Supporting Education and Training in Technology MIS—An Information Exchange System for COMETT*

C. P. LEE
Information Technology Institute, University of Salford, Salford, M5 4 WT, UK

J. M. RAE
Enterprise Unit, University of Salford, Salford M5 4 WT, UK

J. A. KIRKHAM
Information Technology Institute, University of Salford, Salford, M5 4 WT, UK

This paper discusses the design and development of an IT support and communications system to simplify the exchange of information on staff, students, educational products and information between educational and private enterprises in the EC and EFTA countries. It also discusses how such a system can help to promote engineering education and meet the demands of advanced technology training initiatives, such as the COMETT programme.

INTRODUCTION

IN RECENT years, education and training in the EC has received wide attention, and funding, from the European Commission through a range of programmes, including COMETT, ERASMUS, DELTA, EuroPACE, PLUTO, PETRA and LINGUA. Many of these education and training initiatives have required the collaboration of industry as an integral part of the programme. This collaboration is helping to create training programmes that respond to real needs by promoting the transfer of experience and expertise between industry and higher education. The movement of people between enterprise and higher education, via exchange programmes, is one way of meeting effectively the demands of advanced technology training and transfer. The need for continued professional updating, across all phases of an individual's career, poses a difficult challenge. One dimension of this challenge is the mobility of people. This paper describes the evolution of a system that has, as its objective, the easing of barriers to mobility in technology education and training.

The student and personnel exchanges provided by programmes like COMETT (Community Programme for Education and Training in Technology) offer wide-ranging benefits to all those involved—companies, universities, staff and students. The staff and students involved in the exchanges have the opportunity to experience another culture, different working patterns, develop their language skills, and share knowledge within their discipline areas. Universities are attracted to such programmes as they offer an enhanced educational experience to students and enable staff to develop contacts in other countries. The companies have the opportunity to get skills and resources that they would not otherwise possess or could not afford. They view student placements as an opportunity to conduct a long-term interview of a prospective future employee.

BARRIERS TO EXCHANGES

COMETT has worked to develop a pan-European information exchange infrastructure by setting up a network of University Enterprise Training Partnerships (UETPs). The UETP is a partnership between a range of universities and enterprises and serves as the link between the two. (The EC uses the term 'enterprise' to mean any organization outside the realm of higher education. These can include large, medium or small companies, city councils, local community groups, professional bodies, etc. The term 'university' is used to describe any form of higher educational institute including universities and their equivalent in other European countries.) The role of UETPs is to coordinate COMETT-related activities with particular emphasis on staff and student mobility. There are now 207 UETPs across the 12 EC member states and the seven EFTA (European Free Trade Association) countries. Enabling movement between these member states is difficult

---

and there are many barriers. In this section some major obstacles to movement are examined.

With the growing popularity of the exchange programmes, the current style of working is not ideal for the effective processing of applications. From 1987 to 1992 the number of student grants from COMETT increased from just over 1000 to just under 7000. Frequently the information on staff, students and the placement offers is out of date and many telephone calls are wasted on 'telephone-tag' routines because people are out of the office. The problem with distributing information by paper, even via fax, is that once distributed it does not get updated without further and extensive redistribution. This has proven to be very expensive due to wasted staff time and the constant need to make international telephone and fax calls. The experiences of UETPs with E-mail have, unfortunately, often been negative, which has given rise to 'computer phobia' when communicating using a computer.

This communication problem is compounded by the fact that many UETPs have identified a small handful of other UETP colleagues with whom they will organize most of their placements. Usually they have established 'bilateral' trading agreements and do not share their information with other UETPs. This trading arrangement, from the student's perspective, is sub-optimal since it greatly limits both the ranges of possible placements on offer and the range of countries to choose from. Evidence from UETPs is that such arrangements have developed because of the high cost of communication under the current system.

The unfortunate result of these barriers and associated practices has been that sometimes placements have not been filled with the most suitable applicant and/or the right placement has not been found for the applicant. After such a negative experience the enterprise concerned may not reoffer a placement, or the student will return with an unsatisfactory report. Since experience has shown that 'word of mouth' has been a most effective way of marketing placements, such outcomes are detrimental to the success of the exchange programmes.

