PERGAMON

Computers & Education 32 (1999) 137–149

COMPUTERS & EDUCATION

A multimedia framework for second language teaching in self-access environments

Fabio Tamburini

Sezione di Linguistica computazionale, Informatica umanistica e Comunicazione, C.I.L.T.A. – University of Bologna, Piazza S.Giovanni in Monte, 4, 40124, Bologna, Italy

Received 6 April 1998; accepted 19 October 1998

Abstract

This paper presents an account of a self-access language teaching scheme operated at the University of Bologna during the last three years. The main goal of the D.I.A.P.A.S.O.N. (Distributed, Interactive, And Personalised Audio-visual Study Over Network) project is to teach English to university students up to intermediate level, by building a self-access environment freely available to learners. Some laboratories equipped with multimedia workstations, video stations, satellite receivers and specifically targeted courseware were set up and tested in one complete year of work. Here I will analyse some topics concerned with self-access language learning through CALL (Computer Aided Language Learning) and the complete structure of the DIAPASON courseware. Some data collected on a sample of students during the year are presented and an interpretation of the data suggested. The main result emerging from the data is that students are very busy and tend to spend only the minimum required time to study foreign languages, organising this activity in few short sessions during the week.

1. Introduction

Nowadays the need for language study on a large scale is emerging and students are requesting more and more resources for language learning. Increasing movement between countries in Europe, the development of international courses and the new language tests introduced in the curricula of Italian university courses, are making students face a new dimension of learning which involves the knowledge of foreign languages as a basic

0360-1315/99/$ - see front matter
PII: S0360-1315(98)00061-X

requirement. Unfortunately, as stated by Jones and O'Brien (1997), students must respect tight scheduling constraints due to university courses, laboratory activities and extra social activities. For these reasons, it is very difficult for them to set aside the time needed for a conventional language course. Furthermore, all these activities are organised in a dynamic perspective, which results in timetabling that is not compatible with the fixed schedule of a standard course. Thus one possibility for such students to practice or learn a second language (L2) is to obtain personal access to language resources and to set up a self-access learning programme.

The need to read texts and articles written in different languages, or to produce papers, letters or requests to send around the world, and the need to access the huge amounts of material available on the Internet have generated a demand for swift and flexible procedures for language learning and, more interestingly, generate the problem of acquiring a specific lexical set related to a particular technical language. Three years ago, these considerations led us to devise the DIAPASON project as a natural progression from 10 years experience of self-access learning with computers that we underwent at our language centre (CILTA) (Rossini, Silver, Gasser & Tamburini, 1994). Our attempt was to provide the students with a self-access site where they can learn English using multimedia computer courseware, video stations and a satellite receiver. The learner can freely access this laboratory using all the resources to follow a personalised learning programme, developed in collaboration with an English teacher.

Our idea was that this kind of laboratory should be located in various faculty buildings, in order to be physically near to the students' regular place of study.

Considering the student's need for learning a specific language and the physical location of the various laboratories, different versions of the multimedia course had to be developed—one for each specific language—adapting the lexical items involved in the courseware. The first version of the course has been developed for scientific language, but by using the same framework, we are planning to devise similar courses focusing on the language of economics and language for administrative purposes.

As mentioned previously the DIAPASON laboratories were designed for self-access use, but what about the effective ability of students to organise and maintain a self-access programme? The "Guide to self-access study" (1997) written at the University of Dublin, presents a useful example on the complexity of devising a self-access environment and teaching students to use it in a constructive way. Our experience and other research (Cotterall, 1995; Esch & Makin, 1996; Little, 1995) suggest that students cannot be left totally alone when using self-access materials, so the best way to organise this kind of resource would be to allow direct communication between learners and teachers in set periods during the week. Moreover, considering the intrinsic flexibility that self-access material should have, how can a student decide what is suitable for his learning programme, and what is not? Our answer to this problem is addressed in two directions. First a placement test and a discussion with a teacher can set up the starting point, the complete learning programme for each student and all the tasks to be met (Wenden, 1995), adapting the course of study to his needs. Second, during the learning process, we investigate the student's progress by organising tests and intermediate discussions. This way of working, leaving untouched the self-access advantages of the laboratory resources, allows the students' progress to be carefully logged during the training phase monitoring.

