the dominant learning styles of the trainees in order to enable exploration of reaction to the training packages amongst individuals with differing dominant learning styles. A questionnaire developed by Honey and Mumford (1986) was used to produce a rating for each of four identified learning styles to

evaluate whether any particular learning style favoured CBT and determine whether future CBT training initiatives would benefit from an understanding of any dominant learning style amongst health and safety enforcement officers as an occupational group. The four learning styles are activists, theorists, reflectors and pragmatists. Activists learn best by involving themselves fully and without bias in new experiences; theorists prefer to think problems through in a vertical, step by step logical way and learn best by adapting and integrating observations into theories; reflectors like to consider all possible angles and implications before making a move whilst pragmatists are keen on trying new ideas, theories and techniques to see if they work in practice (Honey and Mumford, 1986).

The data derived from the pre-training questionnaire also assisted in determining any influence of previous experience or use of information technology, enforcement experience and learning styles against the use and acceptability of the training packages.

162 pre-training questionnaires were returned from 28 LAs.

#### *b) Allocating participants to training packages and control groups*

The participants were allocated to pilot one of the three training packages or to the common control group. When allocating groups it was necessary to consider:

- The need to ensure that a minimum of 20 officers were allocated to each package with an additional forty in the common control group, which was used for each of the three training packages, matched for experience, job title and age.
- The needs of the LAs involved e.g. availability of Internet access
- The design of the package e.g. special consideration was needed with regard to the Internet package, one component of which allows for interaction between trainees. It was preferable, therefore to keep the number of individuals within a single authority allocated to this package to a minimum to ensure that this facility was used.

The allocation was as follows:

- 32 participants were allocated to pilot the disk;
- 33 participants were allocated to pilot the CD-ROM;
- 30 participants were allocated to pilot the Internet training; and
- 67 participants were allocated to the control group.

Each of the participants completed a pre-training questionnaire.

#### *c) Pre-training desktop exercises*

The participants were required to complete a pre-training desktop exercise (Appendix 1(ii)). This exercise was designed to gather base line data regarding levels of existing knowledge in each of three training areas. The pre and post-test exercises were designed together. In devising these tests, it was necessary to ensure that:

- whilst not identical, the pre and post-training exercises had to be comparable both in content and level of difficulty;
- the exercises were relatively short and simple to complete; and
- the exercises were capable of being readily assessed.

Initially, it was intended to use scenario type exercises, however after consideration of the factors listed above, knowledge based questions were used instead. A pool of questions was devised, piloted and reviewed to identify those questions which were most suitable for the exercises. A marking scheme and specimen answers were also produced.

Each study group received a single exercise according to the package to which they were assigned; the control group was required to complete all three exercises.

Of the original 162 participants 138 completed and returned the pre-training exercise and the study cohort was as follows:

- 31 participants were to undertake the disk package;
- 32 participants were to undertake the CD-ROM package;
- 29 participants were to undertake the Internet package; and
- 46 participants remained in the control group.

*d) User logs*

Those piloting the packages were issued with a 'user log' to complete whenever they used their training package (Appendix 1(iii)). Trainees were asked to record the location and duration of each training session and to note environmental conditions during training. In addition, initial reaction to the training packages was recorded on the user log.

Of the 92 allocated to the training packages -

- 18 piloting the disk returned the user log;
- 26 piloting the CD-ROM returned their user log; and
- 20 piloting the Internet returned their user log.

*e) Post-training questionnaires*

Following receipt of the user logs the participants were sent a postal questionnaire (Appendix 1(iv)), which was in two sections:

- a desktop exercise to gauge any gain in knowledge as a consequence of undertaking the training; and
- a questionnaire designed to establish the acceptability and practical application of the technologies adopted in the study.

The control group received Section 1 of the questionnaire in order to examine the effect of external influences on knowledge gain during the training period. The following numbers of post-training questionnaires were received:

- 14 from the disk group;
- 25 from the CD-ROM group;
- 20 from the Internet group; and
- 37 from the control group.

*f) Telephone survey of managers*

The final cohort consisted of officers from twelve LAs and their line managers were interviewed by telephone regarding the acceptability of the training media and their potential for future health and safety enforcement training. A proforma of the telephone interview was distributed to enable the managers to give a considered response at the time of the pre-arranged telephone interview (Appendix 1(v)).

The managers were employed at a number of different types of LAs as follows:

<b>Authority type</b>	<b>Number of Managers Inter viewed</b>
London Borough	2
Metropolitan District / Unitary Authority	7
Urban and Industrial	1
Suburban	1
Scottish Urban	1

The data gathered was qualitatively analysed; statistical analysis was carried out using SPSS software. The results of this evaluation are presented in Chapter 5. The main findings, discussion and recommendations are presented in Chapter 6; these are discussed with regard to their pedagogical, ergonomic and economic impact and with regard to the training cycle.

## 2. CASE STUDY OF LOCAL AUTHORITY TRAINING PRACTICES

### 2.1 INTRODUCTION

During the second stage of the research project case studies were conducted to examine the training and staff development practices of a sample of twelve Local Authorities (LAs). The investigation took place between September and December 1997. The aim was to review the existing range and scope of training and development activities for health and safety enforcement officers based in LAs. This involved consideration of the strategies and methods which had been employed by these LAs to train their health and safety enforcement personnel over the preceding twelve to eighteen months. The case studies also sought to identify the opportunities and constraints which influenced the design and implementation of training activities.

### 2.2 METHODS

An invitation was extended by the project team (via the Local Authority Unit) to Chief Environmental Health Officers (CEHOs) to participate in the project. To ensure that the sample was representative of the different types of LAs in the UK, reference was made to data regarding numbers and proportions of LAs listed as of March 1996. Table 2.1 illustrates the composition of the case study sample.

**Table 2.1**  
**Composition of the case study sample**

<b>Authority Type</b>	<b>No of Case Studies</b>
London Boroughs	1
Metropolitan Districts	1
Urban and Industrial	2
Suburban	3
Resort and Retirement	1
Rural	2
Scottish Urban	1
Scottish Rural	1

The key areas which the case studies were designed to investigate were:

- the organisation of training activities;
- the means by which training needs were determined;
- the internal and external factors and the opportunities and constraints which influence present and future training activities;
- the training provided for health and safety enforcement officers; and
- the range of training methods and media utilised in training and staff development activities.

In-depth interviews were conducted at each of the authorities with:

- a representative with responsibility for training across the authority;
- the CEHO; and
- a line manager with responsibility for the health and safety enforcement function.

Three semi-structured interview schedules were designed incorporating a combination of closed and open format questions (Appendix 2 (i-iii)). The interview schedule was piloted at three LAs prior to the interview process, to ensure that the required data could be effectively collected and to gauge the time that would be required with each of the three categories of interviewee.

### 2.3 ORGANISATION OF TRAINING

The central training function generally resided within the LA Personnel Departments which were usually part of the Chief Executive’s Directorate. The larger LAs employed up to seven dedicated training staff centrally in addition to departmental training representatives. In smaller authorities, a single officer performed dual personnel and training roles.

There was a clear distinction in each authority between central responsibility for corporate training and staff development addressing general issues such as information technology, customer care and management development, and departmental provision of specific and professional and technical training and staff development to meet service delivery requirements. In some cases, central training staff did liaise with departmental training representatives in relation to specific professional and technical training issues. For example, the pursuit of post-entry qualifications appeared to be needs driven according to the specialist requirements of individual health and safety enforcement units, in some authorities the central training function had an advisory role and in some instances, this responsibility extended to approving and even funding training to secure post-entry qualifications. Table 2.2 indicates the typical division of responsibilities between central training and departmental units for training and staff development activities found in the case study LAs.

**Table 2.2**  
**Division of responsibilities between central training and departments**  
**for training and development activities**

	<b>Training Type</b>	<b>Examples</b>
<b>Central Training</b>	Corporate Focus	IT Skills Management Development Personal Skills Development
<b>Departmental</b>	Professional Development	New Legislation Technical Areas
	Professional Qualifications	Post Graduate Diplomas/MSc NEBOSH Certificate/Diploma

Each authority had a documented corporate training strategy and in most cases, this had been developed by central training personnel prior to approval by senior management and council committees. However, CEHOs and health and safety line

managers were often not conversant with the aims, objectives and content of the corporate training strategy. Furthermore, some Environmental Health Departments (EHDs) had developed their own departmental training strategies or plans, sometimes without reference to corporate strategy. This has the potential to lead to difference between departmental training objectives and broader corporate objectives. Where an integrated approach had been taken this was largely in response to the introduction of procedures designed to secure the Investors in People (IIP) award.

At the time the interviews were conducted, six LAs were progressing towards IIP status (three expected to achieve the award by early 1998), three were exploring the possibility and three had no plans for its introduction. The benefits of IIP were perceived to be formalising existing training practices, development of integrated departmental and organisational training strategies, improvements in the bidding process for training resources and improved contact between staff and line management with regard to training issues. Concerns centred around perceptions of increased work load due to the introduction and operation of IIP procedures and a belief that acquiring the award may become an end in itself rather than representing a genuine commitment to continuing employee development.

## **2.4 BUDGET ALLOCATION**

Budget allocation procedures observed within the case study LAs ranged from relatively sophisticated procedures involving Training Needs Analysis, informed by departmental business or service plans, and/or staff appraisal or employee development review interviews, to informal discussion between officers and line managers. It appeared that the type of method employed was influenced by the size of the authority. Bids for resources to support professional training and development for service delivery were generally finalised by a Departmental Management Team (DMT) as part of the annual bidding process. Training could either be ring-fenced within the departmental budget or be included under another budget heading.

The manager of the health and safety enforcement team was usually also a member of the DMT, but if not they were generally afforded the opportunity to identify the level of funding required for staff training and development within their team. Departmental training budgets were generally approved by senior council committees following recommendations from senior management. Central Training units tended to have a separate training budget and often assumed an advisory role to senior management in respect of prioritisation and allocation of departmental training budgets.

A distinction was often made between the allocation of funding for post-entry qualification courses and that for shorter updating courses and conference activities. Allocation for shorter courses or conferences was typically based on the previous year's allocation plus inflation rather than being determined according to need. For post-entry qualification, resource allocation was based on the needs of the service. In some of the LAs, training budgets were being frozen or gradually reduced.

Resources to meet unplanned and exceptional training needs were invariably acquired by bidding back to the centre as needs arose or were vired from other departmental budgets particularly if training was essential to service delivery or carried implications for the authorities' insurers.

A 'rule of thumb' figure of 1% of pay bill was suggested by one of the case study participants as a simple but equitable means of calculating departmental training

allocations, however the legal requirement for continuous professional updating (CPD) to which some council services are subject, affords them a higher priority in the distribution of resources for training and staff development. Where departmental training budgets were allocated on a per capita basis, this was perceived as disadvantaging smaller departments with fewer staff. The practice of allocating training resources solely on the basis of the previous year's allocation plus inflation had the potential to result in budgets that exceed genuine demand particularly where the department has established an experienced and well-qualified enforcement team. It also appeared to be a feature of local government budget allocation procedures, that under spend adversely affected the following year's budget allocation and that departments could not build up a reserve to finance the development of innovative training activities and methods which might initially have involved significant capital outlay.

## **2.5 IDENTIFICATION OF TRAINING NEED**

The identification of training needs to meet service delivery was performed by line managers at departmental level, possibly with advice from central training. Criteria reported as affecting decisions included service needs, changes in job role, existing qualifications held by individuals, funding received for previous training, and the impact on the service associated with participation in a particular training activity. The needs of the service and council policy were also reconciled with individual training needs expressed by staff. The identification of training and development needs for health and safety enforcement officers in the case studies was achieved by a variety of different approaches.

These included:

- Use of divisional service or business plans informed by annual appraisal or employee development review interviews.
- Formal discussion with line managers and/or the CEHO.
- Informal discussion with line managers prompted by either the individual officer or the demands on the service.
- No system.

The training needs of newly appointed officers were identified by a similar process which incorporated the following features:

- Identification of training and development needs at interview.
- Corporate induction process managed by central training.
- Probationary period of up to six months depending on experience. During this period, new officers might receive partial authorisation and be given responsibility for low risk premises only. They may also be subject to supervision by senior colleagues involving joint visits, shadowing of experienced enforcement officers and verification of correspondence thereby allowing new officers to gradually build up experience and expertise. Essential training and development needs identified during this time were usually met in-house or by attendance at short courses or seminars for which funding is usually provided from departmental budgets. Recently recruited officers were not encouraged to begin qualification courses, and certainly not within six months of appointment.
- Participation in the existing system for the identification of training need.

Generally, departments adopted a similar approach to the identification of training and development needs for newly qualified officers to that of recently recruited, experienced officers but with a longer probationary period and a commensurably greater level of supervision. Interestingly only one of the departments visited in this exercise anticipated recruiting a newly qualified officer, all firmly believing that any vacancies would be filled by the recruitment of an experienced enforcement officer. Financial cut backs were observed to have brought about the demise of student EHO programmes in many LAs, two departments were currently employing student EHOs and none envisaged taking on any more.

## **2.6 METHODS AND MEDIA USED FOR TRAINING AND STAFF DEVELOPMENT**

A variety of methods and media are currently employed by the LAs visited in this exercise for both professional and corporate training and staff development (Figures 2.1 and 2.2). Supervised practice of enforcement officers is a feature of most health and safety teams and coaching both formally and informally is used by the vast majority. Mentoring has been introduced in some departments although it would appear that there are officers adopting supervisory, coaching or mentoring roles without the benefit of formal training. Central training sections tend to use coaching and mentoring methods and are well placed to assist in the development of effective skills for those cast in these roles. Supervised practice is not a technique that had been generally adopted for corporate training in this group of authorities.

Attendance at both in-house and external courses, seminars or presentations continued to be the most popular form of training method. The perception in most departments reflected the view that professional development necessitates 'going on a course'. One day training and development events that avoided excessive travel and overnight stops were increasingly the norm both to combat budget constraints and to achieve performance levels in health and safety enforcement. The practice of disseminating knowledge gained from course attendance to colleagues was widespread and viewed as a cost-effective way of disseminating information whilst at the same time monitoring and evaluating the training exercise. Central training managers appeared to be attempting to change the culture to promote the concept of the 'learning organisation'. Some managers, possibly as a result of participation in management development programmes, were also eager to shift the emphasis towards personal and organisational development through a range of alternative techniques. One manager lamented the prevailing attitude in the department where the reaction to a new problem, issue or situation was automatically to request attendance at a training event.

Award bearing courses that developed professional knowledge either as post-entry qualifications or to meet mandatory guidance criteria were well supported. However, qualification routes that could be directly equate to an officer's current role and/or the needs of the service were invariably not supported largely due to resource implications. Conversely, distance learning was not regarded as an effective alternative principally because departments appeared to be unable to provide officers with appropriate support, particularly time away from work duties for study.

Professional development within health and safety enforcement team activities either in-house or through liaison groups was also proving increasingly attractive. Peer review had been adopted in cross authority exercises by four of the authorities visited. Case studies were frequently used in-house for group training activities often supported by videos and desktop exercises. Action Learning had so far not been used for

professional development but several health and safety managers were attracted to the concept as an extension to current team processes. Clearly some initial staff development would be required before effective Action Learning Sets could be established.

Central training sections made extensive use of Role Play and Case Study exercise, but not Peer review. There were pockets of expertise within some authorities which could facilitate Action Learning Sets, largely as a result of experience in management development courses.

Videos were increasingly used as a focus of group activities, as part of HSE learning packs, or for professional training. Whilst inexpensive and particularly suited to in-house events, there was a definite preference for interactive videos and those that featured workplace situations that enforcement officers were likely to encounter rather than recordings of lectures and seminars. Television programmes were not used for professional development but several authorities had used them to supplement corporate training and staff development. Videos were used widely by central trainers either as professionally produced training material or to record in-house group activities for reflection and self-development. Audiotapes were rarely used.

Figure 2.1  
 Training methods currently employed by the case study LAs.

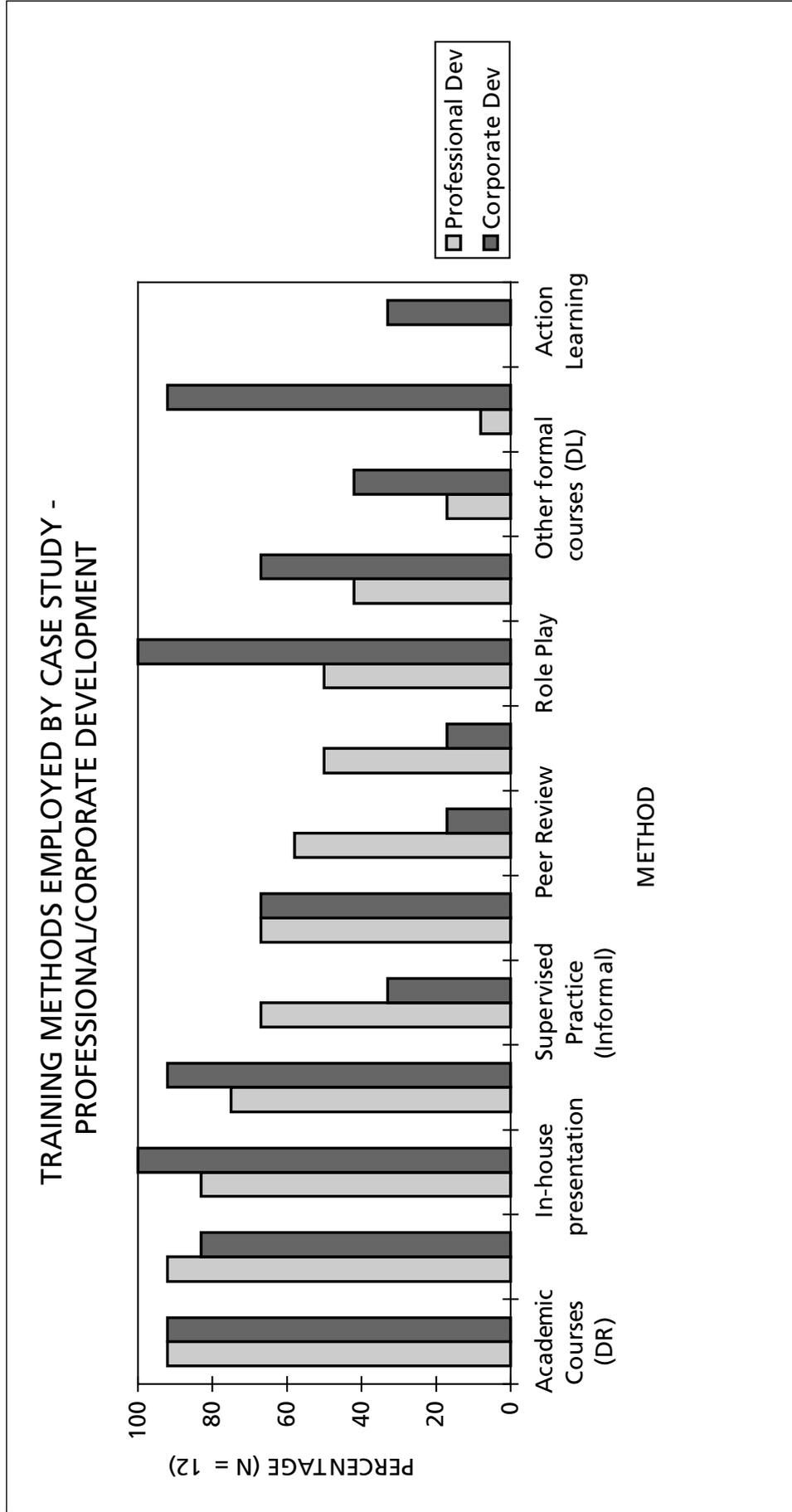
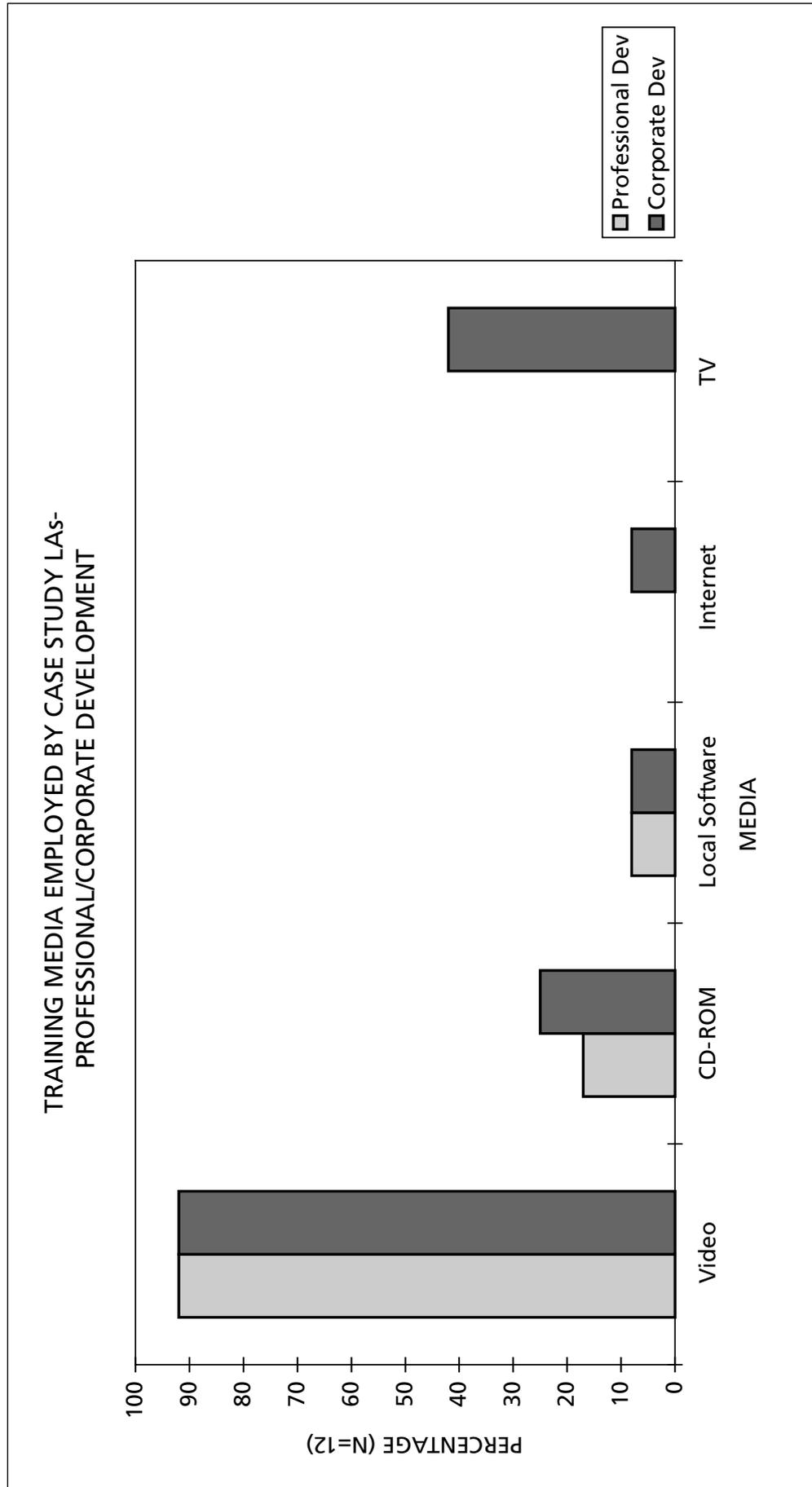


Figure 2.2  
 Training media currently employed by the case study LAs.