There are, of course, many satisfied customers of the exchange programme, but the current downturn in economic activity across the EC has increased the difficulty of getting placements. There is more competition for those placements that are on offer. In such times there is a pressing need to improve the efficiency of the information flow in this system and reduce the current operational cost, much of which arises out of wasted staff time and telecommunications charges.

The MIS (Management Information System) Development Group within the Information Technology Institute at the University of Salford was awarded a contract with the COMETT Technical Assistance Office. The brief was to build an IT support and communications system to simplify the exchange of information about staff, students, educational products and information between both educational and private enterprises in the EC and EFTA countries.

REQUIREMENTS

As UETPs and, in particular, students are the end-users of the system, we set out to identify their requirements. One principal aim was to 'harmonize' some of the working practices of UETPs across the EC and EFTA countries. The development team decided to view the problems from the end-user's standpoint and in the context of the working environment they were used to.

This analysis used a number of ways to identify the users' requirements. UETPs were mailed a user-requirements questionnaire (Appendix) and a selection of UETPs and students were interviewed as part of the initial analysis. In addition, a workshop of some seven UETPs was held at Salford to discover significant features and working practices.

The user-requirements questionnaire was sent to all UETPs and Strand C projects and a total of 91 replies was received (the detailed results are attached—Appendix). Questions 1–5 were designed to find out the size of the database in 1995 compared with 1990. If the size required in 1995 was greater than 1990, then care would have to be taken to ensure that the system would still be adequate in 1995 and could be upgraded cost effectively. The main difficulty here is that about one-third of the respondents were unsure about what would happen to the COMETT funding in the future.

Question 10 shows that there are a significant number of UETPs who would not put information in the public domain. They would prefer to work directly with people they have worked with in the past. There are two reasons for taking this approach. First, they find people whom they can rely on to do things on time and in a professional manner. Secondly, they are afraid of being inundated with applications, making offers and finding out that the applicant does not turn up. One case recounted a student who had made over 100 applications, was offered three places, took one of them and did not inform the other two. Users were divided as to whether to limit the applications, see question 10 part (ii). The majority of users were keen to monitor the progress of students and placements, see question 10, parts (iv) and (v).

The users were prepared to let industry access and update the information, see question 11. This was quite surprising as most of the UETPs would have to become self-financing in the future. Releasing the information, to non-UETPs, would mean they would lose a commercial opportunity. Users were strongly in favour of involving the COMETT Office, the European Commission and the National COMETT Information Centres to use the information on the MIS. The team also felt that it

was vital to get these offices involved in the day-to-day use of the system.

From the questionnaire survey and interviews, the end-users' preferences revealed several common trends. UETPs would like to have a system running on PCs, preferably IBM PCs or compatibles. On the software side, the interface should not be too different from the current popular software packages with window-style environments incorporating drop-down menus and menu-driven facilities. In addition, the input screens should be similar, if not identical, to the actual application forms for placements. The nomenclature and abbreviations for countries, languages, job descriptions, etc., should be valid across the EC and EFTA countries. Where applicable, the system should provide on-line help, especially with the explanation of any abbreviations used. Manuals should be short, step-by-step user guides and written in plain language. Technical support should also be provided. Last, but not least, the system should be cheap to implement and use.

DESIGN CONSIDERATIONS

As one of the aims was to harmonize some working practices of UETPs across the EC and EFTA countries, we considered a number of HCI (human–computer interaction) issues in depth [1]. HCI, for this research, is the study of the way humans operate computers. In this context, a computer is treated as a complex tool that inventive humans have developed. The exchange of information, however rudimentary, between the operator and the tool is essential to use it efficiently. Thus, an alternate definition of HCI would be the *study of the characteristics of this interaction to create computer systems that best serve the needs of humans* [2].

In many ways, we were fortunate to have a detailed description of the users' requirements. However, before arriving at any conclusion as what and how to build the system, we had several concerns. We neither want to 'reinvent the wheel' nor repeat the mistakes people have made in the past in building similar systems.