The general hardware structure of a DIAPASON laboratory is composed of six workstations containing the multimedia courseware, four video stations and a satellite receiver. In the rest of this paper I will concentrate on the software package that I developed for this project. More considerations about distance learning and teaching topics in the DIAPASON project can be found in (Poppi, 1997).

2. Related works and design considerations

There are numerous examples of computer courseware in the literature, designed to teach different disciplines, such as mathematics (Harding, Lay, Moule & Quinney, 1995), computer science topics in higher education (Steeples et al., 1996), philosophy and religion (Ess, 1991), and so on.

Many commercial products for language teaching are currently available, but, in my opinion, none of these addresses our problem satisfactorily. As stated in (Watts, 1997) good courseware should be focused only on the student's needs, and should be designed in a clear and well organised way in order to achieve the learning goal. The available software packages are often too rich on the multimedia "impressive" side, but too poor, or not well organised, on the learning material side. As stated in Hemard (1997), the importance of a well designed learning environment and interface, as well as careful consideration of the learner's needs (Watts, 1997), are very important matters to consider in the early stages of the design process. The DIAPASON software tries to concentrate on communicative features, without exaggerating in the use of image and multimedia features, but concentrating mainly on the learning process. In my opinion, although multimedia considerably improves the acquisition and comprehension of a second language (Brett, 1997; Chun, 1996), we have to carefully consider the quantity, quality and the learning purpose of every sample introduced in the course.

There is another problem that affects commercial products: they usually span a wide range of students' levels and the courseware is not tailored to any specific language field. In having to cover this huge range of tasks, it is difficult or even impossible to obtain in-depth language analysis and sufficient training exercises for each teaching topic. We preferred to concentrate our attention on a limited range of levels and to analyse the lexical items derived from a specific language field. In doing so, it was possible to examine the tasks in detail and to produce many exercises and drills.

3. Courseware structure overview

The DIAPASON courseware is composed of four main activities:

- a multimedia student's book composed of 14 units classified by grammatical/lexical tasks;
- a test generator, used to analyse the learner's ability at the start of the learning process and every time the student requires self-evaluation;
- a large set of extra practice exercises;

- a procedure for sending messages to CILTA, in order to obtain technical help or hints from the teaching staff.

3.1. DIAPASON student's book

The student's book is the core of the entire project. It is composed of more than 100 textbook pages and more than 130 exercises strictly connected with the activities in the teaching units. It is divided into 14 units, one for each topic (or group of related topics), and brings the learning process up to intermediate level. The book pages belong to two main categories, according to their purpose. The first one involves reading texts. Original texts extracted from newspapers, advertisements, scientific publications, etc., were adapted to student needs, building complete works on reading and comprehension ability, vocabulary and listening. Every piece of text was recorded by a mother tongue speaker and the speech sample is freely available to the students. Gloss explanations are extensively used to introduce learners to new concepts or to explain difficult words. Fig. 1 shows an example taken from the unit on the simple past.