Most of the interviewees were optimistic about the potential of CBT as an alternative or additional medium for training and staff development. Many were already using CD-ROMs as an information source and, if not already, were planning to be connected to the Internet. However, none of the case studies employed CBT for health and safety enforcement officer training. Central Training managers were equally enthusiastic about the application of CBT in the future but voiced serious reservations about developing, resourcing and managing computer based learning. None of those interviewed had sufficient knowledge or experience of this medium to make an informed judgement on its effectiveness with the possible exception of one authority that had some experience of Video Conferencing.

Clearly, attendance at short courses and in-house presentations continued to be considered as appropriate methods for delivering knowledge based training. Development in teams focused around a practical activity was also highly regarded with peer review becoming prominent.

## **2.7 EVALUATION AND MONITORING**

Formal processes to monitor and evaluate corporate training were in place at some of the LAs studied. The most commonly used method was post-training questionnaires to investigate reaction to training courses. In some LAs, central training and development officers also contacted line managers shortly after training events to assess subsequent performance. Other departments tended to rely on informal review and feedback or debriefings from officers to line managers. The growing practice of 'cascading', where officers returning from a training event advised colleagues on changes in legislation or enforcement practices also provided an informal means of monitoring and evaluating external training activity. Currently there appears to be little attempt to assess the impact of professional development activities on job performance, with no formal procedures in evidence at many LAs. Authorities progressing towards the IIP award tended to recognise the need to adopt more rigorous evaluation and monitoring procedures. This usually involved collaboration between officers and line managers with the aim of:

- identifying learning objectives prior to attendance at training events;
- evaluating the effectiveness of training activities in meeting learning objectives identified; and
- monitoring the impact of learning on the professional development of the officer and on departmental performance in respect of service delivery.

## **2.8 MAJOR CONSTRAINTS ON TRAINING**

Table 2.3 illustrates the major constraints on training identified by CEHOs, health and safety line managers and central training personnel interviewed. The constraints highlighted were principally concerned with the cost of training and staff development and time away from enforcement duties because this potentially lead to difficulties meeting performance targets. Other constraints included a paucity of local training events, inadequate facilities for CBT, dependence on external training provision, and insufficient suitable courses in terms of location, attendance patterns, content, and relevance to the needs of departments. Specific mention was made of the lack of appropriate qualification courses for Technical Officers (TOs).

**Table 2.3**  
**Major constraints on training**

	<b>CEHO</b>	<b>Line Manager</b>	<b>Central Training</b>	<b>Total</b>
Time available	9	8	11	28
Cost	6	10	9	25
Suitable external courses	5	5	1	11
Travel time	3	4	1	8
Training facilities	2	-	2	4
Inadequate IT resources	1	1	2	4
Quality of external trainers	1	1	-	2
Over demand	-	-	2	2
Shortage of skills	1	1	-	2

More funding for training and flexible attendance patterns such as half-day training events and staggered attendance times (e.g. 9-11a.m. return to work then 3-5p.m.) were suggested solutions to the major constraints of cost and time away from enforcement duties. More in-house activities using training packages and greater collaboration with other authorities were also seen as ways of producing ‘the right course, at the right price, at the right time’. Some geographically remote authorities would like HSE training events to be delivered at more accessible regional locations, and the development of video conferencing by HELA was also seen as a potential solution to overcoming barriers to training.

## **2.9 FUTURE TRAINING NEED**

CEHOs and health and safety line managers predicted that future training and development needs for health and safety enforcement officers would feature:

- greater emphasis on practical training and the development of professional skills and judgement;
- updating to mirror development in the training of health and safety officers in industry;
- a competence-based approach;
- postgraduate level courses; and
- a more proactive approach to training and staff development precipitated by the introduction of IIP procedures in Local Authorities.

Recognising the trend towards greater use of in-house training some health and safety managers would welcome:

- more HSE videos featuring work activities rather than lecture or seminar situations;
- cost-effective literature and videos to facilitate the development of technical skills in typical areas of health and safety enforcement;
- interactive CD-ROMs; and
- relevant self-review and self-assessment material.

Concern was expressed that a skills gap could be created by LA reorganisation and downsizing; it was anticipated that this might generate training needs as available expertise was reduced. There was a recognition that generalist EHDs were not conducive to cost-effective training and staff development. In comparison, specialist teams might ultimately require less in-post training due to continuous reinforcement of knowledge on the job and the accumulation of in-house expertise. It can also be argued that specialisation may reduce the number of staff for whom a particular training facility or course was relevant. Several authorities were attempting to establish or maintain health and safety enforcement teams consisting exclusively of EHOs. The advantage of appointing EHOs appeared to be that they were considered competent by virtue of their entry qualifications and experience, whilst the training and development of TOs was believed to lead to regrading issues.

There was also some dissatisfaction with the existing qualification courses currently available for TOs, which might require addressing in the future. Many regarded the NEBOSH Certificate as the minimum qualification for health and safety enforcement but others felt that the NEBOSH Diploma was not appropriate for TOs.

One CEHO suggested that LAs should consider establishing advisors without enforcement powers for the business community to promote self-regulation. Clearly, such a strategy would also hold implications for future training and development of health and safety enforcement officers.

Central training and development officers were concerned about the cost of providing quality training considering current levels of training budgets which are often threatened in times of financial restraint. They believe that training in the future would:

- become more employee centred;
- include the use of drop-in learning resources;
- promote open and distance learning;
- encourage work-based learning (e.g. NVQs);
- feature managers as facilitators and deliverers of training and development activities; and
- be based largely around computer technology such as CBT for knowledge based subjects and video conferencing.

No one interviewed for these case studies had any experience of CBT. This suggests that prior to any decisions being made about the implementation of CBT for health and safety enforcement officer training, advice would need to be sought and appropriate staff training executed. The capital costs associated with CBT and the requirement to upgrade existing hardware were perceived to be major issues that authorities would need to address if they were to embrace emerging technologies as a training medium. The development of suitable cost-effective software was identified as a major priority.

## **2.10 CO-OPERATION IN TRAINING WITH OTHER LOCAL AUTHORITIES**

Collaboration between Local Authorities with regard to training provision presents a means of increasing the cost-effectiveness of training and the opportunity to share collective knowledge and expertise. There was evidence of a proactive approach to the organisation and delivery of professional training by County Health and Safety Liaison groups which had been active in arranging courses and seminars and in developing learning packs. Some were addressing current issues such as National Vocational Qualifications (NVQs), alternative approaches to the assessment of competence and peer review as a means of promoting consistency.

Some EHD had formed fruitful partnerships with local industry and there were examples of training events for health and safety enforcement officers scheduled 'out of trading hours' on business premises. One health and safety team operated a commercial unit, which provided health and safety training for the local business community; the manager concerned was of the opinion that this operation not only raised funds for the authority but promoted the advisory role of enforcement officers and facilitated the development of their interpersonal skills.

## **2.11 DISCUSSION AND CONCLUSIONS**

A wide variation was found in the training practices of the different authorities comprising the case study set. This section summarises the themes which emerged throughout the course of the interviews.

### **2.11.1 Factors Influencing LA Training Practices**

The needs of the service and the size, structure and geographical location of LAs were among the key external factors that influenced the selection of training strategies and methods for health and safety enforcement officers.

The size of an authority appeared to determine the range of corporate training available to officers. Professional development was influenced by the number of staff involved in health and safety enforcement and the demands inherent in delivering a good service and meeting performance targets. The size of the health and safety team also seemed to determine the degree of the formality attached to the process of identifying and meeting training and development needs.

The deliberate selection of LAs from a wide variety of geographical locations drew attention to additional problems faced by some managers when selecting training activities. Travel time and costs as well as possible overnight stays have budgetary and time implications when choosing training activities.

Internal factors reported by professional officers as impacting upon the training strategies and methods adopted within LAs included the role of central training department, the type of budget allocation in operation, the composition of health and safety enforcement teams in terms of the mix of EHOs and TOs together with the authority's policy on recruitment, professional development and authorisation of TOs. Training decisions also tended to reflect the particular authority's response to changes in central government policy and legislation and peculiar local issues such as the introduction of IIP.

The range and quality of resources available for in-house training was a further influence on training decisions. Whilst the majority of the authorities visited in the project had good or at least adequate accommodation and basic delivery tools, few if any were in a position to immediately embrace current developments in CBT or make informed decisions as to its effectiveness for the professional development of health and safety enforcement officers. The cost of development, implementation, management and updating of technology based resources would appear to be beyond the current level of departmental budget allocations for training and development.

### **2.11.2 Training for Local Authority Health and Safety Enforcement Officers**

The professional updating activities and qualification courses pursued by the health and safety enforcement officers featured in this exercise were undoubtedly selected to meet the needs of the service; whereas participation in corporate training and development seemed to be in response to needs generally identified by individual officers. It would appear that for many, the combination of budget constraints and the issues around absence from the workplace determined the type and location of training, as well as the numbers of staff able to attend external events. This had resulted in the increase of in-house presentations and workshops led by those returning from short professional training activities and conferences. This practice tended to reduce the need for repeating many of the non-qualification training courses and was suggested as the reason why the evaluation of the trainer and the training medium took precedence over the evaluation of the content of the external courses.

Some line managers were attempting to introduce self and peer development either directly on-the-job, through accompanied visits, or by in-house whole team development activities. However, the culture that prevailed was one where training was synonymous with attendance at courses and conferences. The impression was given that line managers would welcome and benefit from training to assist them in facilitating cost-effective training and development for their own staff. Whilst there were claims that mentoring and coaching were regularly employed, these were not substantiated by any evidence nor was it apparent that line managers and senior officers had received training or instruction for these roles. Peer review appeared to be gaining in popularity, particularly when conducted in conjunction with neighbouring authorities. Collaborative ventures with other LAs, HSE enforcement liaison officers (ELOs) and local businesses in on-the-job training activities were generally regarded as proving effective.

The case studies revealed the use of a wide range of instructional techniques in practice. Attendance at taught training and qualification course were likely to remain an effective and popular medium for imparting information and knowledge, providing the issues of cost and time away from enforcement duties were addressed. Distance learning was not favoured when compared to attended courses and the apparent inability of departments and authorities to provide effective levels of support. In-house presentations and workshops where officers cascaded information to colleagues were undoubtedly popular but some managers were concerned about the quality of the presentation skills and the degree of personal interpretation that was associated with this form of peer development.

A variety of group development techniques was employed and videos and case studies focusing on situations that health and safety enforcement officers were likely to encounter had proved particularly cost effective. However, although it appeared that

the introduction of CBT for health and safety enforcement officers would present difficulties, it was anticipated that developments within the LAs in terms of IT provision would address these potential barriers. The line managers involved would undoubtedly benefit from exposure to the potential of this instructional medium but clearly the resource implications were a matter of great concern.

It was noticeable that some departments and authorities, particularly those progressing towards IIP status, had instituted procedures that encouraged officers and line managers to identify and integrate ongoing training and development needs, and the relevant opportunities by which these could be achieved at regular employee development reviews. Learning objectives were set prior to training activities and reviewed immediately after; some authorities were attempting to introduce an evaluation of the impact of training and development on job performance six months later. This process appeared to be in its infancy, and seemed to rely entirely on feedback from the officers concerned at a subsequent appraisal or employment development review interview.

There were a few examples of support and reinforcement activities for officers who had recently gained new knowledge and skills. These included becoming responsible for a new specialist area, teaching colleagues and delivering training to local businesses as well as further development on accompanied visits with senior officers. Those pursuing qualification courses appeared to be very much left to their own devices unless they actively sought the involvement of the department in some aspect of the course such as a work based project or assignment. Authorities seemed to rely on progress reports from colleges or universities rather than on an established procedure for supporting and reinforcing learning.

### **2.11.3 Opportunities and Constraints Affecting LA Training Practices**

A number of opportunities were identified in relation to training provision amongst the case study authorities. Reorganisation had required a period of readjustment for some authorities, however it had created larger health and safety units with more opportunities for officers to be released for off-the-job training and to participate in in-house developmental activities with their new colleagues. Collaborative training and development with ELOs had proved to be extremely effective and a number of departments had taken the opportunity to co-operate with other authorities (via health and safety liaison groups) to organise training courses and seminars and develop learning materials. Most of these groups appeared to be extremely proactive and could be a focus of innovative training and development in the future.

The introduction of staff appraisal /employee development review interviews seems to have presented a major opportunity to integrate the needs of the individual with those of the authority and the service. Those authorities pursuing IIP status had taken the opportunity to formalise existing procedures, integrate central and departmental training strategies, improve bidding processes for training resources and encourage line managers to become more involved in training issues. Some departments anticipate that the IIP award will attract more resources for training and development from the authority and from external funding agencies. It was also noticeable that those authorities that were introducing the IIP award or using similar processes to manage the development of employees were promoting a significant shift from the view that professional and personal development should necessarily always be achieved by attendance at a course, towards the concepts of learning on-the-job and the 'learning organisation'.

The professional requirement for continuing professional development (CPD) for officers delivering certain council services did appear to influence budget allocation and was perceived by several departments to create an opportunity for attendance at outside events which could subsequently form the basis for an in-house cascading activity and for on-the-job development of colleagues. Nevertheless there was some criticism of the effectiveness of the current approach which was largely achieved by attendance at external courses and conferences – the view by one manager was that it should be linked to work based learning and assessment of competence might be worthy of further consideration. The opportunity to provide training for local businesses seemed not only to generate additional income for the authority, but also enhanced the development of the emerging advisory role of health and safety enforcement officers and interpersonal skills of participating officers.

Funding clearly continues to be a major constraint on training and staff development, particularly during an era of reorganisation and restraint on the resourcing of public sector services and at a time when alternative forms of training provision such as CBT and distance learning become more available. This situation is not helped by local government practices that appear to prohibit carrying forward elements of annual training budgets to subsequent financial years in order to facilitate the introduction of innovative change.

The achievement of performance targets and target response times was clearly a major negative influence on the time officers could be released for off-the-job developmental activities for this sample of LAs. Attendance at post-entry qualification courses seemed to be under threat at some of the participating authorities, largely as a result of workload and budgetary constraints. The option afforded by distance learning was rejected by many on the grounds that authorities and departments were unable to provide the essential levels of support required by this form of personal development.

Finding the most appropriate external courses at the right time and price was identified as a constraint on training practices but the impression was also given that this could be resolved by improvements in strategic planning and communications with external providers and liaison groups. The relocation of their ELO appeared to have disadvantaged geographically remote authorities by restricting and in some case removing valued collaborative opportunities for professional development in health and safety enforcement. Some felt this could be addressed by the organisation of more regional training events.

Reorganisation has brought about considerable changes in structure, practices and personnel in several of the authorities featured in these case studies. Unfortunately, employee development does not appear to have been a high priority for some of the new councils particularly where reorganisation was accompanied by budget constraints and downsizing. Restrictions on new appointments were predicted to generate the need for a more diverse and widely developed workforce, whilst simultaneously reducing opportunities to participate in off-the-job opportunities.

### **3. LITERATURE REVIEW AND PRODUCTION OF A GUIDE TO MANAGING HEALTH AND SAFETY INSPECTOR TRAINING**

#### **3.1 INTRODUCTION**

Meeting training and development needs can be onerous in a fast moving area such as health and safety enforcement. Legislation undergoes frequent revisions and work patterns and activities change introducing new and different risks into the workplace. These developments may precipitate gaps in knowledge, skills and/or attitudes, all of which need to be addressed if inspector competence is to be maintained.

Line managers are central to the training process probably influencing as much as 95% of the individual's development in the workplace. Their responsibilities include:

- determining what knowledge and skills are required to fulfil the enforcement role;
- reviewing what knowledge and skills already exist;
- planning to fill the gap between the two;
- ensuring action takes place and
- monitoring and evaluating training outcomes.

(Taylor and Thackwray, 1996).

One of the primary aims of this project was to compile a guide to facilitate health and safety inspector training in LAs and assist managers in the implementation of their authority's corporate training strategy, particularly in ensuring the maintenance of a trained and competent inspectorate as required by the Section 18 guidance (HSC, 1996).

#### **3.2 PREPARATION OF THE GUIDE**

There were four stages to the preparation of the guide:

- Stage 1: Literature Review
- Stage 2: Production of the Training Guide
- Stage 3: Review of the Training Guide
- Stage 4: Dissemination of Training Guide

#### **3.3 LITERATURE REVIEW**

A literature review was undertaken to inform the development of the training guide and the design of the training packages. The primary purpose of the literature review was to examine the published information on training and to provide the theoretical underpinning for the guide.

The review included a consideration of how individuals learn, what the training process involves and how training strategies are developed. Training methods and media were given detailed attention and the selection of suitable training media and the likely impact of emerging technologies in training was explored. The review also considered the effectiveness and suitability of different media, including computer based learning, for training LA inspectors in health and safety enforcement. Although not the primary focus of this research, training content and trainee characteristics were also considered since they impact upon the success of training initiatives.

### 3.4 PRODUCTION OF THE TRAINING GUIDE

The aim was to provide a user-friendly guide to assist managers in developing a structured approach to addressing the training and developmental needs of their enforcement staff. Specific examples, based on local authority experiences, were used to illustrate principles in a meaningful way. The guide was not designed as a blue print for training practice since the diverse nature of LAs precluded such a prescriptive approach.

The guide is based upon the training cycle, (as shown in figure 3.1) and advocates a step-wise approach to managing training. For ease of use it is divided into two parts:

Section A is a quick reference section comprising an action summary for each of the key steps of the training cycle; i.e.

- identifying training needs;
- planning and designing training;
- delivering training; and
- evaluating training.

**Figure 3.1**  
**The training cycle**



Source: Pont, Tony. (1991)

Section B provides more detailed information about the management of each step.

The central message conveyed for each of the steps was as follows:

#### *Identification of Training Needs*

To be most effective training must be integrated into the organisation as a whole and should not occur in a haphazard, unplanned manner. Training Needs Analysis (TNA) is a process by which training and development needs can be identified and problems which can be resolved by training are distinguished from those which cannot. There are a series of steps in Training Needs Analysis, namely:

- 1 the identification of what needs to be achieved within the department;
- 2 setting objectives for performance (this requires an understanding of what knowledge and skills are needed to accomplish the objectives);
- 3 reviewing the knowledge and skills of the staff; and
- 4 planning to fill in the gaps between the two and three to fulfil the identified deficiencies within the department.

*Planning and Design of Training*

Once the training needs for the department are identified, the manager must then plan and design appropriate training and development activities. Planning training in a systematic manner will assist in prioritising training needs, formulating training plans and delivering cost effective training.

There are many training methods to choose from, some examples are listed in Figure 3.2; the line managers' task is to select the most appropriate blend of training methods and media and to incorporate these into a training package for each of their officers. It is unlikely that the use of one training method alone will satisfy all the identified training needs, therefore a 'multi-method' approach that incorporates pre-training experiences and post-training reinforcement is recommended.

**Figure 3.2**  
**Training methods and media**

<b>Training methods</b>	<b>Training media</b>
* Action Learning	* Audio cassettes
* Cascade training	* CD-ROM
* Case studies	* Lectures
* Coaching	* Print
* Mentoring	* Simulation and virtual reality
* One to One instruction	* Video
* Open Learning	* Video conferencing
* Peer review	* Web-based training
* Role play	
* Tutorials	

To develop a systematic approach to training design a training plan for each officer should be prepared by:

- determining the aim of the training;
- stating what the individual needs to know or do following the training;
- describing the content of the training;
- selecting training techniques; and
- determining how the training will be evaluated.

In selecting an appropriate training technique several criteria should be considered, particularly:

- the objectives of the training;
- the nature, location and number of trainees;
- the strengths and limitations of the various methods and media available; and
- practical constraints such as time away from workplace, cost and available facilities.

#### *Implementation of Training*

At the implementation stage the manager must decide whether to harness in-house expertise to deliver training internally, or to look outside the organisation for training provision.

Ways of delivering training internally include participative techniques such as role play and case studies or embracing new techniques and exploring CBT such as the use of interactive CD-ROMs.

External training provision can be in the form of tailored training, that is hiring a trainer to deliver specific training on a pre-determined subject or securing a place for staff on a formal training course.