Given the limited timescale and budget, the team had to make sure what the achievable goals were. Should natural language be used in interfaces? What should the screen layouts look like? How should information appear and in what sequence? What phrasing will ensure the screen information and terminology used will be meaningful for users across the EC and EFTA countries? How can help facilities be implemented without cluttering the screen up with 'information'? Once the system is developed, how can training best be achieved? Last, but not least, how do we effectively support engineering education programmes through such a system?

SYSTEM DEVELOPMENT

To ensure the system is capable of continued systematic upgrades, the team chose an off-the-shelf and well-established database product. The DBMS (database management system) Dataease was selected because of its popularity, economic value and its ability to integrate with other packages; most importantly, it is well suited for novice end-users. A prototype was developed quite early in the project so that end-users could get to 'see and feel' the product.

Many meetings took place with local UETPs and students to test the prototype. It was first publicly shown in January 1991 (Manchester, UK) to a selection of UETPs from across Europe. The purpose was to obtain constructive feedback and continued enthusiasm for the project. We then applied a research method taxonomy known as 'action research' [3] to refine our system. The technique involves capturing the users' response and incorporating it into the system for further testing. This process was repeated to refine the system further.

To employ the technique effectively, protocol analysis [4] was used to monitor the actions and difficulties experienced by those using the system. Users were asked to 'think aloud' for recording purposes (video and sound) while they were using the system. Questionnaires were given out at the end of each session and follow-up interviews were conducted if clarification was necessary.

A later version of the prototype database was publicly shown via a communication link at the COMNET General Assembly (Liège, Belgium) in June 1990. We received many constructive comments and prospective users were given the opportunity for hands-on use of the system. The system was run locally and internationally over a communications link to the University of Salford. The comments received were largely favourable and constructive. After continuous testing and validating we released version 1.0. As part of the contract with the COMETT office, training sessions were held in eight countries. These training sessions extended from November 1991 to June 1992. During this period version 1.2 was released in February 1992 in the light of constructive criticism from earlier sessions.

After all the training sessions were completed, version 2.0 was released. The MIS version 2.0 comprises two systems, namely a Local Office System and a Remote Database System on the MIS host computer located in the IT Institute at the University of Salford. The Local Office System is a replica of the Remote Database System but without the DBMS programming features (Fig. 1). The screens give an idea of the form layout. In practice, the screens were colour coded and different colours were used for static information, labels, titles, etc. The data to be entered such as applicant details, languages, etc., were clearly differentiated. Any messages that result from incorrect data entry
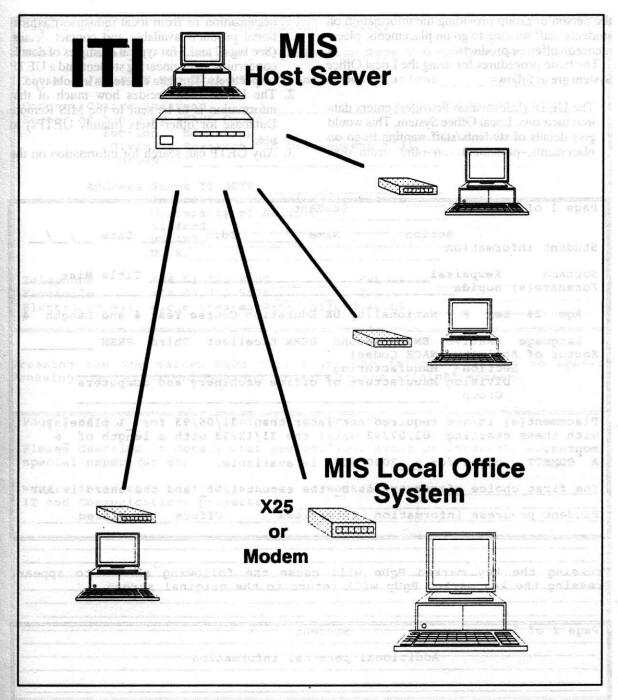
Fig. 1. Outline of the MIS database network.

were coloured differently and worded in a friendly and reassuring manner.