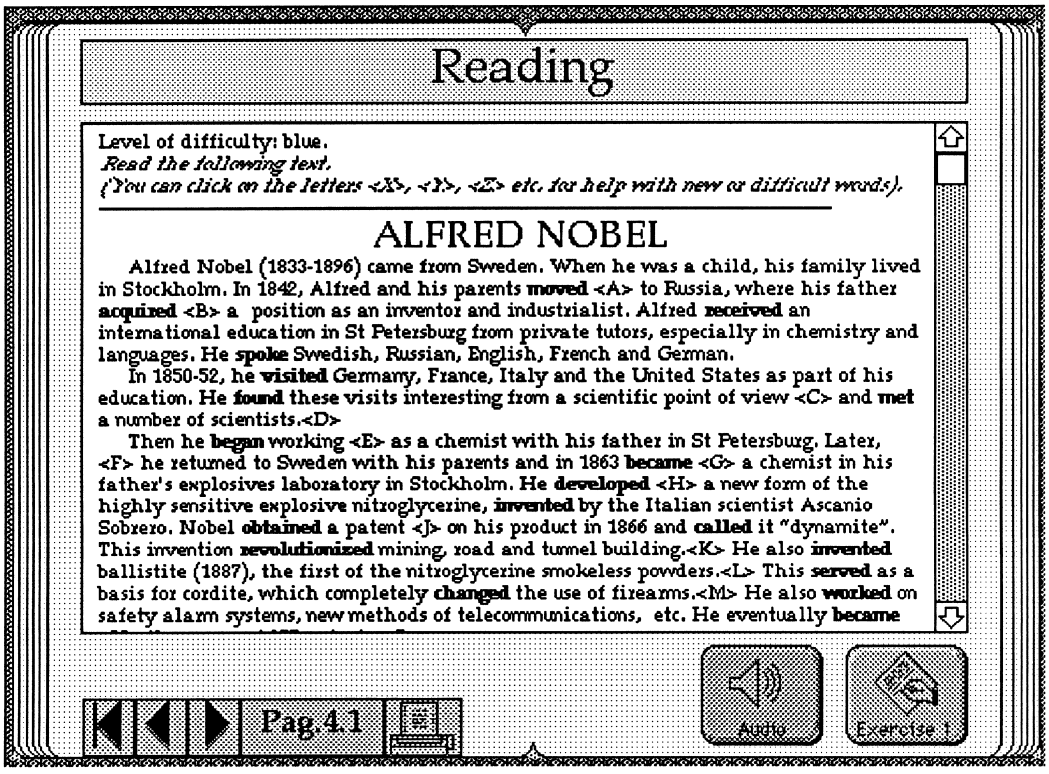

Fig. 1. A snapshot of a book page. This is an example of a text adapted for reading and comprehension tasks.

The learning process is constantly stimulated by comments and indications on the exercise activities strictly connected with the argument analysed on the book page. Some pages also contain video clips, connected with the text topic; they are used both to reinforce the concept just learned and as a base for the exercises.

The second type of book page is the *grammatical page*. Here the description of grammatical and pronunciation rules is the main focus, according to the unit topic. All the rules needed to understand correct language use are carefully listed and described using various examples. Gloss explanations help learners to understand unknown words. The most important feature of these pages is the possibility for students to obtain the same grammatical rules translated in L1. We decided to develop the entire package, messages, explanations and comments, in English (L2 in the teaching paradigm used in DIAPASON). However, for students who succeed in reaching intermediate level, trying to learn the grammatical structure of English language using English-written descriptions could be in some cases too hard or even impossible. Thus, for those who need further help, the grammatical rules are translated into L1 and are available on request. This kind of page also contains audio samples of the grammatical explanations, both to break the monotony of the simple text-reading learning and to practice comprehension and pronunciation skills.

The learning process is supported by a wide range of exercises, permitting an immediate test of the grammatical rule understanding and on vocabulary and text comprehension. There are five main kinds of exercises in the DIAPASON student's book, covering the most common type of exercises realisable in a multimedia computer environment.

3.1.1. Fill-in

This is the most commonly used exercise type in the book and represents the exercise of "filling the gap". It is very versatile and can be easily developed as a "true/false" exercise, as a "right or wrong" exercise, as a "complete the text" exercise and so on. By using this kind of exercise, the learner can practice many skills: text and vocabulary comprehension ability can be reinforced through "true or false" and "right or wrong" exercises while a thorough understanding of the grammar rules can be tested and practised using the "complete the text" scheme of this exercise type.

3.1.2. Crossword

The second kind of exercise is mainly focused on vocabulary learning, both from the text used in the book and from new words. It is a standard crossword exercise, where definitions and clues encourage the learning process.

3.1.3. Dictation

This kind of exercise is focused on the testing of comprehension. The students listen to an audio sample three times. The first and third utterances are recorded at normal speed, while the second contains pauses between the sentences. The student types out the transcript of the entire audio utterance and then, after listening three times, compares it with the original transcript of the dictation.

3.1.4. Word order and categorisation

The last two exercise types cover the subject of word order in sentences and word categories. Adjectives and their positions are often tested using exercises of this type.

