A Hypermedia Database and English as a Second Language Teacher Knowledge Enrichment

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ABSTRACT *TeleTeach* is an electronic hypermedia database of English as a second language (ESL) teaching materials which can be accessed through *TeleNex*, a computer network for ESL teachers in Hong Kong. This article discusses the theoretical framework for the knowledge structure of *TeleTeach*, and how the electronic medium was exploited to help ESL teachers with their daily teaching as well as to enrich their knowledge about ESL teaching. It begins with some background information about the conception and design of *TeleNex*, the ESL teaching profession in Hong Kong, and the need for such a database. This is followed by a discussion of the theoretical framework for teacher knowledge which draws heavily on Shulman (1986) and the ESL knowledge structure of *TeleTeach*. Based on the knowledge structure outlined, a description is given of how the database is designed to ensure that it is of practical use to teachers with a range of teaching experiences and teaching competences, and is also a means of enriching their knowledge. Finally, the authors report on an investigation into the use of the database by teacher users and its effectiveness in helping teachers in their daily teaching and in building on their knowledge of ESL teaching.

Introduction

The application of hypermedia (hypertext documents that include graphics, digitised speech, music, or video segments; the terms 'multimedia' and 'interactive multimedia' have also been used in the literature) to teacher education is a relatively new area in educational information technology. In the last 10 years, studies of the effectiveness of such applications have just begun to emerge (see Willis & Mehlinger, 1996). For example, some attempts have been made in using computer graphic simulations and computer programs with video clips in teacher education courses to teach classroom management skills, questioning techniques, and group teaching

skills by getting student teachers to identify problems in teaching and apply the appropriate procedures (see, for example, Campbell-Bonar & Grisdale, 1991; Bosworth & Welsh, 1992; Strang et al, 1991). Hypermedia packages have been designed which present teaching scenarios or cases for student teachers to respond to, to reflect on and to make decisions about (see for example, Risko, 1991; Goldman & Barron, 1990; Reilly et al, 1992). These packages were designed as course materials for teacher education programs.

So far, relatively few packages have been designed as a resource for the continuing professional development of serving teachers, rather than as course materials for teacher education programs. Packages or databases of this nature differ from those used as course materials in that they need to take into consideration a number of factors. First, the busy everyday teaching life does not allow teachers to sit down for hours in front of the computer to read lengthy texts or to view video clips and respond to questions. Secondly, the resources provided need to be of practical use to teachers. This means that they have to tie in closely with the school curriculum and to serve teachers' everyday teaching needs. Thirdly, in order for the databases to be of use to a wide teacher population, they have to cater for teachers with a range of teaching experience and teaching competence. Fourthly, they have to include materials which will enhance teachers' professional development. Finally, for the databases to be accessed by teachers in schools, they have to take into consideration the technical capacity of computers in schools.

This article describes a hypermedia database, *TeleTeach*, designed for teachers of ESL (English as a second language) in Hong Kong, which has the dual purpose of being a resource for their everyday classroom teaching as well as a means of enhancing their professional knowledge. It first outlines the knowledge structure of *TeleTeach*, and the theoretical framework that guided the conception of its structure. It then explains how the factors outlined above were taken into consideration when designing and writing the database and how the electronic medium was exploited. It reports on an investigation into the effectiveness of the database in helping teachers in their daily classroom teaching and in enriching their professional knowledge.

TeleTeach and Teachers' Needs

In order to contextualise the discussion in the rest of this article, we provide below some background information on the conception of *TeleTeach*, the professional background of ESL teachers in Hong Kong, and their needs.

TeleTeach is one of the databases in a computer network, *TeleNex*, set up to enhance the professional development of serving ESL teachers in Hong Kong. The network was initially set up as a dial-up wide area network in 1993 by the Teachers of English Language Education Center (TELEC) in the Department of Curriculum Studies of the University of Hong Kong. In

the first 3 years, the network linked 380 registered users in 33 secondary schools (http://www.telenex.hku.hk). The schools and teachers participated on a voluntary basis. In December 1996, because of the Government's education policy of making Internet access available in all schools, the network was launched on the Internet so that it could be accessed by all teachers in Hong Kong. *TeleNex* consists of a database component and a messaging component. In addition to *TeleTeach*, the database component also includes a grammar database, *TeleGram* (see Wu & Tsui, 1997). The messaging component allows teachers to join various conferences to share ideas and materials as well as problems in teaching (see Tsui, 1995; Tsui et al., 1994; Tsui et al, 1996; Tsui & Ki, 1996).