The Local Office System is distributed freely to UETPs to manage their own office system. It has all the functionality of the Remote System but allows the users to store and use the information locally without using the Remote Database. The facility is also available to send and receive selected information to the Remote Database in batch mode. This means that instead of being linked to the MIS (using the telephone lines) while they enter or retrieve information, they can type in the data locally and then send it in short bursts to the Remote Database. This reduces telephone costs and allows a more effective use of staff time.

In the Local Office System, two levels of access exist, one for the UETP concerned (owner of information) to edit and modify records, and the other for querying only. The Local Office System consists of five forms called *Information Provider*, *Placement on Offer*, *Students*, *Staff* and *Products*. The *Information Provider* form contains details of

the person or group providing the information on students/staff wanting to go on placements, placements on offer, or products.

The basic procedures for using the Local Office System are as follows:

1. The UETP (Information Provider) enters data into their own Local Office System. This would give details of students/staff wanting to go on placements, placements on offer (from own organization or from local industries), educational products available and contact details. (See Figs 2 and 3 for typical examples of details concerning an engineering student and a UETP respectively. The data entered is in **bold** type.)

2. The UETP then decides how much of that information is to be sent to the MIS Remote Database for other users (mainly UETPs) to use.

3. Any UETP can search for information on the

```
┌─────────────────────────────────────────────────────────────────────┐
│ Page 1 of 2                          Student                          │
│                                                                       │
│                    Action _     Name _____  Id. _____  Date __/__/_│
│  Student information                                                  │
│                                                                       │
│  Surname     Kewpaisal_____        Title Miss_____  │
│  Forename(s) Sopida_____     │
│                                                                       │
│    Age  24  Sex  F   Nationality UK Education Course Year 4 and Length 4│
│                                                                       │
│     Language   Native ENGL Second GERM Excellent Third FREN _____    │
│  Sector of Activity (NACE Codes)                                      │
│          Section   Manufacturing_____          │
│          Division  Manufacture of office machinery and computers      │
│          Group    _____     │
│                                                                       │
│  Placement(s) is/are required not later than 31/05/93 for _1 place(s) │
│  with these starting 01/07/93 until the 31/12/93 with a length of _6  │
│  months.                                                              │
│  A  COMETT_  grant for ___2000 ECUs is available.                     │
│                                                                       │
│  The first choice of country is D_ the second is I_ and the third is ANY│
│                                                                       │
│  Student progress information  Interviews ___  Offers ___  Placed ___  │
└─────────────────────────────────────────────────────────────────────┘
```

Pressing the key marked **PgDn** will cause the following screen to appear.
Pressing the key marked **PgUp** will return to the original screen.

```
┌─────────────────────────────────────────────────────────────────────┐
│ Page 2 of 2                          Student                          │
│                                                                       │
│                    Additional personal information                    │
│  _____  │
│  _____  │
│  _____  │
│                                                                       │
│              Additional skill and work experience information         │
│  _____  │
│  _____  │
│  _____  │
│                                                                       │
│      Details of University, Faculty/Department and Course Title       │
│  _____  │
│  Mechanical Engineering Department, Imperial College, London_____  │
│  _____  │
└─────────────────────────────────────────────────────────────────────┘
```

Fig. 2. *Student* form showing details of an engineering student.

```
┌─────────────────────────────────────────────────────────────────────┐
│ Page 1 of 2                    Information Provider                    │
│                                                                       │
│ Name    Janus__    Country UK_ Organisation Type U Organisation Size S5│
│                                                                       │
│ Title    Janus IT Sectoral UETP IT and Communications_____         │
│                                                                       │
│ Contact Claire Shearman_____ Title Ms_____         │
│ Sector of Activity (NACE Codes)                                       │
│          Section   Education_____                                 │
│            Division Research and Development [73]_____          │
│              Group _____                 │
│                                                                       │
│          Address Janus IT UETP_____                         │
│                  Information Technology Institute_____                 │
│                  University of Salford_____                   │
│                  Salford_____                   │
│                  M5 4WT_____                   │
│                  U. K._____                     │
│                                                                       │
│                                                                       │
│ Telephone        +44 61 745 5509_____    Extension _____     │
│ Facsimile        +44 61 745 5575            Telex _____     │
│ Electronic Mail c.c.m.shearman@iti.salford.ac.uk_____         │
└─────────────────────────────────────────────────────────────────────┘
```