Every reading text or exercise is carefully classified for the students according to the level of difficulty. We adopted a system similar to that used to classify ski slopes. The easiest tasks correspond to green, while the hardest tasks are marked in black. In fact the student's book contains no black tasks, which are all confined to the "extra practice" section. The idea is for the student to reach a basic understanding and practice the language structures in the book and then to try something harder as a separate task.

As mentioned above one of the most important features of DIAPASON is the opportunity to adapt the teaching process to students' needs. Therefore we have created a tool that helps learners to keep track of the work that they have already done. An automatic bookmark procedure records every page of the book that has been read by the student, allowing him to have easy access to previous work. Thus every student using the package has to type in his identity before entering, to ensure that the correct bookmark will be loaded and properly handled.

Another important feature is the possibility for the student to print every book page and every exercise, allowing him to continue to study outside the DIAPASON laboratory or to do exercises at home.

3.2. Test generator

Correct self-assessment of the learning process is the most important feature that a self-access learning package should provide (Jackson, 1995). Bearing this in mind we developed a testing procedure derived from the one used by CILTA for testing University students from scientific faculties. A large database of grammatical and lexical questions has been developed as well as a set of scientific reading passages with comprehension questions. Each item in the question database has been carefully graded and classified using the 14 topics contained in the student's book. In this way a complete testing procedure containing 60 grammatical/lexical questions and a reading text, with 10 comprehension questions, can be automatically generated. The program extracts the items randomly from the database, while selecting the correct level of difficulty and an equal proportion of questions from all the topics. All the questions are multiple choice and the correct answer must be chosen from five possibilities.

At the end of the test the learner obtains a complete assessment of his skills, both in terms of his actual score, and, more importantly, in terms of personal ability in each of the topics considered. The complete question classification in the database allows the program to provide an evaluation of the learner's knowledge of all the topics covered in the learning project. Therefore the student can adapt the learning process to his needs, studying only those units in which he needs more practice. Fig. 2 shows this personal report.

3.3. Extra practice

The extra practice set of exercises covers some subjects that are not fully developed in the book, such as various lexical sets or advanced grammatical structures. This also enables

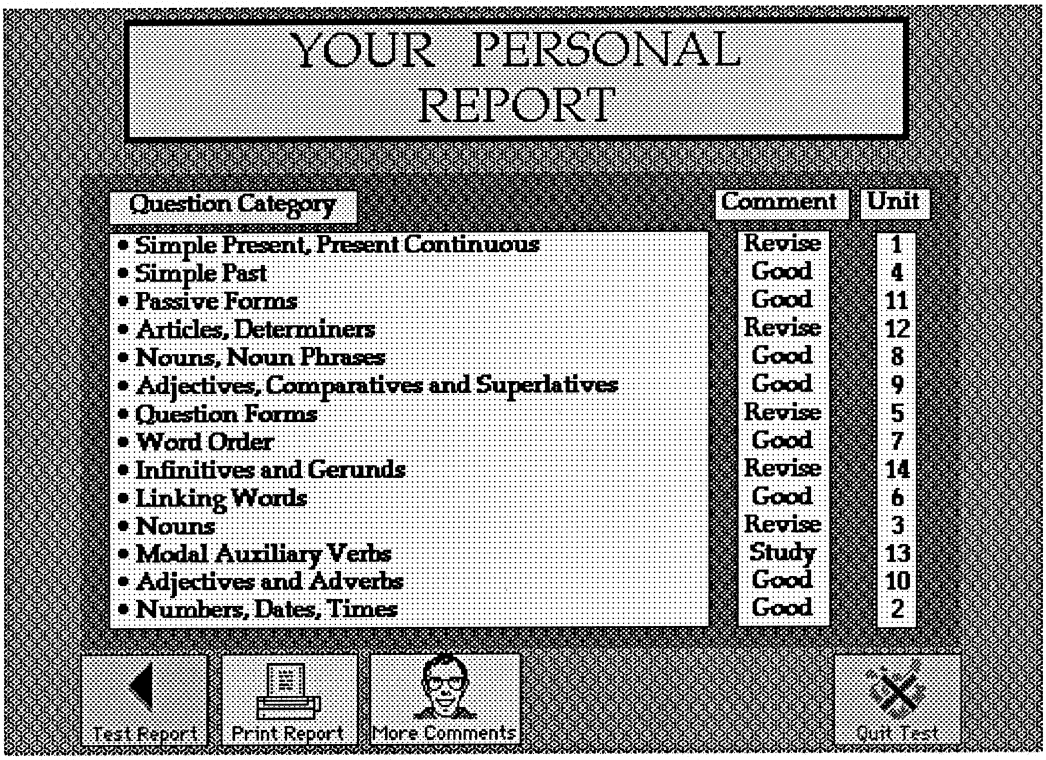

Fig. 2. The report obtained at the end of a test session.