In making decisions about delivery it is necessary to determine if on-the-job or off-the-job training is appropriate and consider the resources available (equipment, personnel and financial).

If an advertised formal training course is the only way to fulfil an identified training need, it must be examined for its suitability. The objectives of the course should be available and examined to ascertain if the course fulfils the training need identified. Verification of the prior level of knowledge that is expected of the delegates is also essential. It should be established whether the training course is a cost effective way of providing training and that the organisation offering the course is reputable.

#### *Evaluation of Training*

The final stage the evaluation of training activities is an essential step in the management process. The aim of evaluation is to assess whether a training activity has met its original aims and objectives. In addition, evaluation of training will indicate whether a training activity has been efficient and effective.

Evaluation at four levels is recommended to:

- assess the reaction to the training, i.e. what the trainees thought of the training;
- assess the learning which has taken place as a result of the training;
- identify changes in behaviour in the job as a result of the training; and
- identify the impact of the training on the organisation.

Evaluation increases in difficulty at successive levels, but it is important to undertake evaluation at all levels. At levels one and two evaluation can include techniques such as post-training interview or questionnaires; however, more sophisticated methods such as observations of job performance or staff appraisal need to be employed for levels three and four. Restricting evaluation to the simpler levels only assesses the effect of the training on the individual, and not the benefits to the organisation. Inappropriate

evaluation may result in misleading findings and money being invested in training that is of little or no benefit to the organisation.

The outcome of an evaluation exercise may result in the decision to continue the training in its original format, redesign the training or indeed the decision that the training is unnecessary. Revisions may be accomplished by modifying the training content, trying different methods of training or revising the preparation for the training for example by redefining the pre-existing knowledge required by the trainees. It may be appropriate to schedule the training for a different time, for instance dedicate time at the beginning or end of the day - when there are no interruptions.

### **3.5 REVIEW OF THE TRAINING GUIDE**

The first draft of the guide was reviewed by 15 local authority representatives, all of whom had line management responsibilities for health and safety enforcement staff. Each representative received a draft copy of the guide and was invited to attend a day long Review Meeting. Views were sought as to the relevance and clarity of the information, the suitability of its presentation, format and ease of use. At the Review Meeting, the representatives worked in groups to comment upon each of the sections of the guide.

The outcomes of the Review Meeting were incorporated into a revised draft of the guide. The revised draft was further appraised by the Project Director, three local authority health and safety line managers and the members of the Health and Safety Executive and Local Authority Liaison Committee (HELTA) before the final draft was completed.

### **3.6 DISSEMINATION OF TRAINING GUIDE**

The guide entitled 'Managing Training for Health and Safety Enforcement Officers - A Guide for First Line Managers' was launched at the CIEH 1998 Congress in Harrogate and subsequently distributed to all local authorities in September 1998.

## 4. DEVELOPMENT OF COMPUTER BASED TRAINING MATERIALS

### 4.1 INTRODUCTION

Learning in the workplace is diverse and extends traditional definitions of learning to include more informal aspects, for example mentoring, job swaps and open and distance learning. This diversity is a key factor in the success of learning at work, where more restrictive formal learning methods may act as barriers. Consequently there are many who believe that organisations should promote new learning technologies to facilitate progression and in doing so, erode temporal and geographical constraints (Jarret & Coates, 1995; Keeling et al., 1998). In response to the enthusiasm of the line managers interviewed during the case studies and the identified potential benefits of CBT it was decided that all three proposed training packages be computer based. It was important that the technologies adopted encompassed the range of computer hardware available within Local Authorities (LAs) and the final proposal was for:

- a simple computer program delivered by floppy disk;
- a highly visual program incorporating video footage, delivered by CD-ROM; and
- a case study employing discussion groups and global information networks, delivered via the Internet.

### 4.2 COMPUTER BASED TRAINING

Computer based training (CBT) is an effective way to deliver information which is easily broken down into steps and sequences and involves facts and formulae; it is also convenient for testing knowledge acquisition. CBT delivers a consistent training message, whilst allowing students to progress at their own pace.

Training packages featuring CBT are popular; the programmes normally use visually stimulating graphics, some also include audio presentations. Many of the training programmes give immediate feedback on results from the training which motivates the user to progress to the next topic (Goldstein, 1993). Personal computers are now widely available, and most workplaces and many homes have systems which are able to operate CD-ROM and other software. Software which does not use moving video images, or contain complex animation or high levels of graphics is inexpensive to produce and purchase, which makes this medium a cost effective alternative to more traditional teaching media.

CBT requires the learner to use a computer keyboard in line with screen instructions; to access information stored on the computer and respond to questions. Instruction proceeds as a function of the relationship between measures of learner performance, available instructional alternatives and criteria of competence (Laurillard, 1993). The role of most CBT is to use a tutorial style approach to solve training problems. The computer has a dialogue with the learner and allows interaction with the program. Learners move throughout the program either in a linear sequence of tutorial frames or by branching around the program. The use of the Internet in CBT encourages the learner to explore beyond the confines of the initial program and access to interact with documents, websites and colleagues at a global level.

#### *The Benefits of CBT*

The benefits of using CBT have been identified and are summarised in Table 4.1.

**Table 4.1: The Benefits Of Computer Based Training**

<b>Benefit</b>	<b>Rationale</b>
Consistency	CBT will always offer the same information, in the same way and will check that the learner has understood the point.
Flexibility	Once purchased, CBT is available most of the time. Training can take place at the convenience of the trainee and the organisation, e.g. during quieter parts of the day. In addition, should an unexpected problem occur preventing an officer from undertaking an allocated CBT session, there are no resource implications since the training can be rescheduled.
Reference Material	CBT can generally be accessed at any time and consequently provides a useful reference tool, for example consulting case law when deciding upon enforcement action.
Revision	Staff may require revision or refresher training, e.g. following career breaks or secondment to another section. Revision can be completed quickly using CBT, since the trainee can bypass areas with which they are familiar in order to concentrate on those areas which need to be updated. This is cost and time efficient, as the individual does not need to participate in training where only a small proportion of the material is appropriate for their needs.
Cost Effective	CBT may be cost effective if a sufficient number of trainees require the training, a suitable 'off-the-shelf' package is available or there is in-house expertise available to develop a package. CBT can save costs otherwise incurred for travel and subsistence.
'Just in time training'	The optimum time to learn how to do something is prior to carrying out that task. This is when motivation is highest and when most skill or knowledge can be transferred from the learning situation into the work activity.
Practical	CBT enables training to be undertaken in small, easily managed periods. This causes minimal disruption to day to day activities, and does not require absence from the workplace.
Pace directed by trainee	Learners can progress at a pace which suits them. They can advance through the program or return to elements which need clarification. In contrast, the pace of traditional training is directed by the 'trainer' and is unlikely to meet the needs of all of the participants all of the time.
Privacy	Working alone on a CBT packages allows trainees to make mistakes and be corrected without the fear of looking foolish amongst their peers.
Learning by discovery	Even simple CBT programs permit the trainees to try different answers to help understand the training material. More complex programs, particularly those delivered via the Internet encourage trainees to look for further information from other sources.

(Ravet, S. and Layte, M., 1997; Tucker, B. 1997)

### *The Limitations of CBT*

The success of CBT, like all other training media, depends on a needs assessment for the individual and appropriate instructional design. Unless well formulated, CBT programmes can be frustrating and therefore demotivating. Some expertise is required in choosing materials to ensure compatibility with workplace computers; technical expertise is also required to install the programmes and instruct trainees in their use. In addition, some trainees may not be confident enough to use the computer alone and will need additional supervision to enable them to make use of the training package. Feedback during training motivates the trainee to progress through a program. Table 4.2 summarises the limitations of and barriers to CBT in the workplace.

**Table 4.2**  
**Limitations of computer based training**

<b>Limitation</b>	<b>Rationale</b>
Software	Commercial software is generally expensive to purchase. The content of commercial training programs may not be suitable for enforcement officers or be sufficiently up to date for users.
Practical constraints	Capital outlay may be too expensive for individual departments, Ideally sufficient terminals should be available or booking system must be designed to facilitate planned access. Insufficient access will demotivate trainees.
Confidence	Not all trainees are confident to use a PC without assistance and may require pre-training and/or additional support.
Reliability	If the system is unreliable, trainees will be discouraged from using it.

(Ravet, S. and Layte, M., 1997; Tucker, B. (Ed.) 1997)

### **4.3 INSTRUCTIONAL DESIGN OF THE WORK BASED TRAINING PACKAGES**

Instructional design can be approached in a number of ways but generally incorporates the following features:

- 1 activating motivation;
- 2 informing the learner of the objectives;
- 3 directing attention;
- 4 stimulating recall;
- 5 providing learner guidance;
- 6 enhancing retention;
- 7 promoting transfer of learning;
- 8 eliciting performance; and
- 9 providing feedback.

Traditional instructional design principles provide a set of formal rules to assist with the development of instructions in three stages: need analysis, choice of materials and evaluation. The needs analysis aims to define the learning objectives of the instructions and tasks required to achieve these objectives. The materials and methods are then selected based on a sequence of activities that help to attain the required outcomes from each learning process. The main criticism of traditional instructional principles is that they follow an objectivist approach which assumes that knowledge is independent of instruction and learners. Thus, learners' characteristics are not taken into account. The very precise and prescriptive nature of the approach stifles the learning process by not allowing learners to have initiatives to explore and be responsible for their own learning.

The constructivist approach which is learner-centred, is built on the psychological theory of learning and cognitive development. The underlying belief is that an instructional control strategy exerted by a learner is more effective for building up knowledge than a control strategy that is pre-defined in computer programs by system designers (Pham, 1998). In this strategy, students gain knowledge by constructing tasks and exploring systems themselves. It has been argued that this encourages students to be more confident, independent and responsible for their own actions. It also helps them to retain the enthusiasm and knowledge learned. Cunningham et al (1993) proposed seven principles for constructivist design which aim to encourage students to actively participate in the learning process, to apply knowledge to realistic and relevant situations, and to collaborate with others. The emphasis is on providing tools for students to retrieve, record and analyse information, instead of providing specific instructions. In addition the model seeks to provide for social interactions between the students and with the tutor.

Spiro's (1988) cognitive flexibility theory builds upon other constructivist theories. It has evolved in response to interactive technology and supports its use for training. The four principles of cognitive flexibility theory are:

- 1 Learning activities must provide multiple representations of content.
- 2 Instructional materials should avoid oversimplifying the content domain and support context-dependent knowledge.
- 3 Instruction should be case-based and emphasise knowledge construction, not transmission of information.
- 4 Knowledge sources should be highly interconnected rather than compartmentalised.

#### **4.4 TRAINING MEDIA**

Traditional methods of instruction rely on linear media, e.g. textbooks and lectures. Linearity of media is not a problem when the subject matter being taught is well structured and simple. However, as the training content and structure of training increase in complexity linear approaches become inappropriate, as they are unable to reflect the multi dimensional interrelationships between the elements.

The use of personal computers in training and programs using hypertext make practicable new forms of non-linear and multidimensional instruction that are better suited to conveying complex content (Spiro & Jehng, 1990). Hypertext is a computer software system for organising and storing information which can be accessed

nonsequentially and constructed collaboratively by authors and users (Jonassen, 1991). A user is able to select a key word from the display on the screen and move through the structure of the document. The user is thus able to elicit further information about the key word or develop an idea. A simple example of straightforward hypertext is the help feature of a word processing package.

Because hypertext is dynamic and non-linear it enables the development of an instructional environment that supports cognitive flexibility theory (Jonassen et al, 1992). In traditional text, learners are encouraged to follow the author's style and organisation of text, these reflect the author's knowledge structure. In hypertext readers are not constrained by the subject matter structure or the author's organisation of the text. An individual's knowledge structure is unique, the ways that individuals prefer to access, interact with and interrelate information is also distinct. Therefore, access to and organisation of information should be under the control of the learner. In hypertext users may explore information in ways that make that knowledge more comprehensible to themselves thus facilitating the meeting of personal learning needs.

#### **4.5 MATCHING TRAINING MEDIA AND INSTRUCTIONAL DESIGN**

The training media selected for this project were all suitable for skill and knowledge acquisition and also had the advantage that they could be accessed by the trainees at times which were suitable to them and their organisation. The subject matter for each medium both reflected and exploited the suitabilities and strengths of the particular medium. These are depicted in Table 4.3. An acknowledged weakness of the packages was that apart from the provision of text giving recommended solutions to the questions asked of trainees there was no personal feedback, nor was there opportunity for contact with a course tutor, as there would be in a traditional setting. Both of these facilities can be incorporated into CBT, but these particular packages were designed to 'stand alone'.

The subject matter for the training for the three packages is as follows:

- 1** The Health and Safety (Enforcing Authority) Regulations 1998 (floppy disk)
- 2** Hotel Safety (CD-ROM)
- 3** Accident Investigation (Internet)

Both the disk program and CD-ROM were developed using traditional instructional design. The study areas were suitable for this instructional design as being typical of subjects with a right and wrong answer; they followed a logical construction which enabled trainees to 'learn' the information transmitted through the package. In contrast, the web based training package was formulated using constructivist learning theory and included elements of Spiro's cognitive flexibility theory since accident investigation contains many areas where there is no right or wrong answer. In practice, investigators build up a picture of the events leading up to the accident in order to determine what actually occurred. By using constructivist theory and encouraging the users to move around the program as they choose, they could undertake the investigation much as they would in practice. In addition, hypertext to external websites and discussion with the other participants facilitated the construction of new ideas and encouraged the trainees to use information other than that given directly.

**Table 4.3**  
**Suitability and strengths of the selected training media**

	Floppy disk	CD-ROM	Internet
<b>CONTENT</b>	Health and Safety (Enforcing Authority) Regulations 1998	Health and Safety Enforcement at Hotels	Practical Accident Investigation
<b>SUITABILITY</b>	Content that is not visual. Subject matter which can be broken down into logical steps. LAs with older or less elaborate computer systems are able to participate in the study.	Subject matter that contains large quantities of information. Content which is enhanced by visually stimulating graphics, including video.	Case studies; subject matter which has related technical information on world wide web; subject areas where consistency of enforcement important.
<b>STRENGTHS</b>	Simple to use. Interactive application gives instant feedback.	Video footage and photographs enhance learning experience. Possible to reproduce or simulate workplace safety documentation.	Trainees able to communicate with each other via email and discussion groups. Access can be gained to numerous relevant databases and organisations. Built in 'peer review' process encourages trainees to discuss the case simulation with each other and enhance consistent approach to enforcement.

#### **4.6 DETAILS OF THE TRAINING PACKAGES**

The aims, objectives and means of assessment for the training packages are presented below.

##### **4.6.1 Floppy Disk: Health and Safety (Enforcing Authority) Regulations 1998**

The Health and Safety (Enforcing Authority) Regulations 1998 came into force on 1 April 1998. The purpose of the regulations is to allocate responsibility for the enforcement of the Health and Safety at Work etc. Act 1974 (HSWA) between the

Health and Safety Executive, Local Authorities and for certain matters the Fire Authority. As the regulations came into force in 1998 there were no nationally based training materials available at the beginning of the project. Legislation is traditionally viewed as an unexciting area for study. The development of CBT to promote a systematic approach to the implementation of the regulations was proposed as a novel and informative method of delivering training in this subject.

#### *Aim of the training program*

To enable health and safety enforcement officers to apply the Health And Safety (Enforcing Authority) Regulations 1998.

#### *Objectives of the training*

At the completion of this training, trainees would:

- 1 have knowledge of the main principles involved in determining the appropriate body for the purpose of enforcing health and safety legislation; and
- 2 be able to apply a systematic approach to establish whether a particular premise is within Local Authority or Health and Safety Executive jurisdiction.

These objectives were realised by the development of a CBT package which:

- offers an explanation and interpretation of the main components of the Enforcing Authority Regulations;
- provides a step wise approach to determine the application of the regulations to individual work activities;
- contains five scenarios for the trainees to practise applying the systematic approach described above; and
- contains a glossary of work activities to assist with the package.

#### *Assessment*

Having familiarised themselves with the terminology of the regulations and practised applying the regulations in a systematic manner, aided by the flow diagram, users can perform a self test using the incorporated scenarios.

#### *Training content*

Essentially the program comprised a flow diagram which described the application of the regulations. At critical points in the application of the regulations, decisions are required which affect the outcome. These points are included in the flow diagram, which also contains hyperlinks to a glossary and regulations. A set of practice questions is incorporated into the program and several realistic work based scenarios, with hidden answers, are available for users to test their knowledge and skill applying the regulations.

Utilisation of hypertext meant that the trainee can 'jump' to connected pages of text, giving definitions, detailed explanations, contents of specific regulations, etc.

This program was designed to run on a basic Windows 3.1 operating system, therefore the graphics and interface were simple. The program is written in Adobe and requires Adobe Acrobat Reader to view it; this was distributed with the floppy disks to ensure that each trainee was able to use the program disk.

Minimum computer specification: 486 PC  
16 colours monitor

#### **4.6.2 CD-ROM: Hotel Health and Safety**

Local Authority based health and safety enforcement officers are responsible for enforcing health and safety legislation in residential accommodation which includes hotels. CD-ROM was chosen for this subject because of the potential to display photographs and video footage to enhance the training content. In addition, the capacity of CD-ROM to store large amounts of data allows supporting legislation and text to be incorporated into the package.

##### *Aim*

To develop the knowledge and skills necessary to conduct a health and safety inspection of an hotel in order to monitor and evaluate compliance with relevant statutory provisions.

##### *Objectives*

To develop:

1. health and safety inspection skills;
2. knowledge of the hazards in hotels and the appropriate control measures to reduce associated risks.
3. the ability to assess health and safety standards in hotels and the degree of compliance with statutory requirements; and
4. the ability to audit safety documentation.

##### *Assessment*

Exercises for the trainee to complete were integrated throughout the package. These included tasks such as assessing the hotel's safety policy and risk assessment documentation and tasks away from the computer, for example reviewing risk rating scores for hotels within the trainee's authority and interpreting the level of risk indicated by this score.

##### *Training Content*

The training content for the CD-ROM was drawn from legislation, approved codes of practice and appropriate guidance notes and was informed by practising health and safety enforcement officers.

Assistance was provided with the collation of training material from Greenhalls Plc (hotel and licensed premises owners). This took the form of consultation with their safety manager in the North West and access to a large hotel to take photographs and video footage. In addition, safety documentation from the hotel was used as a basis for the training exercises contained in the training program.

The training package focuses on two main areas of concern for enforcement officers:

- 1 Safety management within hotels; and
- 2 Physical inspection of the hazards present in hotels.

### *Safety Management*

This section was divided into the following components:

- 1 File History
- 2 Preparing a visit plan
- 3 Safety Policy
- 4 Risk Assessment
- 5 Statutory documentation
- 6 Maintenance documentation
- 7 Accident history
- 8 Safety Management

### *Physical inspection*

This element of the training used photographs and text to describe potential hazards and their control measures. The following areas were included for the user to 'inspect'.

- 1 Bedrooms
- 2 Kitchen
- 3 Leisure facilities
- 4 Plant room
- 5 Public areas
- 6 Reception

Each area included information for the trainee to read, photographs to look at, for instance examples of machines commonly found in kitchens, and a mock risk assessment. Generic information was also available throughout the package, for example electrical safety and manual handling advice.

Minimum computer specification: x16 CD-ROM disk drive  
120 MHz PC with 16MB RAM  
Windows 95, 98 or NT  
640 x 480 / 256 colours screen display

The CD-ROM contained video footage but some users did not have the appropriate software to run it nevertheless such users were not disadvantaged in any way.

#### **4.6.3 Internet: Accident Investigation**

Local Authority health and safety enforcement officers are required to investigate certain workplace accidents that occur within their jurisdiction as defined by the Health and Safety (Enforcing Authority) Regulations 1998 and come within the parameters of the Health and Safety (Reporting of Injuries, Diseases and Dangerous Occurrences) Regulations 1995. Accident investigation requires officers to exercise problem solving skills and professional judgement, neither of which can be taught within the traditional, i.e. lecture or text environments. The Internet was chosen for this subject to encourage collaboration between the trainees and open up access to numerous sources of further information.

### *Aim*

To increase the trainees' confidence in undertaking practical accident investigation and to develop a suitable knowledge base.

### *Objectives*

Although the constructivist approach does not draw on training objectives in the same manner as the objectivist approach, objectives for the training package were set to assist in the evaluation of the training media. However, these were kept very broad in order for the trainees to develop their own specific objectives. The objectives for the web based training package were:

- 1 to enhance the practical accident investigation skills of participants;
- 2 to increase their relevant knowledge base;
- 3 to disseminate examples of good practice by experienced officers to all the trainees;  
and
- 4 to facilitate a consistent approach to accident investigation.

### *Assessment*

When the participants had completed the necessary investigation for the case study they were required to choose one from a range of options for enforcement action. Clicking on their choice produced feedback about that particular course of action and whether or not it was appropriate, i.e. whether they were correct. There were then able to click upon the lead officer's comments hyperlink and receive the rationale for the enforcement action that was actually taken for the real case.

### *Training Content*

The training content for the web based training package was developed using the technique of knowledge elicitation. This was necessary as there is little material available for potential accident investigators and what there is tends to be procedural rather than practical. Knowledge elicitation is a technique that is used to obtain a description from practitioners of how certain tasks are performed. It is used in the design of knowledge based computer systems. The elicitor encourages the expert to verbalise their thoughts about procedures, as well as how particular tasks are tackled. The developers were able to build a more complete picture of accident investigation by working with a group of investigators rather than individuals. Obtaining the data in this way also facilitated a consistent approach to accident investigation. A case study was constructed for a group of experts to discuss and used material from an actual accident within Local Authority jurisdiction. The material used included photographs, witness statements and a verdict from the prosecution taken at the Magistrates' court.