Pressing the key marked PgDn will cause the following screen to appear. Pressing the key marked PgUp will return to the original screen.

```
┌─────────────────────────────────────────────────────────────────────┐
│ Page 2 of 2                    Information Provider                    │
│ Please describe in detail what you do, your areas of interest, any     │
│ special expertise etc                                                 │
│                                                                       │
│ We are interested to find partners to work on various_____          │
│ IT and Communications projects._____          │
│ _____          │
│ _____          │
│ _____          │
│ _____          │
│ _____          │
│ _____          │
│ _____          │
│ _____          │
└─────────────────────────────────────────────────────────────────────┘
```

Fig. 3. *Information Provider* form showing details of an UETP.

MIS Remote Database. This would concern students/staff wanting to come onto its placements, placements on offer for its own students/ staff to go to, products of interest or industrial partners. The search is carried out by filling in the requests of the 'front ends' provided by the Local Office System. (Figure 4 shows a typical example of a UETP looking for students to come on to placements on offer. The data **Manufacturing**, etc. is not typed in, but is selected from a drop-down menu using only one key stroke).

'4. The UETP would then receive a reply from the MIS Remote Database stating the result of the search at the next login.

5. The UETPs are responsible for updating their own data entries. Thus, after any confirmation via fax or verbal agreements over the telephone, they must make the necessary alterations on their own Local Office System and then login to inform the MIS Remote Database.

As has been described, the system is very flexible in that it allows the user complete control of the

```
┌─────────────────────────────────────────────────────────────────────┐
│                        Looking for a Student                          │
│                                                                       │
│                 Please answer the following questions                 │
│                                                                       │
│        I require a student whose main area of expertise is            │
│                                                                       │
│        Section   Manufacturing                                        │
│         Division Manufacture of radio, TV and communication eq. [32]_ │
│          Group   Manufacture of electronic components [32.1]_____      │
│                                                                       │
│        The placement is available from 01/02/93 in country  D__.      │
│                                                                       │
│        I do not want to look at students entered before 31/08/92 .    │
│                                                                       │
│                                                                       │
│              Press the key marked "F2"  to start the search           │
│                                                                       │
│              Press the key marked "Esc" to end the session            │
│                                                                       │
└─────────────────────────────────────────────────────────────────────┘
```

Fig. 4. 'Front end' to search for appropriate students.

information. If the user does not want to share information, then this information can be stored locally. If the user wishes to publicize information, it is sent to the host database where it can be accessed by all the users. Costs are minimized in that the user is only connected to the database for a short time while the information is transmitted. The user has control, at all times, of the information and how it is manipulated. The user has realized that information is a valuable resource and that access to it must be controlled.

DISCUSSION

The MIS development team set out to remove some barriers to human mobility in engineering and technology training. There were several difficulties that had to be overcome, including:

- The variety of UETP practices;
- linguistic and stylistic differences between UETP operations and documentation;
- incompatible qualification structures and descriptions across the EC;
- HCI design problems;
- a widespread mistrust of computer technology; and
- cost considerations.

The design team took the approach of consulting widely and producing several 'see and feel' prototypes. Such an approach is not without criticism since many users were impatient for the arrival of the finished system. The project did, however, meet its stipulated deadlines and outputs. It also received much praise from UETPs for the usefulness of the system and its usability. In addition, all UETPs were given a free copy of the Local Office System and this is widely used. Full on-line use, however, is still to be provided.

There are, of course, many barriers to 'trade'. Political and economic barriers are in many ways more problematic than technical ones. The full implementation of the system is awaiting such decisions. The basic problem is one of cost and the extent of the usage of the system by UETPs. For although there are very real and high costs to the present mode of operation, UETPs are financially constrained and reluctant to be the first to enter a new system. Such reluctance can only be overcome by a central decision from COMETT to encourage the use of more advanced communication facilities in the exchange programmes.