intermediate or advanced students to practice their skills by concentrating on the 160 exercises that make up the extra practice set. All the exercises in the *Extra Practice* belong to one of these exercise types: Fill-in, Crossword and Word Order.

3.4. Help line

The DIAPASON laboratories have been designed to offer a self-access environment in which students can freely use all the available material, both in terms of time and learning schedule. As mentioned above when the learner starts using DIAPASON he is given a placement test and has a brief interview with an English teacher, in order to obtain advice about how to plan his learning activities. Once the learning process has started, the student has to organise his work autonomously and use the self-assessment module. Nevertheless, sometimes doubts or problems arise, so a networked help line has been developed connecting the centre to all the DIAPASON laboratories. Using this e-mail system every student can access help to overcome problems on the use of DIAPASON, be they technical or learning problems. This connection is realised using a custom protocol on standard Internet lines.

4. Technical considerations

All the procedures involved in the DIAPASON package were developed at CILTA using Hypercard for Apple Macintosh platforms. This development tool allows attractive and reliable interfaces for multimedia software to be created. The programs were developed as authoring systems, making it quick and easy to add new teaching material to the courseware.

The most interesting feature of this package is that the programs are kept separate from the teaching materials. Every page in the student's book, every exercise and every set of items in the test generator is stored in a separate file. When a particular page or exercise is displayed, the programs restructure the graphic aspect of the interface to adapt it to this description file. Let us consider, for example, a page from the student's book. The teaching data are stored as simple ASCII files, with a specific format and some defining tags. Once a page has been loaded the objects on the screen (field, buttons, pictures, etc.) are dynamically handled, hidden if necessary, resized and so on. Then the links between the text pages and the corresponding exercise files and audio/video samples are created. Compare the page shown in Fig. 1 with its corresponding source file (the tags are presented in bold face).

```
# Description file for page 1 unit 4
TITLE,50,20,600,60,Reading
TEXT,50,80,600,395
Level of difficulty: blue.
#$IRead the following text.
(You can click on the letters <X>, <Y>, <Z> etc. for help with new or difficult words).#$I
```

```
                                    #$8ALFRED NOBEL#$8
     Alfred Nobel (1833-1896) came from Sweden. When he was a child, his family lived
in Stockholm. In 1842, Alfred and his parents #$Bmoved#$B <A> to Russia, where his father
#$Bacquired#$B <B> a  position as an inventor and industrialist. Alfred #$Breceived#$B an
international education in St Petersburg from private tutors, especially in chemistry and
languages. He #$Bspoke#$B Swedish, Russian, English, French and German.
                                       ...OMISSIS...
```

```
#$IClick on 'Audio' to hear the text.
Now do exercise 1.#$I
/TEXT
GLOSS,50,80,600,200
<A>
his parents moved - i suoi genitori si sono trasferiti
<B>
his father acquired - suo padre ha acquisito
                                          ...OMISSIS...
/GLOSS
AUDIO1,435,405,510,460,Audio,Unit 4 - Audio 1
AUDIO2,***
VIDEO1,***
VIDEO2,***
EXE1,525,405,600,460,Exercise 1,Fill-in,Unit 4 - Exercise 1
EXE2,***
EXE3,***
PICBACK,***
PICFORE,***
```

All the fields containing the text, the title and the glossaries are resized using the values in the description file. It is also possible to fine-tune the formatting of the main text, in terms of style (bold face, italics and underlining) and in terms of character size. The buttons (audio,

video and exercise links) are also completely rescalable, and their labels, positions and links with the corresponding media or exercise file are dynamically built. Pictures can be inserted, either as background or foreground images, following the same rules of positioning and linking as the file on the disk. For each page there is a specific number of available objects; the string "***" indicates that the corresponding object has to be hidden. When the student clicks on a glossary link, a pop-up field with the corresponding explanation will appear. All the other procedures follow a similar pattern. They restructure the interface so that it can be adapted to the tags or commands inserted in the description file.