The expert group established the principles involved in accident investigation, identified the key knowledge, skills and attitude required by accident investigators, provided insight into the way experienced enforcement officers undertake accident investigation and identified common prompts, influencing factors and other considerations which affect an experienced officer's professional judgement and decision making in the field of accident investigation.

The website was developed using the information obtained through the knowledge elicitation exercise. The same case study was used and materials pertaining to the case were displayed on the website. The main components of accident investigation were incorporated into the training package, key questions were asked of the trainees and feedback was given to enable them to understand how the experts tackled each component. In addition, 'top tips' were hyperlinked to provide guidance from the experts to the trainees.

As well as being able to access any of the web pages in any order, hyperlinked information was incorporated into the training at various points. In the introduction, a link was provided to a netskills training package, designed to introduce beginners to the world wide web, a link was included to the BBC website for those participants who had a basic understanding of the Internet but required more practice before undertaking the training. A resources section provided links to other organisations, e.g. the Health and Safety Executive, Institute of Occupational Safety and Health, Stationery Office (for Acts of Parliament and/or Regulations) and the World Wide Web Virtual Library of Public Health. Within the feedback sections there were also hyperlinks to relevant documents or WWW sites, e.g. there was information available on an Australian government site pertaining to risk assessment for fork lift trucks, and the United States Department of Energy which has a comprehensive web page dedicated to accident investigation techniques.

A particular feature of the website was the provision of web discussion groups to enable the geographically dispersed trainees to make contact with each other and discuss the case. A coffee room area was constructed to encourage the trainees to introduce themselves and converse much as they would on a traditional training course. A peer review section was created to enable the trainees to discuss the specific issues raised in the case with other participants. It was intended that inexperienced trainees using the site could use these facilities to talk through the case study with the more experienced participants, in effect simulating the discussion that would occur naturally in an office setting during an actual accident investigation.

Recommended computer specification: PC or Mac, Pentium 120MHz, 16MB RAM  
Windows 95, 98 or NT  
Version 4 browser (Navigator 4,  
Internet Explorer 4)  
Screen resolution: 800 x 600 display

Minimum specification: 486 DX2 with 8MB RAM  
Windows 95  
Version 4 browser (Navigator 4,  
Internet Explorer 4)  
256 colours

## 5. EVALUATION OF THE TRAINING PACKAGES

### 5.1 INTRODUCTION

A major element of this project was to pilot and evaluate the alternative teaching media through the use of training packages developed within the project. Evaluation has been defined by Patrick (1992) as,

*any attempt to obtain information concerning the effect or value of training in order to make decisions about any aspect of the training programme, the persons that have been trained and the organisations .... responsible for providing the training.*

There were two strands to the evaluation of the three training media: the first involved exploration of the impact of the training on the operational enforcement officers and the second considered the reactions of managers in LAs to the use of the media as a delivery method for health and safety inspector training.

The evaluation of the training media was concerned with the trainees' reactions to each training medium, the knowledge acquired and how well the learning objectives were achieved. Sustained impacts on the organisation were not investigated as these could only be measured in a longer term study.

Three levels of evaluation were undertaken:

- Formative evaluation to ensure the acceptability of the training by the target groups. The case study interviews sought opinions on the different training media and their suitability for use in LAs.
- Process evaluation to examine the practicalities of using the media in the workplace. This was conducted by means of self completed user logs and informal discussion with trainees.
- Impact evaluation to assess the effectiveness of the training against the learning objectives. Trainees completed pre- and post- desktop exercises and questionnaires to indicate knowledge gain and to report reactions to the training media.

The second phase of the evaluation examined the application of the instructional techniques in LAs. This part of the project was concerned with evaluating the acceptability and the utility of the methods in the settings for which they were designed. Managers of the operational health and safety enforcement staff were interviewed to identify their reactions to the introduction of the training technology within their organisation. The purpose was to determine how the materials were received within LAs and whether there were either any barriers to their continued use or particular characteristics of the training media which were attractive to and welcomed by managers.

This two phase approach to the evaluation accommodated the pluralistic interests and objectives which exist within the enforcement agencies, accommodating the views and opinions of managers and operational enforcement staff.

### 5.2 THE STUDY COHORT

The sampling frame for selecting trainees was constructed to ensure that the different training media were tested by a range of individuals representing different employee

status (such as managers and technicians) and different types of LAs (e.g. London Borough/Suburban). Initially a total of 162 trainees were recruited. Details of the stages where trainees were lost to the research are detailed in Table 5.1.

**Table 5.1**  
**Number of trainees completing each stage**

Stage	Package				Total
	Disk	CD-ROM	Internet	Controls	
<b>Initial sample</b>	<b>32</b>	<b>33</b>	<b>30</b>	<b>67</b>	<b>162</b>
Pre-training questionnaire	31	32	29	46	138
Knowledge pre-test	18	26	20	37	101
User Log	14	25	20	N/A	59
Knowledge post-test	14	25	20	37	96
<b>Final sample</b>	<b>14</b>	<b>25</b>	<b>20</b>	<b>37</b>	<b>96</b>

A final sample of 96 officers, employed by 23 LAs participated in the evaluation exercise. The makeup of the cohort is presented in Table 5.2 below.

**Table 5.2**  
**Composition of cohort**

Authority type	Control	CD-ROM	Internet	Disk	Total
London Borough	2	-	-	-	2
	4	-	-	-	4
	-	4	0	1	5
Metropolitan District/ Unitary Authority	1	-	-	-	1
	5	-	-	-	5
	-	1	1	1	3
	3	-	-	-	3
	-	4	2	1	7
	-	4	0	2	6
	-	-	2	-	2
	-	-	2	2	4
	-	0	2	0	2
	-	-	-	-	-
Urban and Industrial	2	-	-	-	2
	-	4	2	0	6
	3	-	-	-	3
Suburban	5	-	-	-	5
	-	6	6	5	17
	2	-	-	-	2
	3	-	-	-	3
Resort and Retirement	4	-	-	-	4
	2	-	-	-	2
Scottish Urban	-	2	3	2	7
Scottish Rural	1	-	-	-	1
<b>TOTALS</b>	<b>37</b>	<b>25</b>	<b>20</b>	<b>14</b>	<b>96</b>

Whilst every effort was made to ensure that each category of authority was represented, the allocation of trainees to particular programs was limited by the availability of technology within their employing organisation. In some cases more than one medium was tested within a local authority where a large number of employees were available to participate in the study.

### 5.2.1 Employee Categories

Trainees were asked to specify their job title and these were subsequently allocated into four categories: manager; environmental health officer; technical officer and student. The distribution of employee status participating in the testing is presented in Table 5.3

**Table 5.3**  
**Proportion of employee categories (percentage) within the cohort**

Pilot Group	Employee Status (%)			
	Line Manager	EHO	TO	Student
Disk (n = 14)	14	43	43	0
CD-ROM (n = 25)	16	64	16	4
Internet (n = 20)	15	60	20	5
Controls (n = 37)	11	54	35	0
Total (n = 96)	14	56	28	2

As expected, the majority of the trainees were Environmental Health Officers, but the total sample did include representation from all four employee categories.

## 5.3 EVALUATION

A comprehensive approach to evaluation must acknowledge such factors as prior knowledge in the subject area and where computer-based training is to be used, attitudes and prior exposure to computers. In addition, factors such as the reliability and usability of the medium as well as economic factors are major considerations if the medium is to be widely adopted within a training framework.

The information gathered was therefore examined under three key aspects:

**Pedagogic:** the capability of the media to develop the desired learning outcomes;

**Ergonomic:** the reliability, usability and flexibility of the media. These factors may determine the acceptability of the media to trainees and managers and often tend to be the overriding factor in the selection of a particular medium.

**Economic:** what can be afforded and/or justified in terms of cost.

### 5.3.1 Pedagogical Assessment

Many factors influence the outcomes of training programmes. These may include the personnel involved, the nature of the skills to be acquired, the time that can be devoted to training, the media to be employed in facilitating learning and the opportunities available to apply the knowledge and/or skills acquired.

In assessing the success of the media in terms of learning outcomes, consideration was given to the aptitudes and characteristics of the trainees. Data about participants including their age, gender, previous experience of computers and reported attitudes to CBT were gathered to examine the potential influence of these factors on the achievement of learning outcomes. It was not possible in this evaluation to examine the impact of the training packages on operational effectiveness, but instead, data was gathered on knowledge gain and the opinions of the trainees about the degree to which learning objectives were achieved.

*a) Measuring Knowledge Gain*

Before using each training package, the trainees were given a knowledge pre-test and on completion of the package, a post-test. Controls were given the same pre and post-tests as the trainees testing the packages, but did not have access to the training packages. All of the participants were made aware that these tests were not to evaluate their individual performances, but to contribute towards the evaluation of the training packages. The tests were designed to assess the changes in knowledge related to use of the package.

Pre and post-test scores were calculated for all trainees who completed both tests (n= 96) and converted to percentages. The pre and post-test score means for all those who completed the training packages (n=59) and the controls (n=37x3) (controls completed all three pre and post-test exercises) are presented in Table 5.4.

**Table 5.4**  
**Pre and post-test scores**

Package	Means (%)		
	Pre-test	Post-test	Difference
<b>All packages (n = 59)</b>	46.4	61.8	15.4
<b>All Controls (n = 37x3)</b>	48.1	58.6	10.5

Results revealed that those trainees who had completed the training packages increased their test scores by an average of 15.4%, compared with an increase within the control group of 10.5%. A paired t-test revealed a significant improvement in knowledge gain amongst the trainees ( $P = 1.11 \times 10^{-10}$ ). An independent t-test on the pre and post-test score differences for all packages versus all controls was found to be significantly different ( $P = 0.025$ ), indicating that those undertaking the training had significantly increased their knowledge gain.

Further analysis was undertaken to assess the pattern of this increase in test scores and results are presented in Table 5.5

**Table 5.5**  
**Analysis of performance for packages and controls**

Package	Performance between post and pre-test			
	Improved	Same	Worse	n
<b>All Packages</b>	83%	2%	15%	59
<b>All Controls</b>	76%	1%	23%	111 (37x3)

This analysis revealed that 83% of the trainees who had completed the training packages had increased their test scores. Seventy six percent of the controls also improved their test scores which may be an outcome of completing the pre- and post-tests themselves, by promoting further investigation of the subject area covered by the test. The results indicated that CBT has the potential to be an effective method of delivering professional development training for local authority based health and safety inspectors.

*b) The Influence Of Trainee Characteristics On The Use Of CBT*

Following investigation of the impact of the packages on knowledge gain, further analysis was undertaken to clarify the effect of trainee characteristics on the effectiveness of the packages and how this may affect their acceptability. Four aspects have been routinely investigated by previous authors, namely age, gender, previous experience of computers and attitudes to computer-based training.

*i) Age*

Several authors (Maclure, 1985; Elder et al., 1987)) have discussed the impact of age on attitudes to the use of computers. Their findings suggested that older individuals may have had less routine exposure to computers and this may have had a negative impact on their general attitudes towards computer use. The cohort included trainees with a wide spread of ages ranging from 21 to 61 with a mean age of 36 (see Table 5.6). There were proportionately fewer trainees in the 40 to 60+ age range as compared to the 20-39 age range.

**Table 5.6: Percentage Of Trainees Within Each Age Range**

Groups	Age Group (%)					Total Number
	20-29	30-39	40-49	50-59	60+	
Floppy disk	7	53	20	13	7	15
CD-ROM	28	44	24	4	0	25
Internet	35	40	20	5	0	20
Controls	22	44	28	6	0	36*
<b>Total</b>	<b>32</b>	<b>43</b>	<b>23</b>	<b>6</b>	<b>1</b>	<b>96</b>

\* 1 missing case

The impact of age on the pre and post training scores was examined by dividing the cohort into those under 35 years of age and those over 35. Those in the under 35 group were assumed to have had routine exposure to computers during their schooling and therefore be more comfortable with the technology. The results for the pre and post-test scores for the under and over 35s are presented in Table 5.7.

**Table 5.7: Age And Pre and Post-Test Performance**

	Under 35's (n = 32)			Over 35's (n = 27)		
	Pre	Post	Diff	Pre	Post	Diff
<b>ALL PACKAGES</b>	47.2	63.3	16.1	45.4	60.1	14.7
Paired T test (Probability)	2.02 x 10 <sup>-7</sup>			6.75 x 10 <sup>-5</sup>		

The under 35 group who had used the training packages improved their test scores by an average of 16.1%, whilst the over 35 group improved their test scores by 14.7%. Paired t-tests confirmed significant improvements for both the under 35 and over 35 trainees. An independent t test on the differences between the pre and post-test scores for the under 35s versus the over 35s revealed no significant difference ( $P = 0.37$ ) between the two groups, confirming no significant difference in the knowledge gain achieved. Further analysis on their performance is presented in Table 5.8.

**Table 5.8: Under 35 Vs Over 35 Performance**

Age	Performance between post and pre-test			n
	Improved	Same	Worse	
Under 35's	78%	4%	18%	27
Over 35's	87.5%	-	12.5%	32

Analysis revealed that 78% of the under 35s had improved their test scores, compared with 87.5% of the over 35s.

This analysis revealed that age did not appear to have a significant impact on the knowledge gained as a result of using the three CBT packages.

*ii) Gender*

Since their introduction, computers have been widely seen as a male domain of knowledge and expertise (Selwyn, 1997). Indeed, previous studies of the use of information technology have found that men tend to make more use of it than women (Applebee, 1992). The numbers of males and females engaged in the evaluation were similar although they were not equally represented in each of the pilot groups as indicated in Table 5.9. The Internet group was found to have a greater proportion of females, compared to the other packages.

**Table 5.9: Gender Of Participants In Pilot Groups**

Pilot Groups	Gender (%)		Number in Sample
	Male	Female	
CD-ROM	60	40	<b>25</b>
Internet	30	70	<b>20</b>
Disk	64	36	<b>14</b>
Controls	59	41	<b>37</b>
Total	<b>54</b>	<b>46</b>	<b>96</b>

The effect of gender on the pre and post-test scores was examined and results are presented in Table 5.10.

**Table 5.10: Effects Of Gender On Test Scores**

	Males (n = 30)			Females (n = 29)		
	Pre	Post	Diff	Pre	Post	Diff
<b>All Packages</b>	46.0%	66.7%	20.7%	46.8%	56.8%	10.0%
Paired T test (Probability)	2.49 x 10 <sup>-9</sup>			7.88 x 10 <sup>-4</sup>		

Whilst both the males and females significantly improved their test scores, the male trainees improved their test scores by an average of 20.7%, compared with a 10% improvement amongst the female cohort. An independent t test on the pre and post-test score differences revealed a significant difference between males and females ( $P = 0.0035$ ). To confirm that this difference was related to the use of the package, the pre and post-test scores of the male and female controls were examined. Analysis revealed no significant difference between the male and female control test scores ( $P = 0.19$ ).

Further analysis of the effects of gender on performance is presented in Table 5.11.

**Table 5.11: Male And Female Performance**

Gender	Performance between post and pre-test			n
	Improved	Same	Worse	
<b>Males</b>	90%	10%	-	30
<b>Females</b>	76%	3%	21%	29

The training packages appeared to have a greater impact on the test scores of male trainees than female trainees, with 90% of the male trainees showing an improvement in performance compared to 76% of females.

It was therefore concluded that whilst both males and females significantly improved their test scores following completion of the training packages, knowledge gain amongst the males was significantly greater than amongst the females. The reasons for the greater improvement in scores by males is unclear but factors such as attitudes and previous exposure to computers may be influential.

*iii) Experience Of Using Computers*

Several authors have attempted to assess the impact of familiarity with computers on learning outcomes. Lund and Volet (1998) have shown a correlation between student's general computer use and CBT with positive expectations for future CBT. Torkzadeh and Angulo (1992) have observed that inexperienced computer users are often unwilling to use computers for fear of damaging them.

Prior to commencing the training packages, the cohort was questioned about their experience of using various computer applications such as work monitoring systems, word processing, spread sheets, etc. Each trainee's experience was then categorised as high, medium, low or none. Table 5.12 indicates the spread of computer experience across the various training packages.

**Table 5.12: Computing Experience Of The Pilot Groups**

Pilot Group	Computing Experience (%)			
	None	Low	Medium	High
<b>Disk</b> (n = 14)	0	36	36	28
<b>CD-ROM</b> (n = 25)	8	44	28	20
<b>Internet</b> (n = 20)	0	70	20	10
<b>Controls</b> (n = 37)	0	41	22	38
<b>Total</b> (n = 96)	<b>2</b>	<b>47</b>	<b>25</b>	<b>26</b>

Approximately half of the cohort had either no or very low experience of computing and the remaining half had medium or high experience. The group piloting the Internet package did appear to have less computing experience than the trainees in the other groups.

The impact of previous computing experience on the pre and post-test scores was examined by dividing the cohort into two groups, those with none/low experience and those with medium/high experience of computing. The results are presented in Table 5.13.

**Table 5.13: Effects Of Computer Experience On Knowledge Gain**

	None/low experience (n = 27)			Medium/high experience (n = 32)		
	Pre	Post	Diff	Pre	Post	Diff
<b>All Packages</b>	47.6%	63.9%	16.2%	44.9%	59.4%	14.5%
Paired T test (Probability)	2.5 x 10 <sup>-6</sup>			7.2 x 10 <sup>-6</sup>		

Both groups showed significant knowledge gain. An independent t test confirmed that there was no significant difference in the knowledge gain between those trainees with none/low experience and those with medium/high experience (P = 0.34). Further analysis of the effects of previous computing experienced and knowledge gain are presented in Table 5.14.

**Table 5.14: Previous Computer Experience And Performance**

Computing experience	Performance between post and pre-test			
	Improved	Same	Worse	n
<b>None/low</b>	85.2%	-	14.8%	27
<b>Medium/high</b>	81.3%	3.1%	15.6%	32

The pattern of knowledge gain was found to be similar between the two groups. It was therefore concluded that previous computing experience was found to have no significant impact on knowledge gained from the use of CBT.

*iv) Attitudes To Computer Based Training*

A prospective user's overall attitude toward using a computer is a major determining factor in their eventual decision whether or not actually to use CBT. For many the computer is still an object which invokes strong negative reactions: fear, suspicion, resentment and even downright hostility (Selwyn, 1997). These feelings are primarily related to a lack of knowledge that novice users have about using IT (Torkzadeh & Angulo, 1992).

Attitudes towards CBT were determined prior to allocation to the training packages. Trainees were grouped into those who reported feeling enthusiastic or comfortable about CBT and those who saw it as a challenge or were resistant, anxious or unsure about CBT. The reported attitudes about the use of CBT for each of the training package cohorts are presented in Table 5.15.

**Table 5.15: Percentages Of Those With Differing Attitudes To CBT In The Different Pilot Groups**

Pilot Group	Attitudes to CBT	
	Enthusiastic/Comfortable %	Challenged/Resistant/Anxious, Unsure %
Disk (n = 14)	79	21
CD-ROM (n = 25)	76	24
Internet (n = 20)	50	50
Controls (n = 37)	62	38
<b>Total (n = 96)</b>	<b>66</b>	<b>34</b>

Two thirds of the total cohort reported being either comfortable or enthusiastic towards CBT however the spread of attitudes was not identical across the different packages. The Internet trainees had a much higher proportion of trainees who reported being anxious about using CBT.

The impact of attitudes to computer-based training on knowledge gain was examined. The cohort was divided into two groups, those who reported being enthusiastic/comfortable about computer-based training and those who reported being challenged/anxious/resistant/unsure about CBT. The results are presented in Table 5.16.

**Table 5.16: Effects Of Attitudes To Computer Based Training On Knowledge Gain**

	Enthusiastic/comfortable (n = 40)			Challenged/anxious/resistant/unsure (n=19)		
	Pre	Post	Diff	Pre	Post	Diff
<b>All Packages</b>	46.5%	63.2%	16.7%	46.2%	59.1%	12.9%
Paired T test (Probability)	8.04 x 10 <sup>-7</sup>			.00055		

The two groups improved their scores and this improvement was found to be significant. Further analysis of the pattern of performance (see Table 5.17) did reveal a trend suggesting that those who were enthusiastic/comfortable were more likely to improve their test scores than those who reported being challenged/anxious/resistant/unsure. However, an independent t-test on the test score differences was not significant (P = 0.2).