CONCLUSION

The technology that has been developed is an international on-line database to help in the promotion of engineering and technology education. It is a product to simplify the organization of and the flow of information for exchanges of staff and students and promotion of educational courses and products. It is a system that has been custom built for the end-users.

The advantages of using such systems are many: they can reduce telephone costs to a minimum; the information is accurate, current and timely; and they can help with the administrative load in the local office. Furthermore, in removing many constraints that lead to 'bilateral trading', the people who are intended to benefit most from the exchange programmes gain the full benefit of the the COMETT initiatives. Engineering education has much to gain from a system that removes several barriers to the exchange of people in the single market.

out, without which this research would not have been possible. We would also like to thank the other members of the MIS Development Group for their excellent contributions and teamwork. Gratitude is due to our colleages at JANUS-IT for their useful hints and comments. Many thanks to the pilot centres for their hospitality and their excellent organizations in setting up the training events. Last, but not least, we sincerely appreciate the end-users for their interest, time and effort spent in testing and using our system. The work was carried out with COMETT Technical Assistance Office under project no. 90/2/3653/Cb, September 1990–August 1992.

REFERENCES

1. W. Wulff and D. E. Mahling, An assessment of HCI: issues and implications, *SIGCHI Bull.*, **22**(1), 80–87 (July 1990).
2. J. Kirakowski, *Human Computer Interaction—From Voltage to Knowledge*. Chartwell-Bratt, Bromley, p. 5 (1988).
3. D. E. Avison and G. Fitzgerald, *Information System Development: Methodologies, Techniques and Tools*. Blackwell Scientific, Oxford, p. 244, (1988).
4. K. A. Ericsson and H. A. Simon, *Protocol Analysis: Verbal Reports as Data*. MIT Press, London, pp. 313–373 (1984).

APPENDIX: UETP Management Information Systems (MIS) Questionnaire (V1.1)

No. of questionnaires returned: 91

1. *Approximately how many of UETP students will require placements abroad in 1990 and 1995?*

1990		1995	
1 - 10	29	1 - 10	8
11 - 20	8	11 - 20	8
21 - 30	9	21 - 30	4
31 - 40	5	31 - 40	3
41 - 50	2	41 - 50	3
More than 50	6	More than 50	18
Don't know	10	Don't know	36

2. *Approx. how many placements will you have available in government, industry and commerce in 1990 and 1995?*

1990		1995	
1 - 10	22	1 - 10	7
11 - 20	12	11 - 20	6
21 - 30	5	21 - 30	5
31 - 40	2	31 - 40	5
41 - 50	3	41 - 50	5
More than 50	7	More than 50	11
Don't know	12	Don't know	33

3. *Approximately how many staff will you have that require placements in 1990 and 1995?*

1990		1995	
1 - 5	23	1 - 5	20
6 - 10	1	6 - 10	4
More than 10	3	More than 10	7
Don't know	21	Don't know	44

4. *Approx. how many placements for staff will you have available in government, industry and commerce in 1990 and 1995?*

1990		1995	
1 - 5	14	1 - 5	13
6 - 10	3	6 - 10	11
More than 10	1	More than 10	3
Don't know	30	Don't know	47

5. *Approximately how many training products, packages and courses do you expect of offer in 1990 and 1995?*

1990		1995	
1 - 5	31	1 - 5	24
6 - 10	14	6 - 10	13
10 - 15	1	10 - 15	1
More than 15	4	More than 15	13
Don't know	9	Don't know	32

6. *Describe any other initiatives on which you would like to exchange information?*

Exchange facilities and interested applicants in Strand Bb and Bc
Announcement of the training courses within Strand Ca
Eurotechnet
Tempus
BC-NET
Saturn
Lingua
NOW
Horizon
Petra
Biomedical Engineering
Communicate with the other partners of a project with a common modern tool
Language courses for engineers
Continuing education in industry
Technology transfer, R&D projects
Seminaries, firms that would like to present training projects
Cooperative partners in industry and universities for technology transfer
Other EC programmes
Use of mathematical modelling software
Research, food science and technology, environmental studies, joint ventures
Proposals and searches for partners in COMETT, information on delta activities
Document management systems