It should be noted that this method of storing teaching materials is very useful, because of the intrinsic portability of this kind of format. In this way, creating a version of the DIAPASON package for a completely different platform is simply a matter of rewriting the software part, leaving all the teaching materials totally intact.

It is also very important to mention the quality of the audio and video clips. Considering the comments given in (Kies, Williges & Rosson, 1997) we did a number of experiments to try and find the best trade-off between student satisfaction and technical requirements, regarding the disk space needed to store audio/video files and the computer speed needed to sustain a large amount of information to be transferred during the play operations. Audio samples do not create major problems since they generally consist of a single human voice. A good recording phase in an appropriate environment allows poor sampling methods (e.g., 11 kHz with 16 bit mono resolution) to maintain good speech quality using limited storage space. Video clips present a completely different set of problems. In order to be useful for language teaching they have to be large and sharp enough to allow the learner to see small details such as lip movements and facial expressions. To achieve these results we had to choose a minimum resolution of 320×240 with a high frame rate (more than 15 fps). This kind of digital sampling produces a megabyte of data for every second of clip length. The huge amount of disk space required to store video clips has heavily limited the use of video in the software part of the DIAPASON project. The presence of video playing stations and a satellite receiver in the laboratory could compensate for this kind of limitation.

5. Student use of the laboratories

During the year of experimentation we collected a considerable amount of data regarding the flow of students in the two laboratories currently operating. We took a large sample of 218 students from the 470 that attended the laboratories, analysing the total time spent in the laboratory and the time spent for each session. Table 1 shows the distribution of the global time spent by each student in the DIAPASON laboratory.

I have grouped the results into four main categories that, in my opinion, describe the main types of students using the laboratories. Examining the table above we can derive some considerations about the kind of students that have used the laboratories over the past year, in particular:

1. this group contains students that used the laboratory for a very short period, did the preliminary interview with the teacher but did not return. It is a high ratio (30%) of the

Table 1
Total time spent in the DIAPASON laboratory

	Global time spent	Number of students
1)	time <1 h	66 (30%)
2)	1 h $\leq$ time <4 h	97 (45%)
3)	4 h $\leq$ time <10 h	39 (18%)
4)	time ≥ 10 h	16 (7%)
Total number of students		218
Total time spent		835 h

total number of students, but we must consider that some students are simply curious, but not directly interested in using it to improve their language skills. Many students are already at an advanced or upper-intermediate level of English and others are reluctant to use the technology or self-access learning in general. This class also contains those students that do not find DIAPASON interesting or useful;

2. the second category contains those students who did a little work using the DIAPASON material. They are mainly students that already know a sufficient level of English to take their university exams, but want to consolidate their knowledge with some extra practice and gain confidence in their learning abilities;
3. the third group represents those students who needed to revise some important topics. They practised 2/4 units of the book and the connected exercises. The choice of material was probably derived from the preliminary interview made with the teacher;
4. the last group contains students who practised most of the DIAPASON material, including many of the book units and exercises. They were probably students with a level of English generally known as *false beginners*.

Other interesting considerations can be derived by examining Fig. 3. It shows the amount of time spent by the student during each session in the laboratory.

The first thing to note is that most of the students spent one hour in the laboratory (the global average is 1 h 10 min). This value is very interesting, considering that 75% of the session times were between 40 min and 1 h 20 min, and tells us that students do not allocate a precise time during the week to the study of English, but, probably, insert it into the intervals between two lessons. This idea is confirmed by the fact that 2 h is another peak value in the graph (in Italy we often have intervals between lessons, usually of one or two hours, for lunch, for moving around the campus or due to scheduling problems).