**Table 5.17: Attitudes To Computer Based Training And Performance**

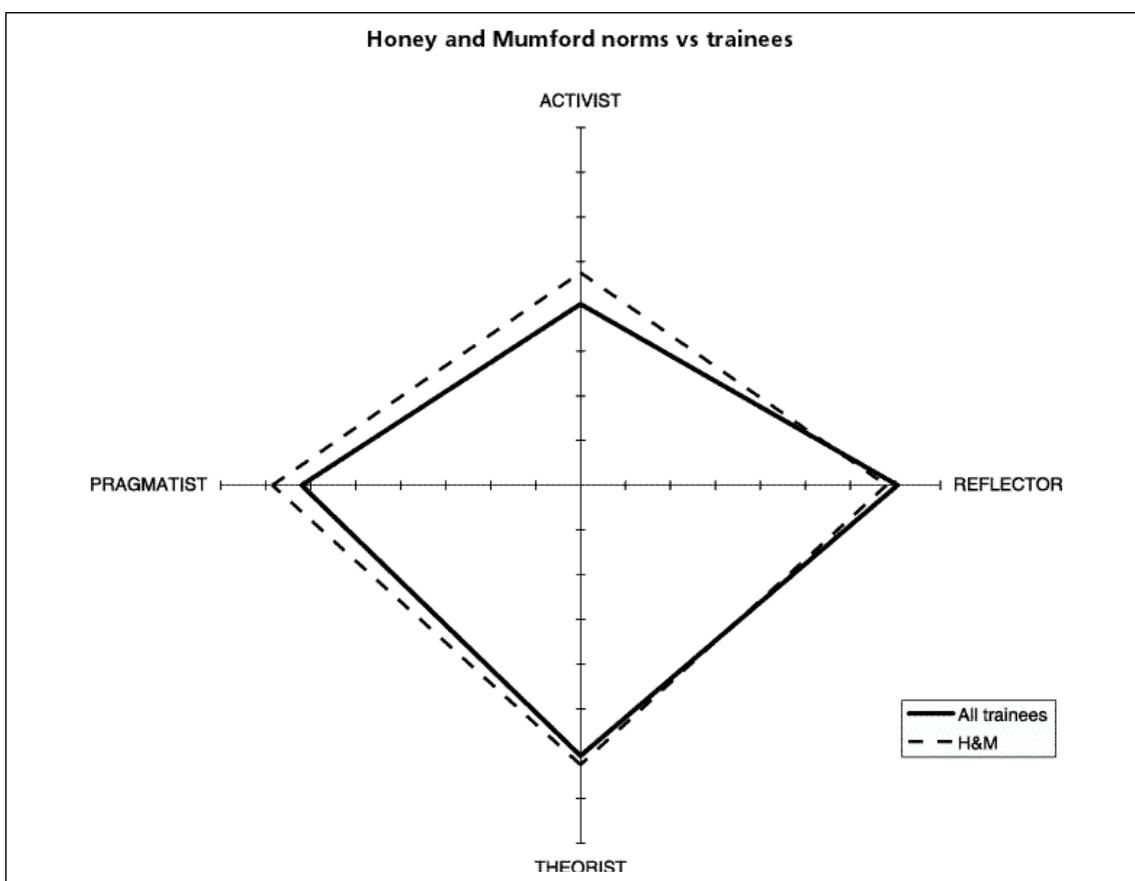
Attitude to CBT	Performance between post and pre-test			
	Improved	Same	Worse	n
<b>Enthus/Comf</b>	90%	-	10%	40
<b>Chall/anx/resist/unsure</b>	68.4%	5.3%	26.3%	19

*v) Learning Styles Of The Participants*

The process of learning is often taken for granted. Adults assume that they know how to learn and need no further assistance with the process. Yet people vary, not only in their learning skills but also in their preferred learning styles. Extensive work has been undertaken in this area, initially by Kolb (1984) in the USA and subsequently by Honey and Mumford (1986) in the UK. They defined four major categories of learners: activists, reflectors, theorists and pragmatists.

Each of the trainees in this research was asked to complete the Honey and Mumford learning styles inventory, which gave an indication of the learning styles. Their learning styles were then compared with the norms that had been reported by Honey and Mumford and results are presented in Figure 5.1. Each of the learning styles groups will find some of the activities within the training packages relevant and appropriate to their preferences. It may be that those who have a very strong or strong preference for theorist and/or pragmatist styles find that the techniques employed in CBT suit them. Those with activist tendencies may enjoy trying CBT, but may become bored or lack the self-discipline to plan their training. However, those with reflector preferences may find the packages, particularly the Internet package (where the participants were encouraged to look outside the structured training for further information and collaborate with other trainees) disagreeable.

**Figure 5.1: Comparison Between Honey And Mumford ‘Norms’ And Participants.**



This analysis revealed that, although differences from the norm for reflectors and theorists were small, the environmental health group as a whole were less activist and less pragmatic than the Honey and Mumford norms. This analysis provides important clues as to how future packages need to be designed to ensure that they address the learning styles of those to whom the training is aimed. As individuals from all the learning style groups were represented in the total sample, future CBT packages need to be designed to incorporate features which will appeal across the range of learning styles.

*c) Knowledge Gain For Each Training Package*

The three packages were each examined individually to assess their impact on knowledge gain. A key consideration in deciding upon an appropriate media was to

ensure a good fit between the strengths of the media and the training content and objectives. The consequence of this approach was to make comparison of the effectiveness problematic, since the content and complexity of the packages were different. The interaction of factors such as prior knowledge and experience, computing competence and various contextual factors such as the availability of time to devote to training influence the effectiveness the training packages. In comparing the media three main aspects were reviewed:

- Knowledge gain
- Time spent in using the package
- Preparedness in terms of pre-requisite knowledge/skills and technical competence to use the package.

Trainees were not given any guidance as to how long the package should take to complete. The Internet based package was the most complex in terms of nature of the task and the computing expertise required. Conversely, the floppy disk covered a straightforward subject and required little previous computing experience to operate it. Trainees were asked to record the number of times they accessed and used the package and the length of time spent at each session. The interaction of previous knowledge and computing expertise was examined by seeking the views of the trainees on completion of the training as to whether they believed they possessed sufficient knowledge and computing expertise to satisfactorily complete the training.

*i) Floppy Disk Analysis*

Fourteen trainees completed the floppy disk package, which dealt with determining the appropriate enforcement agency for health and safety. The results of the pre and post-test scores for trainees and controls are presented in Table 5.18.

**Table 5.18: Pre And Post-Test Scores For Floppy Disk And Controls**

PACKAGE	MEANS (%)		
	Pre-test	Post-test	Difference
Disk (n = 14)	36.0	58.8	22.7
Controls (n = 37)	38.6	54.0	15.5

The trainees improved their scores by an average of 22.7%. The controls increased their scores by an average of 15.5%. A paired t-test on the pre and post-test scores was performed and the knowledge gain for the trainees using the was significant ( $P = 3.56 \times 10^{-5}$ ). However, an independent t-test on the pre and post score differences of the trainees and controls revealed no significant difference ( $P = 0.07$ ). Further analysis on their performance is presented in Table 5.19.

**Table 5.19: Floppy Disk Analysis**

Package	Performance between post and pre-test			
	Improved	Same	Worse	n
Floppy Disk	100%	-	-	14
Controls	84%	3%	13%	37

This revealed that all of the trainees improved their scores, compared with 84% of the control group.

The mean time, range, standard deviation and confidence limits for each package were calculated and results are presented in Table 5.20.

**Table 5.20: Time Spent On Floppy Disk Package**

<b>PACKAGE</b>	<b>Mean Time (mins)</b>	<b>Range</b>	<b>Standard Deviation</b>	<b>95% Confidence Interval</b>
<b>DISK</b>	98	30 - 280	78	98 ± 41

On average, trainees completed the disk package in around one and a half hours and of the three, this was the package which was completed most rapidly. However, 36% of the disk trainees did report that work activities prevented them from spending sufficient time on the training.

The disk package was straightforward, both in terms of knowledge and computing expertise and 86% reported having both the technical expertise necessary to use the floppy disk program and the prerequisite knowledge and skills necessary for training in this subject. Motivation to learn about the ‘Enforcing Authority’ regulations was probably at its optimum during the study as the new regulations were being implemented and the majority of the cohort would be applying them on a daily basis.

It was concluded that the floppy disk package had provided an effective medium for increasing knowledge in Enforcing Authority Regulations.

*ii) CD-ROM Analysis*

Twenty-five trainees completed the CD-ROM training package, which dealt with hotel safety. The results of the pre and post-test scores are presented in Table 5.21.

**Table 5.21: Pre And Post -Test Scores For CD-ROM And Controls**

<b>PACKAGE</b>	<b>MEANS (%)</b>		
	<b>Pre-test</b>	<b>Post-test</b>	<b>Difference</b>
<b>CD-ROM (n = 25)</b>	48.4	70.1	21.6
<b>Controls (n = 37)</b>	54.5	65.9	11.5

The trainees improved their scores by an average of 21.6%, compared with the controls, who increased their scores by an average of 11.5%. A paired t-test on the pre and post- test scores of the trainees who had completed the CD-ROM training was performed and found to be significant ( $P = 4.62 \times 10^{-9}$ ). An independent t-test on the pre and post score differences of the trainees and controls revealed a significant difference in knowledge gain between the two groups ( $P = 0.005$ ). Further analysis on their performance is presented in Table 5.22.

**Table 5.22: CD-ROM Analysis**

<b>Package</b>	<b>Performance between post and pre test</b>			
	<b>Improved</b>	<b>Same</b>	<b>Worse</b>	<b>n</b>
<b>CD-ROM</b>	100%	-	-	25
<b>Controls</b>	76%	-	24%	37

Analysis revealed that all of the CD-ROM trainees improved their test scores, compared with 76% of the controls.

**Table 5.23: Time Spent On CD-ROM Package**

<b>PACKAGE</b>	<b>Mean Time (Mins)</b>	<b>Range</b>	<b>Standard Deviation</b>	<b>95% Confidence Interval</b>
<b>CD-ROM</b>	201	60 - 435	116	201 ± 45

On average, the trainees completed the CD-ROM package in approximately three and a half hours. However, 72% reported that work activities prevented them from spending as much time as they would have liked on the training package.

Seventy-six percent of the cohort reported having both the necessary pre-requisite knowledge and skills and technical expertise to complete the training package. Hotel safety was a topic with which the majority of this cohort was familiar, but one which is extensive, therefore it is likely that there was something of interest within the package for even the more experienced officers.

It was therefore concluded that the CD-ROM package had provided an effective medium for increasing knowledge in hotel safety.

*iii) Internet Analysis*

Twenty trainees completed the Internet package which dealt with accident investigation. The results for pre and post-test scores for trainees and controls are presented in Table 5.24.

**Table 5.24: Pre And Post-Test Scores For Internet Package And Controls**

<b>PACKAGE</b>	<b>MEANS (%)</b>		
	<b>Pre-test</b>	<b>Post-test</b>	<b>Difference</b>
<b>Internet ( n = 20)</b>	51.1	53.7	2.6
<b>Controls (n = 37)</b>	51.3	55.8	4.5

The scores of the pre and post-tests for those who had used the Internet package showed little difference. The trainees only improved their scores by an average of 2.6%, compared with the controls, who increased their scores by 4.5%. A paired t-test was carried out and this showed no significant knowledge gain ( $P = 0.15$ ) for the trainees undertaking the Internet training. An independent t-test on the pre and post score differences of the trainees and controls revealed no significant difference ( $P = 0.285$ ). Further analysis of their performance is presented in Table 5.25.

**Table 5.25: Internet Analysis**

<b>Package</b>	<b>Performance between post and pre-test</b>			
	<b>Improved</b>	<b>Same</b>	<b>Worse</b>	<b>n</b>
<b>Internet</b>	50%	5%	45%	20
<b>Controls</b>	68%	0%	32%	37

Amongst the control group, which had not used the package, 68% had improved their performance, whilst only 50% of the trainees had improved their scores.

**Table 5.26: Time Spent On Internet Package**

<b>PACKAGE</b>	<b>Mean Time (Mins)</b>	<b>Range</b>	<b>Standard Deviation</b>	<b>Confidence Interval</b>
<b>INTERNET</b>	261	40 - 825	179	261 ± 78

The Internet package had the largest dispersion from the mean (indicated by the standard deviation) and the largest 95% confidence interval, indicating a large variation in the time spent. Sixty percent of the trainees reported that work activities prevented them from spending sufficient time on the training programme.

The Internet training package was in the form of a case study and required the user to work through the information presented, read supporting documentation and research technical and legal advice, much as they would when investigating a real accident. Following creation of the Internet package it was estimated that trainees would need to spend at least six hours interrogating it to achieve the learning objectives, assuming competence in Internet technology. The mean time taken for the Internet package was 261 minutes, with a range of 40 - 825 minutes. Sixteen of the 20 trainees spent less than six hours accessing the package and this may be a contributory factor in explaining the lack of knowledge gain by this group.

Internet technology is not yet commonplace within Local Authorities. Only 30% of the Internet trainees reported having both the necessary technical expertise to use the Internet and the pre-requisite knowledge and skills in accident investigation. Two of the trainees (10%) reported having neither of these attributes.

The Internet package did not appear to impact on the knowledge base of accident investigation but there does appear to be a number of fundamental issues which may explain the lack of knowledge gain. The number of trainees who felt themselves to be adequately prepared for undertaking the training was low and the adequacy of the time available to explore the site and pull together the complex tasks involved in the investigation of the accident meant that the majority of the trainees had not completed the package before completing the post-test questionnaire.

Despite the absence of a demonstrable knowledge gain trainees and managers were positive in their evaluations of the potential of the medium to deliver professional development training. These aspects are explored more fully in Chapter 6.

*d) Reactions To Training Media*

The impact of each of the packages was examined by analysing the scores given (on a 1-10 scale, Appendix 1(iv)) for pedagogical aspects (i.e. design and layout; training content and achievement of learning objectives) and ergonomic aspects (i.e. flexibility, usability and acceptability of each package). The scores for pedagogical aspects are presented in Table 5.27.

**Table 5.27: Summary Of The Trainees' Reactions To Pedagogical Issues**

Aspect	Factor	Score		
		Disk	CD-ROM	Internet
Pedagogical	Design and layout	4.8	6.8	6.2
	Training Content	5.5	7.9	6.9
	Achievement of learning objectives	4.6	7.2	5.7
	<b>OVERALL AVERAGE</b>	<b>5.0</b>	<b>7.3</b>	<b>6.3</b>

Those trainees who had used the CD-ROM were most positive overall about the pedagogical aspects of the medium, although the Internet group was also enthusiastic about its potential. The Disk package scored lowest on pedagogical issues.

*e) Pedagogical Evaluation*

In addition to analysing the impact of the training packages on knowledge, other qualitative data on pedagogical aspects were considered. To be successful in professional development the media must be capable of developing skills as well as knowledge. The learning objectives of each of the training packages included a skills-based element. In order to assess these aspects, the pedagogical assessment examined the views of the trainees and managers on:

- design and layout of training material; and
- training content and achievement of learning objectives

The following tables (Tables 5.28 & 5.29) provide a summary of trainee opinions on each of these aspects and where appropriate, managers attitudes towards pedagogical issues.

*i) Design And Layout Of Training Material*

Presentation of the training material on the computer screen and the way in which the learner can move between screens and access information can influence the outcome of training. Users were asked specific questions regarding the design and layout of the package they piloted and were also invited to make additional comments. Results are presented in Table 5.28.

*ii) Training Content*

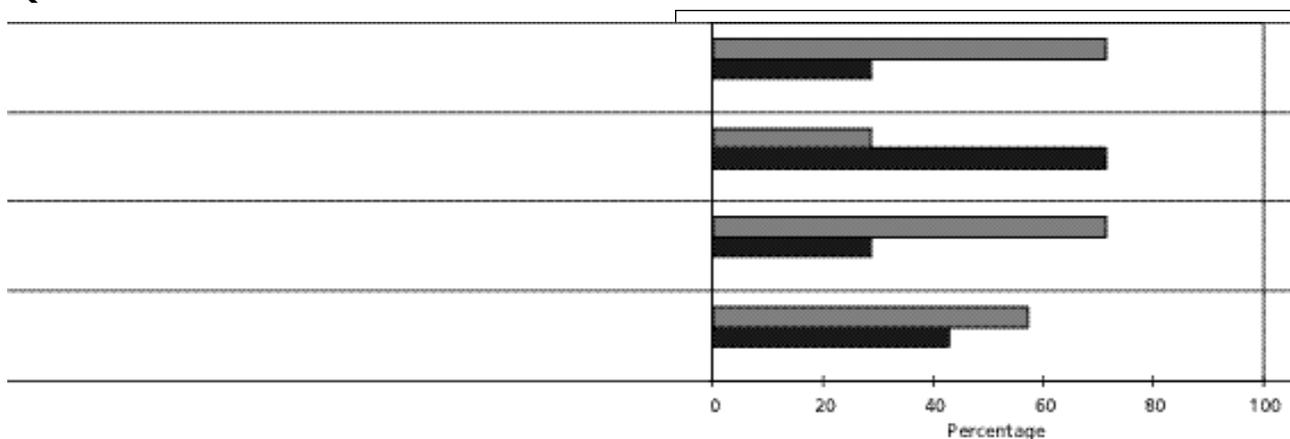
Users were asked specific questions regarding the training content of the package that they piloted, in particular whether they found the material interesting and whether the information presented was at an appropriate level for them. Results are presented in Table 5.29.

Table 5.28: Summary Of Design And Layout Evaluation

## DESIGN AND LAYOUT

### QUESTIONS

### DISK



### TRAINEE COMMENTS

No set order to work through - not sure when I had worked through all the areas.

Did not find very user friendly, it was just like sitting down and reading the regulations - no pictures.

An improved navigation system would make package more user friendly.

Able to refer to Regulations easily whilst working through the examples and scenarios

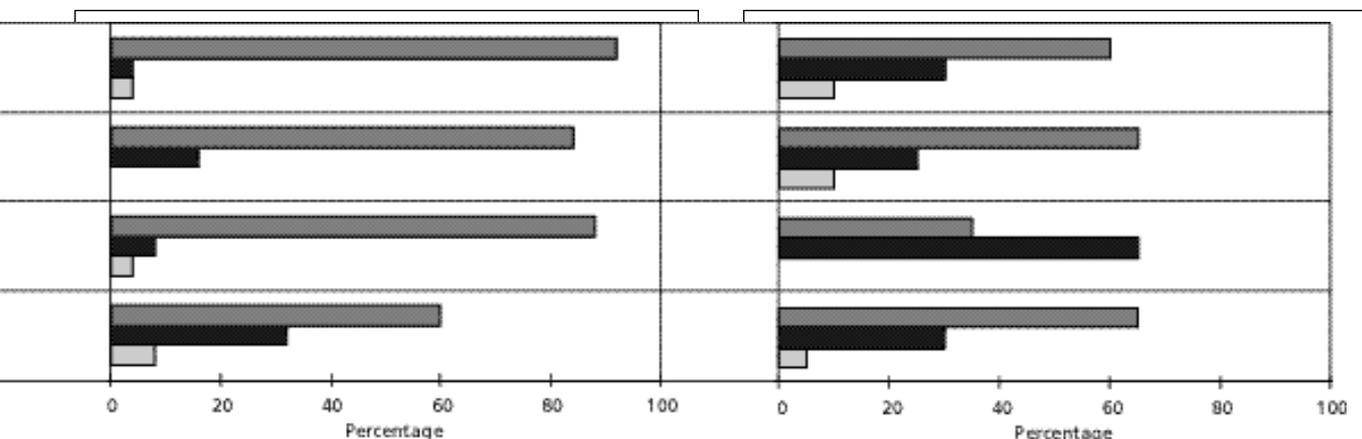
### SUMMARY

The majority of the participants (76%) felt in control of their learning using CBT; most noticeably, 92% of those using the CD-ROM felt that this was so. Whilst 84% of the CD-ROM cohort and 65% of the Internet cohort reported that their interest was maintained throughout the package, only 29% of the Disk cohort reported this as being so.



### CD-ROM

### INTERNET



#### TRAINEE COMMENTS

Good visual effects, colourful, kept you interested.

The novelty value helped maintain interest and concentration.

Discovered certain sections which I was not previously aware of. Also, not always obvious that you had reached the end of a section.

There was so much information available, that I found it hard to take in and began to lose interest after a couple of hours.

Shame that responses were not able to be stored for reference.

#### TRAINEE COMMENTS

As I was unsure of the length of the package it was difficult to plan appropriate time length to use it.

Easy flow through the package.

It wasn't explicit whether the 'top tips' were to be read before or after completing a section - the sequence wasn't explicit.

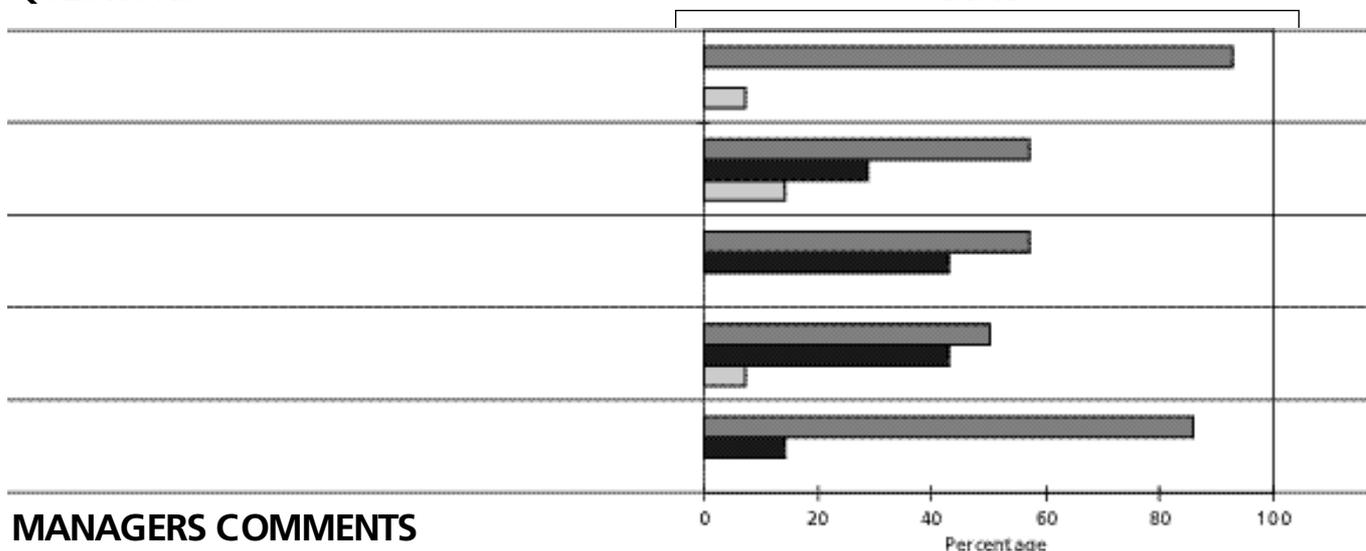
Very clear.

Only 35% of the Internet group were satisfied that they had completed the training compared to 84% and 71% of the CD-ROM and Disk cohorts respectively. Navigation through the packages was thought to be straightforward by most of the trainees (60%) with 65% of the Internet group observing that navigation was straightforward.