7. *Would you find a Mailbox facility useful?*

Not useful	9
Useful	48
Extremely useful	30
Don't know	4

8. *Would you find a bulletin board facility useful?*

Not useful	12
Useful	61
Extremely useful	18
Don't know	6

9. *Would you find a facility which searched the MIS and left a message for you saying that something of interest had occurred?*

Not useful	3
Useful	8
Extremely useful	34
Don't know	8

10. *Using the placement of students and vacancies as a typical example:*

(i) a) **Students requiring placement**

Place details on MIS	9
Place details on MIS and contact UETPs	57
Contact UETPs only	12
Don't know	14

(i) b) **Job vacancies**

Place details on MIS	11
Place details on MIS and contact UETPs	46
Contact UETPs only	13
Don't know	20

(ii) *Would you like to limit the number of applications for vacancies for any one student?*

Yes	30
No	28
Don't know	34

(ii) a) *If the answer to 10 (ii) is Yes, how many?*

1 - 5	23
6 - 10	5
More than 10	0

(iii) a) *Would you like to limit the number of applications that could be made for the vacancy?*

Yes	22
No	36
Don't know	31

(iii) b) *If the answer to 19 (iii) is Yes, how many?*

1 - 5	12
6 - 10	5
More than 10	1

iv) *Would you like to monitor the progress of the availability of a placement for a particular student?*

Yes	61
No	9
Don't know	19

v) *Would you like to monitor the progress of the applications and availability for a particular student?*

Yes	62
No	7
Don't know	22

11.   *Would you be prepared to let industry have access to and update the information on the MIS?*

        Access & Update OK   46
        Access Only   26
        Not an issue   14
        Access and update not OK   10
        Don't know   8

12.   *Do you think the COMETT office, the EC Commission and the National COMETT Information Centres should use the MIS?*

        Yes   72
        No   2
        Don't know   17

14.   *Do you have access to a PC?*

        Yes   91
        No   0
        Don't know   0

15.   *If the answer to question 14 is yes:*

        a)   *How many PCs do you have in your office?*

                1 - 10   69
                11 - 20   8
                21 - 30   3
                More than 30   6

        b)   *Who manufactures the PCs?*

                Apple Macintosh   29
                IBM   30
                Olivetti   8
                Elonex   3
                Phillips   3
                Schneider   3
                Tandon   3
                Apricot   2
                Commodore   2
                Compaq   2
                Vobis   2
                Others   33

16.   *Do you have a printer in your office?*

        Yes   88
        No   2
        Don't know   1

17.   *If yes, what type of printer is it?*

HP	19
Laser (unspecified make)	17
Apple Macintosh	14
Olivetti	3
Star	5
Epson	12
Canon	4
IBM	5
Brother	3
NEC	5
Commodore	1
Others	16

18.   *Do you have a modem?*

Yes	38
No	38
Don't know	0

C. P. Lee is a physics graduate from the University of Birmingham. He joined the University of Salford in 1990 to do an M.Sc. in radiochemistry where he developed a PC-based system for an ESR (electron spin resonance) machine to aid the detection of irradiated food products. He later joined the Information Technology Institute to conduct research on the use of mental model studies of on-line database users to enhance the design of interfaces. At the Institute, he was appointed Systems Engineer for the MIS Project and has extensive experience in providing training courses on on-line database access in many EC and EFTA countries. He has a wide experience in IT consultancy and presenting training courses for small companies.

Dr J. Rae is an economics graduate with many years of industrial experience. He joined the University of Salford in 1987 from York University where he developed the first PC-based expert system for the electricity industry. Before being appointed Enterprise Director in 1990, Dr Rae was a member of the small team that established the Information Technology Institute at the University of Salford. The Institute developed innovative teaching and learning methods in IT. He has a wide experience in IT consultancy, continuing education and training.

Mr J. Kirkham is a physics graduate with an M.Sc. in business studies and operational research. He has over 25 years of experience in computing, both in the UK and the USA, working for government, private industry and education both as employee and consultant. He is Head of Research at the Information Technology Institute where he is working, with colleagues, on two Science and Engineering Research Council grants in the areas of intelligent authoring and information integration for the construction industry.