6. Future projects and conclusions

Keeping the teaching material completely separate from the software allows for a number of challenging experiments. With a small amount of work we transformed the *Test Generator* into a Java applet, exploring the possibility of inserting this exercise, and the entire package, onto the Internet. Unfortunately current stable versions of Java suffer from a lack of graphic and

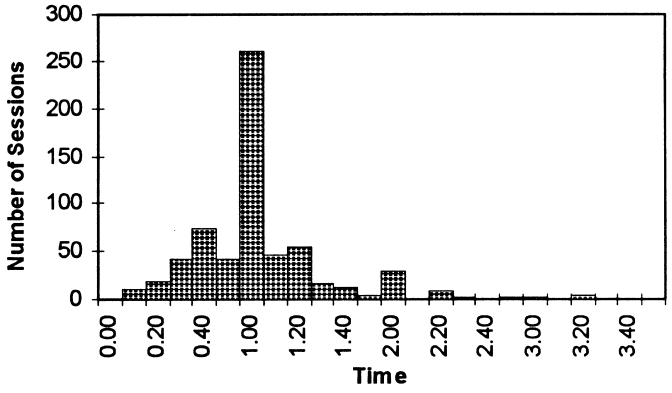

Fig. 3. Distribution time for each session in the DIAPASON laboratory.

multimedia features, so the transformed interfaces do not seem to have the same impact as those developed within a special multimedia package.

A version of DIAPASON for *x86* platforms is currently under development, using the Toolbook package. It is thought that, in the future, DIAPASON could be available on different platforms, such as an application on X-windowed Unix systems, a Java package on the Internet, and so on. However, with regard to Internet availability, the need to put audio/video on line has to be carefully examined, both in terms of requested bandwidth and in terms of teaching usefulness.

An audio/video compression method has to be investigated thoroughly, in order to reduce mass storage and also to limit the requested bandwidth for network transmissions.

Another interesting task to be set up in the future is to modify the set of tags, and also the tagging method, to conform to an accepted world standard, such as the SGML coding scheme. This would simply be a translation of the current tagging method, but it could lead to an exchange of teaching materials between different organisations.

Future versions of the DIAPASON courseware will probably contain new tools. We are planning to insert a small corpus of authentic material, strictly related to the language topic (e.g., scientific language), and to provide a simple concordancer program. In this way students could examine samples of authentic language. They could do exercises based on the specific corpus evidence and reinforce their knowledge by extracting and examining the language structures they have studied earlier and viewing them in an authentic language context.

After one year of direct experience on DIAPASON laboratory management we can derive some conclusions. Firstly, according to Esch and Makin (1996) and Wenden (1995), we can state that students are not able to plan and maintain a complex self-access learning scheme without some input from the teacher. The evidence is that even a very well equipped self-access laboratory, with no available teacher as support, is not sufficient to allow students to achieve their linguistic aims. It is absolutely necessary that every student be interviewed by a teacher in the initial phase. They should work together in order to develop a complete timetable of the learning procedure, based on student needs, effective language ability, and the teacher's experience. That is why we have provided every laboratory with an advisor over the complete opening time, allowing students to be continuously monitored, helped and advised. Secondly,

we noticed that there are a lot of students that do not want to follow the learning plan prepared by the teacher. Some of them only use the video facility and others prefer to do a lot of practice tests in order to pass their university exams, without studying anything in the student's book. Moreover, there were students that only used the extra-practice exercises. This way of using the courseware and the laboratory facilities has to be carefully investigated, in order to adapt them better to these particular needs.

The data collected in the laboratories showed that students are very busy and tend to spend only the minimum time required to study foreign languages. They expressed their appreciation of the DIAPASON labs, but the engagements deriving from their study, the need to revise only a few isolated concepts or practise some specific items in order to pass the university exam reduced their study time, in most cases, to a total number of hours less than 10. From our point of view this is not bad: the laboratories have been devised to allow autonomous learning, with no pre-designed itinerary provided by the material. The fact that students can adapt their language practice in the labs to their needs and time constraints means that we have provided a useful self-access facility. Now it is time to consolidate our work and expand it with new ideas, materials and targets.

Acknowledgements

I wish to thank Rema Rossini Favretti who is responsible for this project, William Bromwich, Alison Greenwood, Franca Poppi and Amanda Thursfield, the English teachers who designed the teaching material and helped me with precious suggestions in the delicate phase of designing the DIAPASON software.

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