Table 5.29: Summary Of Training Content Evaluation

## TRAINING CONTENT AND ACHIEVEMENT OF LEARNING OBJECTIVES

### QUESTIONS



### MANAGERS COMMENTS

Eleven of the twelve managers thought the media were capable of developing technical knowledge and legal and procedural application but half of the managers expressed reservations about the media's ability to develop practical skills.

CD-ROM and web-based training was thought to be capable of contributing to the development of practical skills if packages are designed to maximise interaction and supplemented by other forms of training such as peer review and coaching.

The potential of CBT to promote consistency of enforcement because each trainee was reviewing the same information was noted as a clear advantage. It was important that clear and comprehensive information was provided if consistency in learning outcomes to be achieved.

### SUMMARY

For the majority of the participants (69%) their training objectives were clear; but 43% of the Disk group thought that their training objectives were unclear. The majority of the participants (81%) reported having the necessary pre-requisite knowledge and skills for their subject area, but 30% of the Internet group did not possess the pre-requisites in accident investigation. 96% of the CD-ROM cohort and 90% of the Internet cohort found their training material interesting, but only 50% of the Disk group found their training interesting.

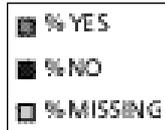
### TRAINEE COMMENTS

More applicable as induction training for new officers/students.

Course guided user through the Regulations in a systematic way.

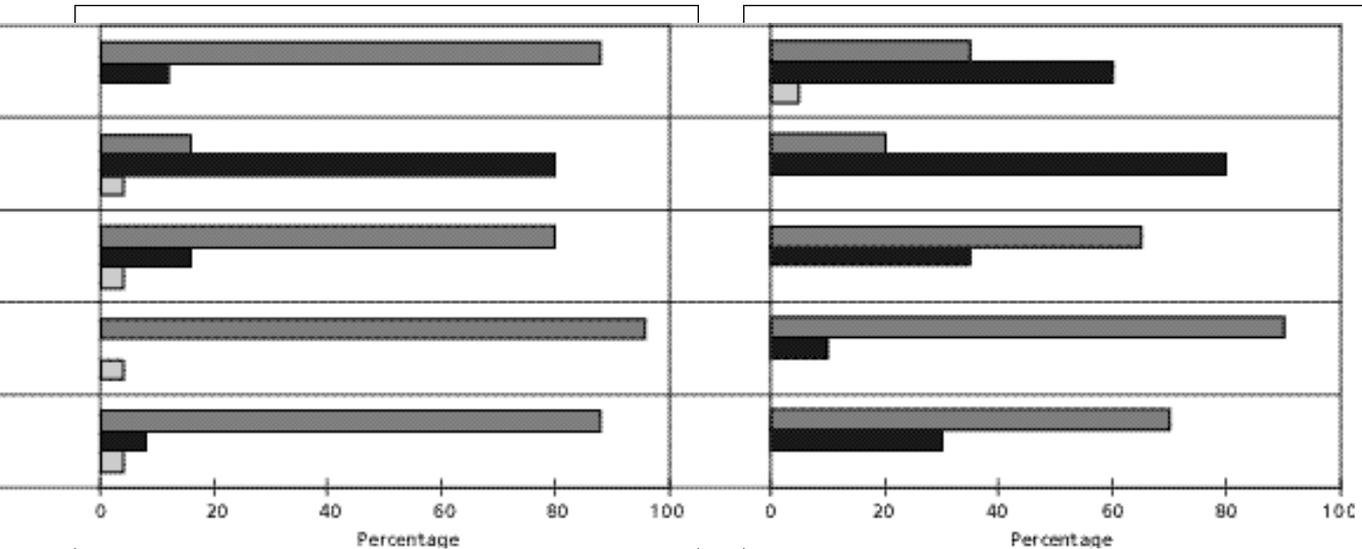
Scenarios were very useful.

Liked being able to access exemptions to the Regulations, especially when the Enforcing Authority appears clear cut.



### CD-ROM

### INTERNET



#### TRAINEE COMMENTS

Good basic training for new/inexperienced officers. Good refresher/reinforcement for experienced officers.

I found reading lots of information on a screen tiring.

I found the content very detailed in certain sections - more than I would need to carry out a routine inspection.

The content was very good. In my opinion, this programme could be used to gather reference material prior to initial training.

#### TRAINEE COMMENTS

The 'top tips' may be more relevant to those with less experience of accident investigation.

I would have liked to have been able to print off 'feedback' for future reference.

Sparked good discussion within the health and safety unit about legal procedures.

The content was very clear, but this was my first experience of conducting an accident investigation.

There was a balance between new knowledge and consulting known information - very good package to help deal with consistency.

Following the training period, 94% of the Disk cohort and 88% of the CD-ROM cohort considered themselves more confident to undertake the tasks covered in their training, but only 35% of the Internet group reported any gain in confidence. However, 57% of the Disk group reported that their training was too simple for them; this was not the case for the CD-ROM and Internet groups with only 16% and 20% respectively believing that their package was too simple.

### 5.3.2 Ergonomic Evaluation

The scores for ergonomic aspects of the training packages are presented in Table 5.30.

**Table 5.30: Summary Of The Trainees' Reactions To Ergonomic Factors**

Aspect	Factor	Score		
		Disk	CD-ROM	Internet
Ergonomic	Flexibility	5.2	6.8	6.7
	Usability	6.3	6.7	5.7
	Acceptability	5.9	7.7	5.9
	<b>OVERALL AVERAGE</b>	<b>5.8</b>	<b>7.1</b>	<b>6.1</b>

As with pedagogical aspects, the trainees commented most favourably about the CD-ROM and were positive towards the Internet but less so towards disk based training.

The following tables (Tables 5.31 - 5.33) provide a summary of trainee opinions on each of these aspects and where appropriate, managers' attitudes towards ergonomic issues.



Table 5.31: Summary Of Flexibility Evaluation

## FLEXIBILITY

### QUESTIONS

Enjoyed being able to work at own pace

Was able to work without disturbance

Work activities meant less time available for training

Could plan to undertake training at a specific time

### MANAGERS COMMENTS

Ten of the twelve managers perceived advantages from the convenience of staff being able to access CBT at any time of the working day/week. It was recognised that this afforded managers flexibility in staff deployment for example, training sessions could be cancelled without incurring cost should an emergency arise.

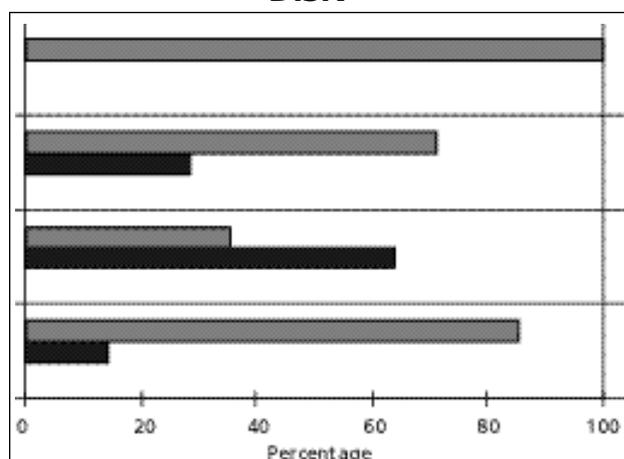
The two managers who did not comment favourably about this aspect were employed by LAs in which the provision of IT equipment was limited, thus negating the flexibility CBT can offer.

Ten of the twelve managers appreciated the advantages of staff being trained on site not only in so far as the savings made on travelling expenses but also because staff did not need to be absent from the workplace.

### SUMMARY

The vast majority (85%) of the participants enjoyed being able to work at their own pace, this was particularly noticeable in the Disk group where all the members responded positively. The Disk package was less time consuming and it is apparent that this had an impact on the flexibility of the medium, with the majority of the Disk cohort reporting being able to work undisturbed and undertaking their training

### DISK

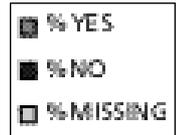


### TRAINEE COMMENTS

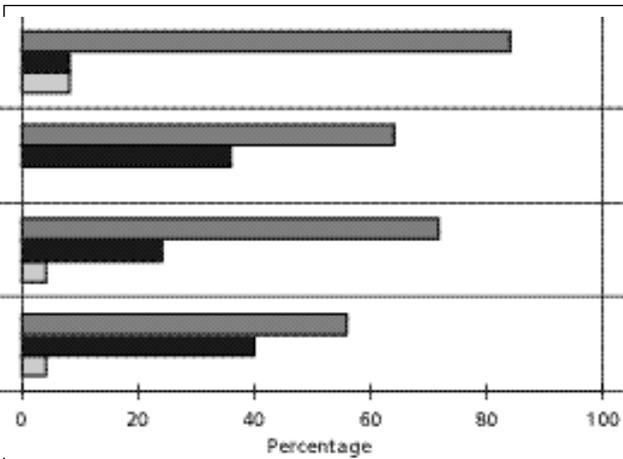
Able to access information quickly and work through for variable time, i.e. 10-30 mins.

A considerable amount of time was spent becoming familiar with the navigation system.

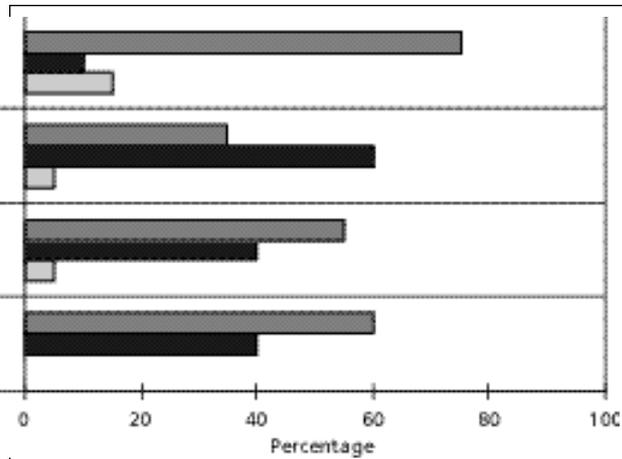
Only took 45 minutes to complete.



### CD-ROM



### INTERNET



#### TRAINEE COMMENTS

Access could be gained and length of session could vary depending on officer time available. Because of design, it was easy to do sections at a time.

Did not need to be a computer genius to use the package. Can start and stop whenever you need to, so can do it when it suits you.

Very quick to set up therefore ideal as preparation before an actual inspection.

Sometimes an effort to arrange access to a CD-ROM computer away from my workstation, otherwise would be interrupted.

#### TRAINEE COMMENTS

Flexibility is one of the key benefits.

Flexible- but too easily put to one side as a result of daily workload.

Lack of knowledge of working on the Internet hindered my progress in this exercise. The only flexibility was working on it in my own time or not doing it at all.

Only limit was booking computers with Internet access within our organisation. If it were available on computers on desks it would be very flexible.

The package took longer to complete than anticipated because I do not have direct Internet access and share a PC with a colleague also involved in the study.

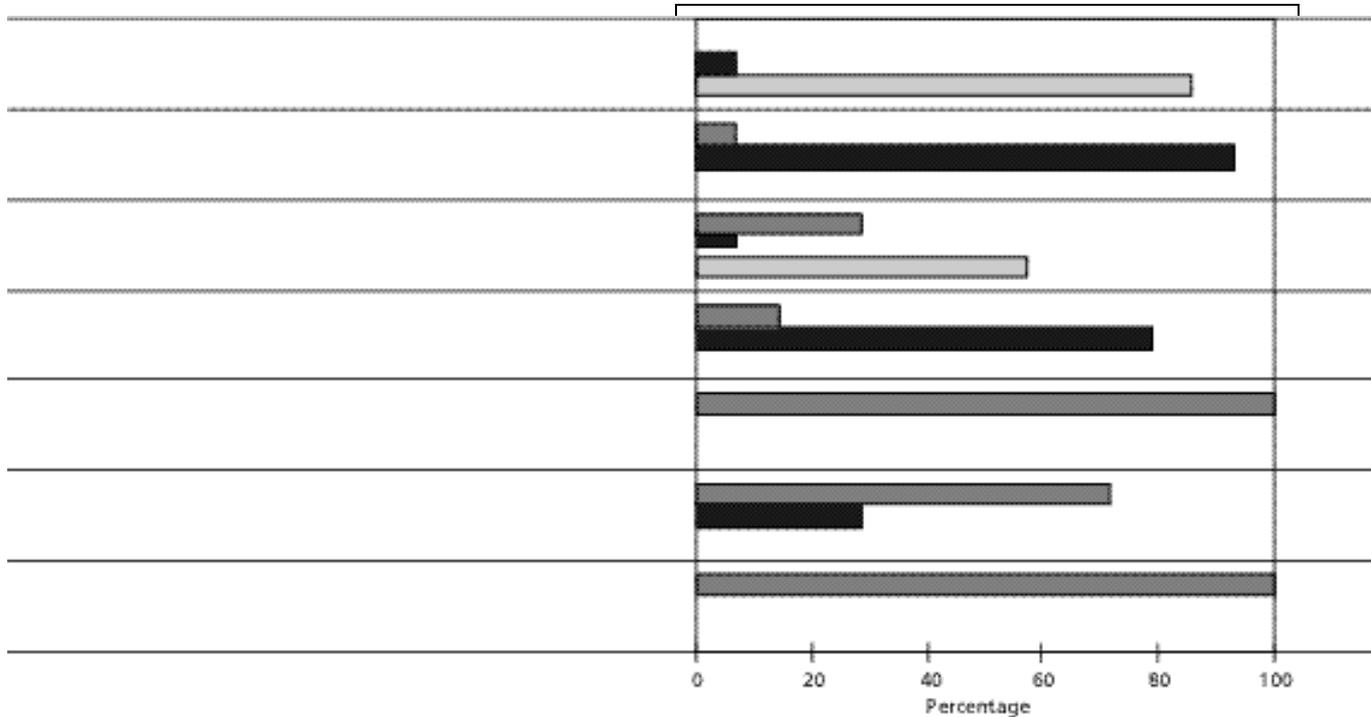
sessions at a specified time. For instance only 36% of the Disk cohort reported that work activities prevented them from spending sufficient time on their training package compared to 72% of the CD-ROM group. Furthermore 71% of the Disk group were able to work on their package without disturbance, this was so for only 35% of the Internet group.

Table 5.32: Summary Of Usability Evaluation

# USABILITY

## QUESTIONS

## DISK



Half of the managers reported problems with hardware - in some cases this was attributed to computers not being of a sufficiently high specification and in others there were insufficient machines available for use in the workplace.

Five managers did not have sufficient on-site technical support in their workplace.

Four managers believed their staff did not have sufficient technical expertise to make the best use of the CD-ROM and disk training packages, but in the case of the Internet, only one manager thought staff had sufficient technical expertise. There was a general view that staff needed to become more familiar with navigation of the web before they were able to use the WWW based training to its full potential. The need for further written instructions both for managers and trainees was mentioned. Although Internet trainees had been directed to a web site that explained how to use the web it was clear from the user logs that this site had not been visited by trainees.

## SUMMARY

The overwhelming majority of the participants (86%) found the training media easy to use. However, 75% of the Internet cohort did require in-house support to use the medium, only 12% of the total cohort reported that in-house support was not available when needed. All of the Disk group (100%) and 84% of the CD-ROM group

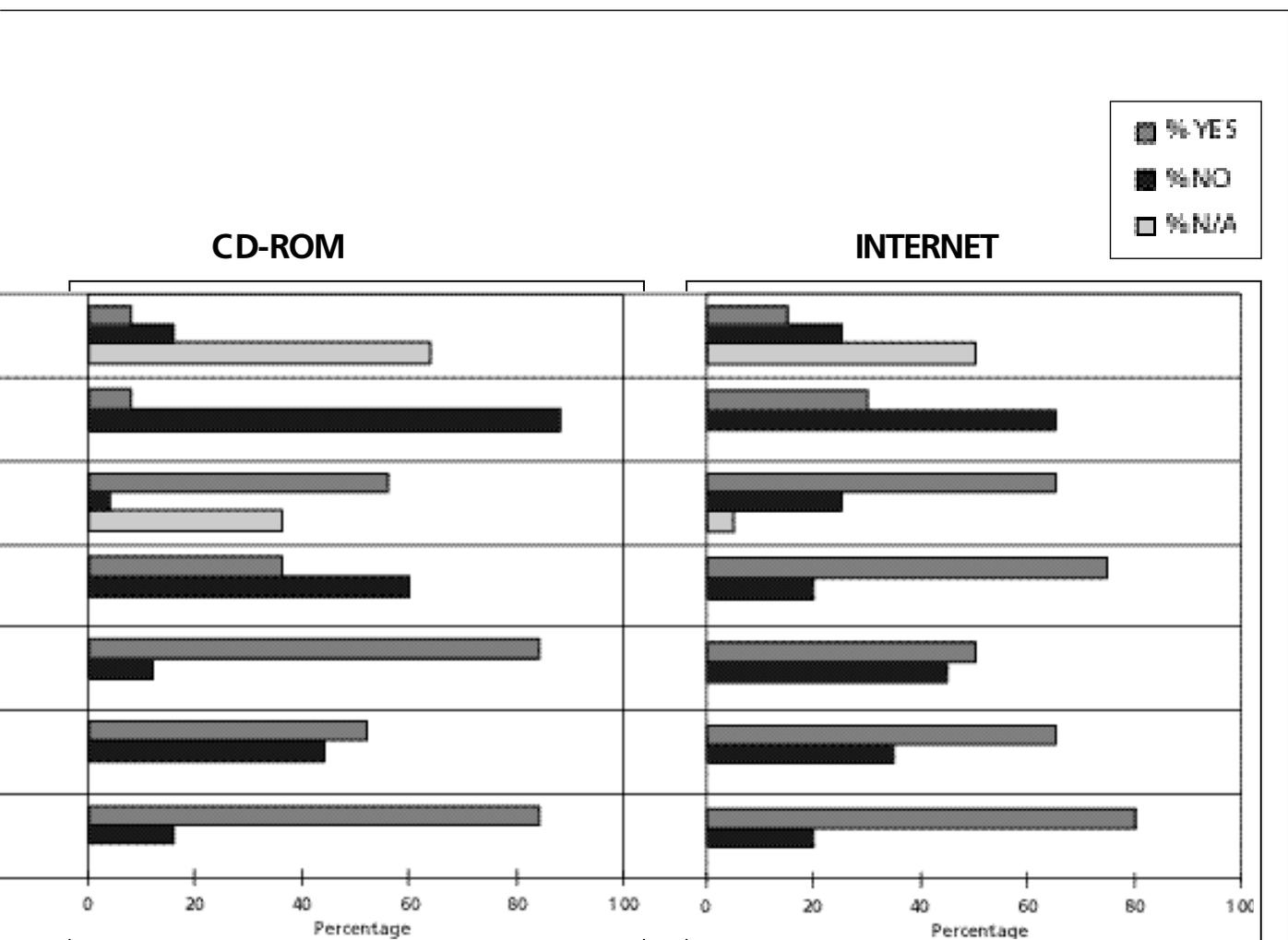
### TRAINEE COMMENTS

The use of 'hot keys' or multi tasking (several screens open at once) would have been very useful.

Couldn't install program - had to use a colleague's disks.

Package didn't work well on a 14 inch monitor.

Easy to use.



**TRAINEE COMMENTS**

Easy to operate and use.  
 I am not particularly good at using IT, but as CD-ROM was loaded for me, I had no problems after that.  
 Easy, once the initial compatibility issues were sorted out.  
 Easy to use, but there was a picture clarity problem with some machines, this was too technical for me to sort out.  
 Easy to access. Time consuming to work through if work disrupted therefore ability to save where left off is essential.  
 Ability to search for topics would be a help.

**TRAINEE COMMENTS**

Easy to use. Good to be able to work at own pace.  
 I found that it took me a while to familiarise myself with the Internet and to understand that I had covered all the areas of the package.  
 I would have liked to have been able to print information from the training package to use in my everyday work.  
 Relatively user friendly after initial teething problems, partly due to my Internet inexperience.  
 Software problem initially caused problems with access to website, needed to seek in-house and external support.  
 Time restrictions did not permit familiarisation with the Internet.

reported having sufficient technical expertise to use their training media but only 50% of the Internet group possessed suitable IT skills. In general the programs operated without significant problems, but 44% of the CD-ROM group experienced some problems running their program.

Table 5.33: Summary Of Acceptability Evaluation

## ACCEPTABILITY

### QUESTIONS

- Would like to use this medium for training in the future
- Using the package increased trainee confidence in CBT
- Technical difficulties discouraged use of the package
- Was a good medium for the training undertaken
- Trainee enjoyed using the training package

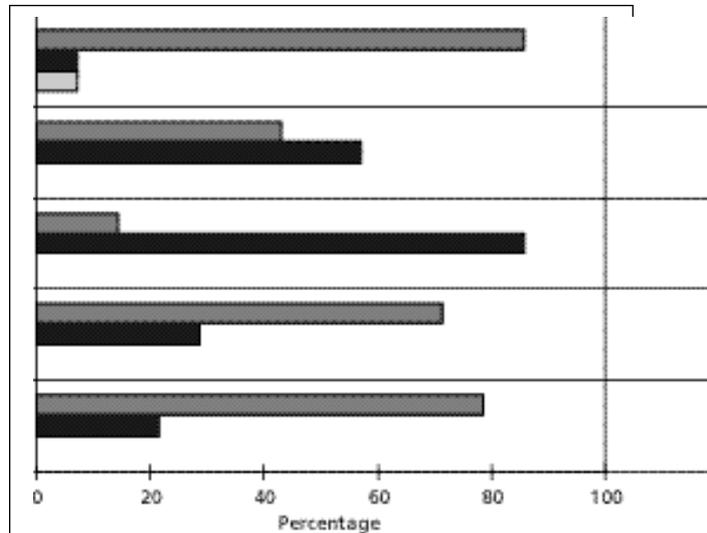
### MANAGERS COMMENTS

All 12 managers were prepared to use other CD-ROM and web-based packages if they were available. Two of the eight managers whose staff piloted the Disk based training did not see any future for training delivered in this way because of the limitations when compared to CD-ROM and web based training.

### SUMMARY

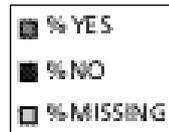
The vast majority of trainees enjoyed using CBT (83%); moreover 86% of the cohort wished to use the media that they piloted for future training. 82% of the CD-ROM cohort thought that this medium was suitable for hotel safety training with 71% of the Disk group and 70% of the Internet group believing that the medium they piloted was suitable for the training content. Whilst 76% and 70% of the CD-ROM and Internet cohorts respectively reported that their confidence in CBT had increased as a result of this training, this was so for only 43% of

### DISK

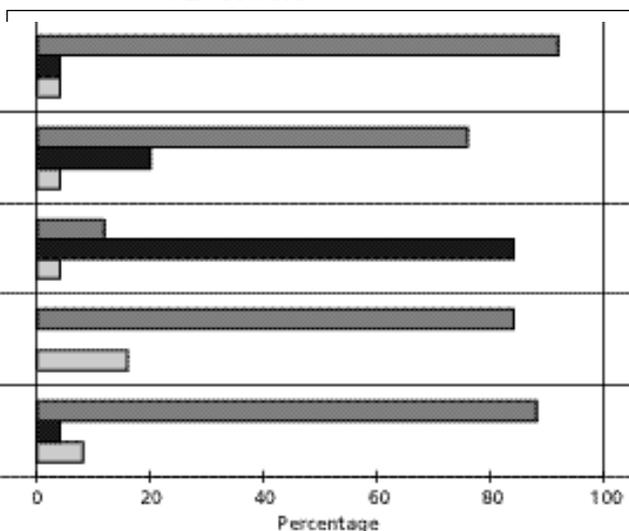


### TRAINEE COMMENTS

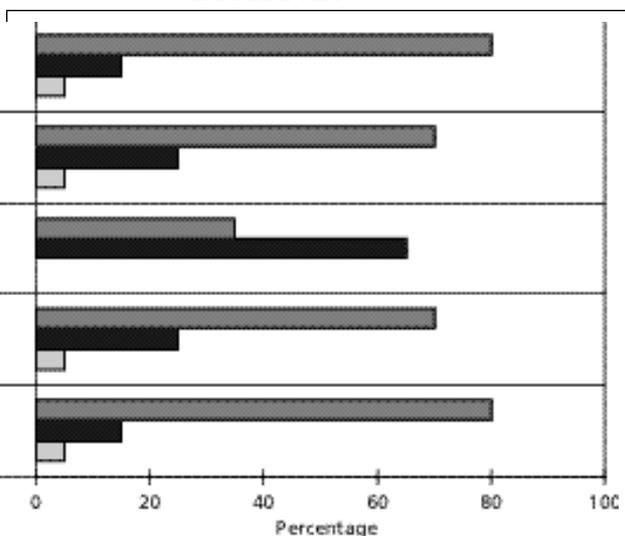
Surprised at how well it worked for me!  
 Training was easily carried out in time allocated.



### CD-ROM



### INTERNET



#### TRAINEE COMMENTS

I think it has its place as a resource in a department as a preparation for inspections and also as a training aid for students.

I don't see any significant advantages over traditional training material.

We have had a lot of classroom training and one's weaknesses can be exposed to public view in a group, but with CD-ROM this does not happen - the CD does not raise its eyebrows at your speed of uptake etc.

More CD-ROM please!

Very good fun, graphics were excellent. Quality of package much higher than 'self learning' paper systems.

OK but intensive visually - concentration span limited.

Easy to use, but access to computer with CD-ROM was difficult.

A very enjoyable means of training and CD will also continue to serve as an inspection prompt.

#### TRAINEE COMMENTS

I would prefer to learn by way of lecture/one to one to aid feedback.

I believe the greatest achievement has been to get through it and overcome all the difficulties. I doubt if I would ever have used a computer outside of the confines of work recording had it not been for this unavoidable exercise.

First time I'd tried web-based training - but found it easy to use and enjoyable.

Most use was gained from the use of the Internet rather than the content of the training in health and safety issues.

Health and safety training became secondary to just getting to the end of the exercise.

The Internet is great for learning, however my confidence was lowered by the access difficulties hence time wasted left little time to concentrate on training.

Very acceptable as photographs, diagrams etc. can be used to their maximum effect.

the Disk package; however it should be noted that all of the Disk cohort reported that they already possessed sufficient technical expertise to use the medium so it is unlikely that their technical ability was challenged by this medium. Only 12% and 14% of the CD-ROM and Disk cohort respectively were Discouraged from using the package by technical difficulties (despite 44% of CD-ROM group reporting technical problems), but 35% of the Internet group were discouraged due to technical problems.

## 5.4 ECONOMIC EVALUATION

Whilst training is important and necessary, it can also be costly and organisations must maximise the return on the investments they make in training their workforce (Read and Kleiner, 1995). Several research studies have concluded that, under the right circumstances, computer based delivery systems are considerably more cost effective than classroom teaching and produce learning that is at least equal, if not superior to what can be achieved in a lecture (Goldstein, 1993).

The financial implications of using the training media were investigated to assess their cost effectiveness. Cost effective CBT may not necessarily be the most desirable from an instructional point of view, but for specific identified training needs it may present an economical and effective strategy for staff training and development (see Section 3.2). The cost of development of the training (assuming technology and equipment and support was available in the workplace), was estimated, based upon the time taken to write the training content, the software development and the number of potential users. It was also assumed that 50% of Local Authorities would purchase the packages, leading to a predicted cost of £100 for floppy disk package, £400 for a CD-ROM package and £100 for an Internet package.

The views of line managers within the 12 Authorities in which the packages were piloted were sought to establish whether they had the resources available to use CBT and whether they anticipated being able to purchase computer-based training materials in the future. In addition to the 'up-front' costs of the packages, managers were also asked to consider the other potential benefits of computer-based training, such as minimising travel costs and disruption, the flexibility of choosing when to train and ensuring consistent information in training content.

All of the managers thought that training delivered via CD-ROM and the Internet was viable and they also agreed that training provided via the Internet appeared to be cost effective. There was less consensus about the cost effectiveness of CD-ROM training. Two managers, both of whom were responsible for 10 or more officers, believed CD-ROM was cost effective and a further four thought it would be for core/essential areas where there was a recurring need for training. A further three managers stated that at £400 per training package the purchase costs were too high. All managers agreed that at a cost of £100 Web based training was cost effective although one authority reported concern about the recurrent costs associated with working on-line.

Both CD-ROMs and the Internet were regarded by all managers as having a future role in the training of enforcement officers but only 5 of the 8 managers whose staff used the floppy disk training perceived it had a future role. The reservations centred around the absence of advantages over traditional and less expensive methods and that the other two technology based media offered greater potential for building interactive training.

## **6. MAIN FINDINGS, DISCUSSION AND RECOMMENDATIONS**

### **6.1 INTRODUCTION**

Computer based training (CBT) is now increasingly an integral element of professional development in the workplace and it has the potential to improve the effectiveness of Local Authority health and safety inspector training in a number of important ways. It can provide the opportunity for learners to adopt different learning styles or strategies - an aspect which is not normally addressed in traditional lecture-based programmes. It allows repeated access to the material, thus providing an instant refresher course to those working in a particular area, or a general introduction to those who may be moving into a new area of work. The layering of material accommodates a range of abilities and prior knowledge and enables trainees to work through the material at their own pace. Engaging trainees through interaction with the media can also support deep learning and encourage the trainee to validate knowledge through experimentation. Employers may also recognise the benefits of staff completing training within the workplace rather than attending more traditional lecture based courses away from work.

However, it is important to recognise that CBT introduces new demands on both the trainees and their employers. CBT moves control of the material covered to the trainee and therefore requires a more pro-active approach to learning. Managers must also recognise a fundamental change in the way in which they organise the training provision. A shift towards training in the workplace requires managers to organise and oversee the achievement of learning objectives as trainees progress through the training packages. If trainees and organisations are unclear about the management of this process, motivation to complete the training may diminish. Failure to acknowledge the time and support needed to acquire new study skills may result in alienation. In order to ensure successful implementation of CBT empirical research that explores not only knowledge acquisition but also the impact of various contextual factors and personal characteristics on the effectiveness, productivity and success of CBT is essential in implementing health and safety enforcement training within local authorities.

### **6.2 VERIFICATION OF THE COHORT**

In order to assess whether CBT was a valid training option for LA based health and safety inspectors it was necessary to recruit a cohort that reflected the different types of authority within the UK. The first priority for the sample was to include LAs from various geographical areas as well as various types of authority. The LAs recruited to participate in the study included representatives from England, Scotland and Wales; from Metropolitan Boroughs, London Boroughs and others. In addition, individuals were placed in the various study groups according to age, gender, occupation and work experience. Computing experience and attitude to CBT were not priorities as these factors were to be evaluated within the project.

### **6.3 KEY ASPECTS**

Many factors influence the outcomes of training programmes. These may include the personnel involved (both as trainers and trainees), the nature of the skills to be acquired, the financial resources available to develop and support training packages, the time that can be devoted to training, the media to be employed in facilitating learning and the opportunities available to apply the knowledge and/or skills acquired.

In order to facilitate the efficacy of training programmes these factors should be considered and should be integrated in a way that reflects the various theories of learning (e.g. Bruner, 1966; Gagné, 1977; & Glaser, 1976).

In drawing together the main findings of the research, the discussion, conclusions and recommendations will be presented under three key aspects:

*i. Pedagogic*

Discussion centres around the degree to which the trainees increased their knowledge in each of the subject areas and the factors which influenced this. In addition the potential of the media as an appropriate delivery method for health and safety enforcement training is explored.

*ii. Ergonomic*

The issues of reliability, usability and flexibility of the media are discussed in the context of how these factors can influence the attitude of the trainees and line managers to the use of the medium and how such barriers can be overcome to facilitate future CBT.

*iii. Economic*

The financial implications of using the training media are considered and recommendations are proposed to assist health and safety line managers when considering how to implement CBT in a cost effective manner.

Quantitative and qualitative data from several sources were examined to evaluate the effectiveness of the media. Analysis of the pre and post-test scores of the cohort explored the knowledge gain associated with use of the packages and the impact of various trainee characteristics. Opinions from trainees and managers were assimilated to investigate the knowledge gain, acceptability, usability, design and layout, training content and achievement of learning objectives for each medium.

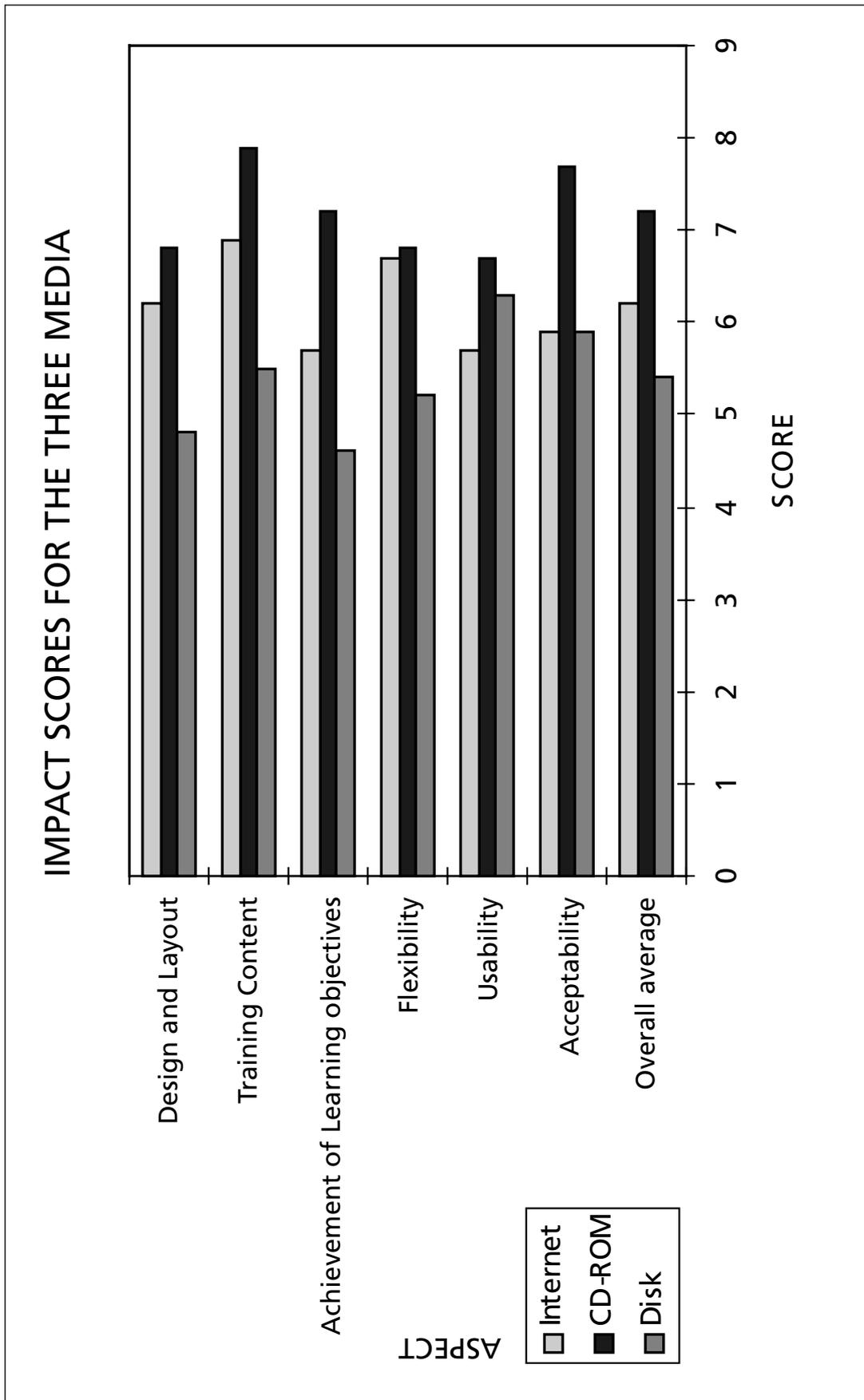
The packages were enthusiastically received by both trainees and managers. Both groups confirmed the capability of CBT to form an important element of their professional development. Seventy one per cent of the users believed they had achieved the learning objectives specified for the package used. Both managers and trainees acknowledged that these three media provided an interesting and innovative approach to learning.

### **6.3.1 Knowledge Gain**

A key outcome of the research was to measure whether the use of the training packages resulted in any demonstrable change to the base line knowledge of the trainees. The pre and post-test scores of the 59 officers who had used one of the three packages were examined. An immediate post-test, such as the one conducted for this evaluation is able to identify the effects of a specific training intervention, even if important aspects of learning and reflection take place only later.

Analysis revealed that 83% of the trainees had improved their scores. On average, test scores improved by 15% and a paired t-test on the pre and post-test scores for each trainee confirmed this improvement to be significant ( $P = 1.1 \times 10^{-10}$ ).

Figure 6.1 Impact Scores For The Three Media



Participants in the study were involved for a number of reasons; some offered to help with the project, others were asked to help by their managers. The nature of the selection of the cohort may have resulted in some participants being included who were 'perfectly extrinsically motivated' i.e. their participation in the training held no interest for them and they were only doing so because they were required to by their manager. The training packages were not in response to any individually identified training need of the participants and consequently, their completion was not overseen by their line managers. Indeed, in most cases it was left to participants to find time in their working day to complete the packages. Thus, the motivation of the individuals in the study might have been less than normally expected. Learners must be 'ready to learn' (i.e. have the necessary ability, motivation and attitudes to learning) or learning will not take place (Goldstein, 1993). It is therefore possible to conclude that the learning that took place probably represents the very minimum that could be achieved and if CBT were implemented in a more managed and supportive environment one would expect an even greater impact on knowledge.

Previous authors have discussed the impact of pre and post-tests in promoting learning by reinforcement and practice, and proposed that what is actually being measured is the combined effects of the learning materials plus the tests (Draper et al. 1994). This phenomenon appears to be evident in the knowledge test results since the controls also improved their scores by an average of 10%. However, comparison of the improvements in scores confirmed that trainees showed significantly greater knowledge gain than controls ( $P = 0.025$ ).

### **6.3.2 Trainee Characteristics And Knowledge Gain**

The influence of trainee characteristics and their response to CBT has been an important element of previous research studies. A prospective user's overall attitude toward using a computer is a major determining factor in their eventual decision whether or not actually to use CBT. This attitude is, in turn, a function of perceived usefulness and perceived ease of use (Davis, 1993). Reluctance to use CBT cannot be overcome merely by increasing a trainee's exposure to this type of training. The user must gain in confidence, see the computer as beneficial to them, to feel in control when using the computer and also see the computer as an acceptable behaviour (Selwyn, 1997). Successful integration of CBT into a wider training framework must therefore acknowledge, in addition to the learning objectives, the characteristics of the group at which it is aimed to ensure that they are made to feel comfortable and in control of their learning experience.

Within this research project, the impact of age, gender and previous computing experience on knowledge gain was examined.

### **6.3.3 Age**

The computer is subject to a great deal of 'generational' stereotyping. However, analysis of the pre and post-test scores for under 35 years of age and those over 35 years of age revealed that age did not significantly impact on knowledge gained through the use of the packages.

#### **6.3.4 Gender**

Computers are often viewed as a masculine preserve and IT is widely presented as, and therefore perceived as 'masculine', both in society (i.e. through the media) and via education. Leister (1993) reported that this view of the computer has left many women believing that IT will play no role in their lives as professional adults. Thirty males and twenty-nine females were involved in testing the packages. Analysis of their test scores revealed that males improved their scores by 21% compared to 10% for females. Whilst both males and females increased their scores significantly, comparison of the two groups revealed that improvement in male scores was significantly better than improvement in female scores. Further analysis of the characteristics of the trainees was undertaken to ascertain whether attitude and/or experience were linked to gender differences.

#### **6.3.5 Previous experience of computers**

Previous authors have suggested that individuals who are familiar with computer technology are more likely to be positive towards the future use of CBT (Lund & Volet, 1998). The cohort was found to have very different levels of experience in using computers and almost half reported having none/low experience. Surprisingly, this did not appear to impact on their knowledge gain. The average knowledge gain amongst the none/low experience group was 16.2%, compared to 14.5% for the medium/high experience group. The difference in knowledge gain between these two groups was not significant.

#### **6.3.6 Attitudes**

For many people the computer is still an object which invokes strong negative reactions: fear, suspicion, resentment and even downright hostility (Selwyn, 1997). These feelings are primarily related to a lack of knowledge which novice users have about using IT (Torkzadeh & Angulo, 1992).

The attitudes of the participants towards the use of CBT were determined prior to allocation to the training packages. The spread of attitudes within each of the training packages was not identical and those in the Internet cohort included a higher proportion of anxious trainees. Male trainees and those with greater computing experience generally possessed more positive attitudes towards CBT. Nevertheless, differences in attitudes did not appear to effect knowledge gained by use of the package as both groups significantly improved their scores. In addition, previous experience of using computers did not appear to influence the knowledge gained from the use of the training packages as trainees with previously low computing experience and those with previously high computing experience demonstrated a significant increase in their knowledge after use of the training package.

#### **6.3.7 Learning styles**

Analysis of the learning styles of the 96 officers who participated in the study revealed some differences to the norms reported by Honey and Mumford (1986). Health and safety staff were found to be marginally less activist and pragmatic than the Honey and Mumford cohort. Future training designed specifically for this audience needs to acknowledge the different learning styles and a more comprehensive survey of health and safety inspectors may be appropriate to inform future developments.

## **Recommendation**

*Future initiatives to introduce CBT materials using technology based training must acknowledge the potential impact of trainee characteristics, which may engender anxiety and, in some cases resistance to using the technology to its full potential. The demands made on individuals who do not feel confident must be acknowledged and mechanisms to assist trainees in the transition process must be in place before CBT is implemented. Failure to do this will undermine the likely educational success of the technological innovations that are being introduced.*

## **6.4 THE IMPACT OF THE DIFFERENT MEDIA**

The pedagogical, ergonomic and economic effectiveness of each package was examined in a number of key areas:

- Knowledge gain
- Time spent
- Preparedness
- Design and layout
- Training content
- Achievement of learning outcomes
- Usability
- Acceptability
- Economics

The trainees' ratings for these aspects of the training packages are summarised in Figure 6.1.

#### 6.4.1 Floppy Disk

The floppy disk package aimed to enable enforcement officers to apply the Health and Safety Enforcement Regulations 1998. Fourteen trainees completed this package and all of them improved their test scores. Post-test scores were on average 23% higher than pre-test scores and this improvement was significant ( $P = 3.56 \times 10^{-5}$ ). The controls also improved their scores - by an average of 15% - and comparison of the knowledge gain for both trainees and controls was not found to be significantly different ( $P = 0.08$ ). Undoubtedly, part of the improvement in the post-test scores can be attributed to the increasing familiarity of the participants to the newly introduced Enforcing Authority Regulations. The mean time spent on this package was 98 minutes although 36% of the cohort did report that they found that work activities prevented them spending as much time as they would have liked on the package. Analysis revealed that the vast majority of the trainees (86%) were both technically competent to use the package and had the necessary knowledge and skills. This finding is not surprising because of the simplicity of using the package, with little prior experience needed.

Although significant knowledge gains were recorded, trainee opinions on the design and layout, training content and achievement of learning objectives did vary. Fifty-seven percent found navigation through the package straightforward, and 71% reported that they felt in control of their learning and were satisfied that they had completed the package. However, only 29% felt that their interest was maintained throughout the package. Ninety-three percent of the trainees felt that they had achieved the learning objectives although 43% reported that the training objectives were unclear. All of the trainees reported that the floppy disk package was easy to use and 71% reported that the package had operated without significant problems.

The floppy disk package was the most straightforward and all of the trainees using this media were able to use it, however 29% of the cohort did report some difficulty operating the program.

Seventy eight percent of the disk cohort enjoyed using the training package and 71% felt that it was a good medium to learn about the enforcing authority regulations. This was a straightforward computing package and as expected, only 43% felt that its use had increased their confidence in CBT. However, 86% reported that they would like to use a floppy disk package for training in the future.

Economic considerations may ultimately determine whether training packages are widely utilised within a training framework. Following a review of the costs of developing each of the training packages, a cost of £100 was attached to the purchase of a floppy disk training program and managers were asked to comment on whether they felt that at this price it would be an economically viable prospect. Five of the eight managers whose staff had used the floppy disk package did not believe that this type of technology had any long-term future. Managers may however have under-estimated the potential of disk-based training in certain areas, since the results indicated a clear knowledge gain amongst the trainees who used it.

The results reported for the floppy disk may reflect the limitations of this technology and this type of subject probably reflects the maximum capability of this technology. Managers also expressed reservations about the potential of this medium to enhance practical skills and the advantages over paper-based training activities were unclear.

## 6.4.2 CD-ROM

The CD-ROM package aimed to develop the knowledge and skills necessary to conduct a health and safety inspection of a hotel to monitor and evaluate compliance with relevant statutory provisions. Twenty-five trainees completed the CD-ROM package and all them improved their test scores. Post-test scores were on average 22% higher than pre-test scores and this improvement was significant ( $P = 4.62 \times 10^{-9}$ ). The controls also improved their scores - by an average of 12.6%. Comparison of the knowledge gain between trainees and controls was significant ( $P = 0.0005$ ). Trainees on average completed the package in 201 minutes although 72% of the trainees reported that work activities had prevented them spending as much time as would have liked on the package. Analysis revealed that 76% of the trainees reported being technically competent and had the necessary pre-requisite knowledge and skills to use the package.

In addition to the knowledge gain, trainees were very positive about the design and layout, training content and the achievement of learning objectives. Ninety-two percent felt they were in control of their learning and 88% were satisfied that they had completed the package. Eighty-eight percent felt that they had achieved the learning objectives and 84% reported that their interest was maintained throughout. However, 32% of the trainees reported difficulties in navigating their way through the package. This would undoubtedly be improved by embedding a menu system. The managers felt that CD-ROMs could be used to develop technical knowledge, legal and procedural application. Interactive CD-ROMs were also perceived as contributing to the development of practical skills, when embedded within a training programme which incorporated other forms of training such as peer review and coaching. The potential of the medium to address the training needs of different groups of inspectors, ranging from newly qualified officers, with practical experience of inspecting hotels, to those experienced officers who may wish to refresh their knowledge of the subject was considered to be an important strength by both trainees and managers.

The CD-ROM program was designed to begin automatically, once the trainee inserted the CD-ROM into the disk drive and 84% of the trainees reported that the package was easy to use. Although it was straightforward, 44% of users did experience some technical difficulties.

Eighty-eight percent of the CD-ROM cohort enjoyed using the medium and 84% felt that it was a good medium to learn about hotel safety. Seventy six percent reported that using the package had increased their confidence in using CBT and 92% would like to use CD-ROM for training again.

Managers were asked to comment on the likelihood of adopting CD-ROM training in the future, if it were to cost £400. Opinions as to the economic viability varied. Two believed it to be cost effective; a further four felt it would be in areas of recurring need for training, whilst three felt that the purchase cost would be too high. Thus, whilst the CD-ROM package was enthusiastically received by both managers and trainees, financial constraints within local authorities may prevent its widespread adoption as a training medium.

The CD-ROM was without doubt the most enthusiastically received package. Both trainees and managers embraced this medium. Not only did the trainees demonstrate increased knowledge in the subject area, but they were clearly engaged by the ability of the medium to present the training elements necessary to understand hotel safety in a visually attractive and stimulating format. However, economic constraints may discourage widespread use.

### 6.4.3 Internet

The Internet package aimed to develop a suitable knowledge base for undertaking accident investigation and increase trainees' confidence in their ability to undertake such an activity. Twenty trainees completed the Internet package, but the results of the knowledge tests were less clear. Trainees and controls both showed only marginal improvement in their knowledge gain (2.6% and 4.5% respectively) and neither of these improvements was significant. Trainees on average spent 261 minutes undertaking the package, although further analysis revealed a large range in the actual time spent - from 40 to 825 minutes. Eighty percent of the trainees spent less than the six hours considered necessary to thoroughly work through the package and 55% felt that work activities prevented them from spending as much time as they would have liked on the package. A further confounding factor was that only 30% of the Internet trainees believed they had the necessary technical expertise and pre-requisite knowledge to undertake the training. Lack of familiarity with the medium was evidenced by their inability to exploit features such as hyperlinks and on-line discussion groups which were incorporated to facilitate learning.

Sixty five percent of the trainees thought the navigation was straightforward. However, only 35% were satisfied that they had completed the training. Sixty percent reported being in control of their learning and 65% reported that their interest was maintained throughout. Sixty five percent felt that the training objectives for the package were clear, but only 35% reported that they felt they had achieved the learning objectives. There may be several contributory factors to this mismatch. The research tool randomly allocated trainees to particular packages without consideration of their preparedness to undertake the training package. The floppy disk and CD-ROM were likely to have been more familiar to these trainees than the Internet. This may have affected their learning experience as they had little previous experience of web based technology and had a limited understanding of its operation. Time was therefore spent familiarising themselves with the technology, rather than undertaking the training. Inexperience with the Internet is an issue which must be addressed if its potential as a delivery method is to be realised. Use of the Internet may require more careful management than more familiar CBT media. Time may need to be ring-fenced to ensure trainees have an effective training experience and further consideration may need to be given to the design of the package. For example, incorporating tasks that necessitate the use of Internet features will enable trainees to have a clearer understanding of the tasks involved and the milestones which need to be achieved. This should also facilitate the development of their navigation skills around the site.

Whilst 80% of the Internet cohort reported that the package was easy to use, 75% required assistance to use it.

Eighty percent of the Internet cohort reported that they enjoyed using the package and 70% felt it was a good medium to learn about accident investigation. Seventy percent reported that using the package had increased their confidence in using CBT and 80% reported that they would like to use this medium for future training.

Managers were asked to consider the economics of adopting Internet training. A price of £100 was attached to gain access to the web site. All of the managers agreed that Internet training, provided at this cost would be cost effective, although one manager did raise concerns about the recurrent costs of working on-line.

Although the impact of the Internet package on knowledge gain was unclear, both trainees and managers acknowledged the pedagogical and ergonomic potential of this medium to deliver training. Managers clearly viewed the Internet as the most economically viable means of addressing the health and safety training needs of their health and safety staff in the future. Evaluation of the Internet package did however highlight the critical importance of managing the introduction and implementation of web-based training within local authorities.

## **6.5 DISCUSSION AND RECOMMENDATIONS**

Following evaluation of the packages developed within the research project it is clear that the use of CBT within LA Environmental Health Departments has the potential to augment the range of training methods and media currently available to ensure a competent health and safety inspectorate. The packages designed and developed for this project used a hypermedia system incorporating graphics, video, applications software and specially designed interactive teaching materials. The media provided an innovative mechanism to combine theory and worked examples to enable trainee development and offered the opportunity to integrate different aspects of training within a supportive environment.

The task of the line manager is to select the most appropriate blend of delivery, giving consideration to training content, trainee and organisational characteristics and resources.

### **Recommendation**

*Professional development will often be necessary for those whose task it is to integrate CBT into an existing training programme.*

The introduction of CBT has several consequences, not least of which are the management issues it raises for line managers. The findings of this study should assist in informing this management process by highlighting the potential of using CBT as a training vehicle. Earlier work highlighted the importance of a structured approach to managing training, consisting of:

- The identification of training needs;
- Planning and design;
- Implementation; and
- Evaluation.

Further recommendations from this research are therefore reported within this framework.

### **6.5.1 The identification of training needs**

To be effective, training must be integrated into the organisation as a whole and should not occur in a haphazard, unplanned manner. The research explored the impact of trainee characteristics on knowledge gain and with the exception of gender, their performances were not significantly affected by these characteristics. However, previous research has acknowledged the impact of age, previous computing experience and anxiety on performance therefore managers should be sensitive to these issues.

## **Recommendation**

*Managers must be directly involved in identifying the training needs of their staff and incorporate factors such as individual characteristics in selecting an appropriate delivery medium. Managers need to appreciate that the computing expertise of staff will vary and a significant proportion are likely to need assistance in developing their computing skills before they are adequately prepared to make best use of the training packages. In advance of introducing CBT a computer literacy inventory should be undertaken.*

### **6.5.2 Planning and design**

Whilst local authorities may be enthusiastic about the potential of CBT to deliver health and safety training in the workplace, it is important to acknowledge that they may not be organised around the concept of learning. Whilst larger authorities may well provide additional resources to trainees to support their learning, this is by no means universal. A major problem highlighted within several authorities who participated in the study was the provision of adequately specified computers. Some trainees also reported difficulties in accessing computers and using them for prolonged periods of time or at a time most convenient for them. Others reported difficulties in obtaining timely in-house technical support, which often thwarted progression through the package. These issues may have a negative impact upon the potential flexibility of CBT in the workplace. For many local authorities the start up costs of implementing CBT may be significant, although the scale will depend upon the nature of the equipment used. Additionally, local authorities may wish to consider the implications of providing unrestricted access to the World Wide Web because of the perceived dangers of employees becoming diverted from their work.

## **Recommendation**

*An essential pre-requisite before the introduction of CBT is a technology audit which combines the traditional training needs analysis with an inventory of the hardware and software currently available within the organisation. Local authorities must also consider the need for technical back-up for both trainees and managers, which may result in significant financial burdens.*

There are significant differences between CBT and the training traditionally prevalent in local authorities. With the exception of peer review, methods such as seminars are essentially passive; i.e. there is no obligation on the trainee to participate, other than being physically present at a specific place at a specific time. In contrast, CBT requires the trainee to be more proactive and responsible for their own learning. Often the learning curve associated with the acquisition of new study skills can result in student alienation and all of these issues may conspire to demotivate the trainees and reduce the potential of the media to provide an effective learning experience. Student resistance can be reduced by introducing change gradually, including appropriate skill development activities, communicating clearly the commitment required of them and introducing activities to increase their confidence in their ability to meet these requirements.

## **Recommendation**

*Trainees must be involved in the process of introducing and managing work-based learning and in understanding the implications of undertaking CBT in the workplace. Marketing of CBT should be undertaken to ensure that staff understand from the outset the reason for the changes in training delivery and the potential benefits which may ensue. Managers must also recognise that moving trainees towards self directed learning might raise complex issues about the long-term motivation of their trainees.*

This research highlighted a number of design features which, if incorporated within packages should help to improve the acceptability of the media:

- Navigation around the packages must be intuitive and ensure that trainees are clear about the scope of the package and their progress within it. This training was designed to be undertaken in the workplace and consequently it is likely that trainees will be required to undertake it in a number of sessions. The packages must therefore be designed to enable trainees to bookmark their progress and to re-enter at the point they exited.
- Comprehensive written support material and troubleshooting guides need to accompany the packages so that managers have details about them, e.g. pre-training and reinforcement activities, the level of prior technical and subject expertise required, its aims and objectives, the tasks to be completed and the length of time trainees will need to complete the packages.
- The packages should be designed to provide feedback to the trainees about their progress. Milestones could be put in place to track trainee performance through the programme. Performance summaries, available to both trainees and managers could assist in identifying difficulties or weaknesses which may inform future training.
- The interactive opportunities offered by the Internet, such as e-mail and web-based discussion groups, have the potential to provide a forum for individual support which is increasingly squeezed out of conventional provision. These technologies provide a vehicle for communication between the trainee and the tutor, the group and the tutor and most significantly between the trainees themselves. For geographically remote authorities web based training provides trainees with the possibility of becoming part of a wider learning community from which they can receive valuable peer support.

### **Recommendation**

*Managers should develop a matrix or set of criteria (including the features raised above) to assess the suitability of CBT packages and where possible to try out the packages they are considering using.*

### **6.5.3 Implementation**

Managers have a significant role to play in the implementation of CBT. Using new technology can break down some of the barriers to learning. It may also, however, remove some of the boundaries which have helped shape current thinking about the learning process. One practical implication is that employees may no longer get the time for training because they are not required to physically leave their work station. In a sense they may lose out on the 'protected time' they previously received. The advantages gained by embedding the learning more effectively within the activities and culture of the working organisation may be offset by the reluctance of the participant's line managers to give a really effective allowance for the time needed to pursue the learning programme itself. So the familiar problem of finding real time for work-based learning does not disappear.

### **Recommendation**

*Managers must ensure that adequate time is available for trainees to undertake and complete the training.*

Whilst it may be possible for local authorities to contract out the provision of CBT, the packages designed for this project were intended for use within the workplace. This resolved some of the problems identified by local authorities as barriers to training such as travel and subsistence costs and fitting around work schedules of staff. Local authorities will need to put in place processes which carefully manage the implementation of CBT. Access to computers may result in diversion away from the original purpose of learning at work. They should therefore recognise their responsibility for monitoring trainee performance and progress. Work-based learning should furnish trainees with the opportunities to discuss their learning with external and internal peers, providing scope to use the workplace as a powerful source of learning and not just a location for it.

### **Recommendation**

*In selecting training packages, managers must give careful consideration to attaining a good match between the identified training needs of staff and the learning outcomes specified within the programme. Managers must also recognise the importance of implementing systems which track progress through the training packages (by examining performance in assessment exercises, etc.), so that regular feedback can be given to trainees. The sophistication of the system required should be determined by local conditions. The linking of this training to other learning opportunities should be explicit in the pre and post- training tasks embedded within the package.*

### **6.5.4 Evaluation**

The aim of any training programme should be to bridge the gap between existing knowledge and skills and those required to enable staff to undertake their work effectively. Evaluation should therefore confirm that the skills and/or knowledge deficit identified during training needs analysis has been addressed and that improvements in job performance are apparent. An essential component of any training programme must therefore be the development of appropriate, sensitive evaluation procedures. Clearly, a layered approach is required to evaluate different aspects of the training provided. The criteria used to evaluate effectiveness of training include:

- the quality of the instructional materials and methods;
- satisfaction ratings;
- changes in knowledge and attitudes; and
- changes in professional performance.

Analysis of these elements should continually inform the training strategy and will ensure a dynamic training provision which provides cost effective solutions to organisational training needs. Budgetary decisions concerning future initiatives may ultimately rest on the evaluation of the outcomes.

### **Recommendation**

*Managers must ensure that the evaluation tools used enable them to collate the information on the quality and effectiveness of different training packages, enabling training budgets to be wisely invested and the resources committed to instructional media to produce tangible results. Where possible, users should also endeavour to feedback the findings of their evaluation to training providers to assist in refining and improving the development of future packages.*

## REFERENCES

- Applebee, A. (1992) *Attitudes towards computers in the 1990s*. MEd. Thesis, University of Canberra, as cited in Applebee, A., Clayton, P. & Pascoe, C. (1997) *Australian Academic Use of the Internet*. Internet Research: Electronic Networking Applications and Policy **07**;02.
- Bruner, J. S. (1966) *Towards a Theory of Instruction*. Cambridge, MA: the Belknap Press of Harvard University Press.
- Casstles, H., Ford, N. J., Green, L. Murphy, R.G., and Rennie, D. (1998) *Managing Training for Health and Safety Enforcement Officers: A Guide for First Line Managers*. Salford: Department of Environmental Management, University of Salford.
- Cunningham, D. J., Duffy, T. M. & Knuth, R. (1993) The Textbook Of The Future. In Mcknight, C., Dillon, A. & Richardson, J. (Eds), *Hypertext: A Psychological Perspective*. Ellis Horwood.
- Davis, F. (1993) User Acceptance Of Information Technology: System Characteristics, User Perceptions And Behaviour Impacts. *International Journal Of Man-Machine Studies*, **10**:129-137.
- Department of Trade and Industry (DTI) 1993. *Review of the Implementation and Enforcement of EC law in the UK*. London: HMSO.
- Draper, S. W. (1994) 'Evaluating Courseware' in *Information Handbook: Version 2*, Learning Technology Dissemination Initiative, Herriot Watt University, pp56-60.
- Elder, V.B., Gardner, E.P. & Ruth, S.R., (1987) *Gender and Age in Technostress: Effects on White Collar Productivity*, Government Finance Review, **03**:17-21.
- Gagné, R. M. (1977) *The Conditions of Learning*. 3rd Edition. New York: Holt, Rinehart and Winston.
- Glaser, R. (1976) Components of a Psychology of Instruction: Towards a Science of Design. *Review of Educational Research* **46**:1-24.
- Goldstein, I. L. (1993) *Training in Organizations* (3rd Edition). California: Brooks/Cole Publishing Company.
- Health and Safety Commission (1994) *Review of Health and Safety Legislation*, London: HMSO.
- Health and Safety Commission (1996) *Standards of Competence and Training for Health and Safety Inspectors and Adequate arrangements for Local Authorities as Enforcing Authorities*. HSC(G)4.
- Honey, P. and Mumford, A. (1986) *The Manual of Learning Styles*. Maidenhead: Peter Honey.

- Jarret, J. & Coates, J.F. (1995) Employee development and Job Creation: Trends, Problems, Opportunities. In London, M. (Ed.) *Employees, Careers and Job Creation: Developing Growth-Orientated Human Resource Strategies and Programs*. USA: Jossey-Bass Publishers.
- Jonassen, D.H., Ambruso, D.R. & Olesen, J. (1992) Designing a Hypertext on Transfusion Medicine Using Cognitive Flexibility Theory. *J. Of Educational Multimedia and Hypermedia* **01**:309-322.
- Jonassen, D. (1991) Hypertext as Instructional Design. *Educational Technology Research and Development* **39**:01;83-92.
- Kearsley, G. (1991) Training Media and Technology in Morrison, J. E. (Ed.) *Training for Performance: Principles of Applied Human Learning*. Chichester: John Wiley and Sons.
- Keeling, D. I., Jones, E., Botterill, D. and Gray, C. (1998) Motivational Perspectives in Work-Based Learning in Brown, S. Armstrong, S. & Thompson, G. (Eds.) *Motivating Students*, London: Kogan Page.
- Kolb, D. A. (1984) *Experiential Learning*. New Jersey: Prentice Hall.
- Laurillard, D. (1993) *Rethinking University Teaching: A Framework for the Effective Use of Educational Technology*. London: Routledge.
- Leister, J. (1993) Promoting Gender Equity In Computer Literacy, Paper Presented At *ACM SIGUCCS User Services Conference XXI*, San Diego, CA.
- Lund, C. & Volet, S. (1998) *Barriers to Studying Online for the First Time: Students' Perceptions*. EdTech'98 Proceedings.  
<http://cleo.murdoch.edu.au/gen/aset/confs/edtech98/pubs/articles/l/lund.html>
- Maclure, R.F. (1985) Age and Video Game Playing, *Perceptual and Motor Skills*. **61**:285-286.
- Patrick, J. (1992) *Training: Research and Practice*. London: Academic Press.
- Pham, B. (1998) Quality Evaluation Of Educational Multimedia Systems. *Australian Journal Of Educational Technology*. **14**:02; 107-121.
- Pont, Tony. (1991) *Developing Effective Training Skills*. London: McGraw Hill Book Company.
- Prince, L., Campbell, A. and Nanton, P. (1994) *Training in Health and Safety Enforcement for Local Authority Environmental Health Officers and Technicians*. Institute of Local Government Studies.
- Ravet, S. and Layte, M. (1997) *Technology Based Training*. London: Kogan Page.
- Read, C. W. and Kleiner, B. H. (1996) Which Training Methods are Effective? *Management Development Review* **09**:02.

Selwyn N. (1997) Teaching Information Technology to the 'Computer Shy': A Theoretical Perspective On A Practical Problem. *Journal of Vocational Education and Training*, **49**:03;395-408.

Spiro, R.J. & Jehng, J.C. (1990) Cognitive Flexibility and Hypertext: Theory and Technology for the Non-Linear and Multi-Dimensional Traversal of Complex Subject Matter. In Nix, D. & Spiro, R.J. (Eds.) *Cognition, Education and Multimedia: Explorations in High Technology*. New Jersey: Lawrence Erlbaum Associates, Publishers.

Spiro, R.(1988) *Cognitive Flexibility Theory: Advanced Knowledge Acquisition In Ill-Structured Domains*. (Tech. Rep. No. 441) Champaign, IL: Center For The Study Of Reading.

Taylor, P. & Thackwray, B. (1996) *Investors in People Explained*. 2nd Edition. London: Kogan Page.

Torkzadeh, G. & Angulo, I.E. (1992) The Concepts and Correlates of Computer Anxiety. *Behaviour and Information Technology*, **11**;99-108.

Tucker, B. (Ed.) (1997) *Handbook of Technology Based Training*. Aldershot: Gower.

## **RESEARCH INSTRUMENTS**

**Appendix 1 (i)** Pre-Training Questionnaire

**Appendix 1 (ii)** Pre-Training Desk-Top Exercises

**Appendix 1 (iii)** User Log

**Appendix 1 (iv)** Post Training Questionnaire

**Appendix 1 (v)** Proforma For Telephone Interview With Line Managers

**Appendix 2 (i)** Case Study Interview Schedule For CEHO

**Appendix 2 (ii)** Case Study Interview Schedule For Health  
And Safety Line Manager

**Appendix 2 (iii)** Case Study Interview Schedule For  
Personnel Department Representative.

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