Identifying Teachers' Needs

The need for a computer network to support serving teachers was first conceptualised in view of the findings of a survey of teachers conducted in 1991, which showed that only 27% of the graduate ESL teaching profession in secondary schools were subject-trained and only 21% were both subject-trained and professionally trained. (In 1996, according to the Education Department, the percentage of professionally untrained English teachers was 66%. 'Subject-trained' refers to graduate teachers who studied English linguistics or literature as the major discipline in their first degrees.) It was felt that there was an urgent need for a computer network where teachers could access on-line quality teaching materials and information about areas of grammar which are problematic to teachers and learners, and where they could obtain professional support from teacher educators as well as from their peers (see Tsui et al, 1994).

In the process of designing *TeleTeach*, the needs of ESL teachers with regard to teaching resources were identified by administering a questionnaire to all users upon registration (Questionnaire A, see Appendix). A total of 328 questionnaires were administered, and 299 responded, the return rate being 91%.[1] In Part 2 of the questionnaire, data was collected on the following:

- whether the teachers were satisfied with the textbooks and existing materials that they were using (Q. 18, 19), and whether the textbook(s) are of the right level for their students (Q. 20, 21);
- whether the teachers' notes in existing textbooks provided adequate explanation of the rationale behind the materials (Q. 22);
- whether they had the freedom and the time to use supplementary teaching materials, and to adapt materials (since most schools in Hong Kong use prescribed textbooks) (Q. 17, 23, 25, 26);
- whether they had difficulties finding suitable supplementary materials and adapting materials (Q. 24, 27, 28, 29); and e) the areas of ESL teaching in which they needed more materials (Part B, Q. 33–41).

The results show that:

- 69% indicated that the textbooks were inadequate, and 95% felt that they needed a wider variety of activities than those provided in textbooks. However, only 26.3% found the textbooks too difficult and even less (only 8%) found them too easy. In other words, on the whole the textbooks were of the right level for their students;
- 86% indicated that they would like to see more detailed explanations of the rationale behind the materials provided in textbooks;
- 82.7% indicated that they had the freedom to use supplementary materials, roughly the same percentage often made adaptations to textbooks; 91% used supplementary materials in their teaching, and only 28.2% indicated that they had no time for supplementary materials in their scheme of work;
- 94% said that they needed guidance in adapting and producing materials, 60% indicated that they had difficulties finding supplementary materials of the right ability level for their students as well as for big classes, and 77.3% found it too time-consuming to look for supplementary materials;
- over 70% indicated a need for materials in all areas of ESL teaching.

There were five areas where over 90% indicated that supplementary materials were very much needed or needed. They were integrated skills (98.2%), writing skills (95.4%), communicative games (94.5%), speaking skills (93.7%), and communicative grammar (90.9%).

These are all areas which existing textbooks in Hong Kong either do not deal with, namely writing skills, integrated skills and games, or which are insufficiently or poorly dealt with, such as speaking skills and grammar teaching. The questionnaire results showed that teachers felt a great need for a bank of supplementary materials covering all aspects of ESL teaching to help them in their teaching. It also showed that teachers felt a need for guidance in understanding the rationale behind the suggested classroom practices and in adapting the materials to suit their students' ability levels.

Knowledge Structure of *TeleTeach*

TeleTeach is a database of teaching materials which was developed over 5 years from 1993 to 1998. It covers all aspects of ESL teaching except for listening. This is owing to the fact that most registered teacher users access the database from the computers at school, which have technical limitations, such as lack of disk space, slow modem speed and lack of a sound card. These limitations also restricted the teaching files to text and graphics in the first 3 years. With the upgrading of computers in schools and the provision of Internet access in schools, sound files have been included in the more recent pronunciation files. Teachers can access the materials by logging onto *TeleNex*. They can also download the files and print them out for teaching. In each of the files, various kinds of information have been provided,

including the rationale for the activities and the teaching approaches, ways of adapting the materials for students of different abilities, information on classroom management issues, and linguistic information. The information aims to help teachers understand the 'why' and the 'how', in addition to the 'what' of teaching. (Detailed discussions of the design of this database will be given below.)

Teacher Knowledge Structure

In determining the knowledge structure of *TeleTeach*, we drew heavily on Shulman's (1986) conception of teacher knowledge, which proposes that teachers' content knowledge encompasses three categories.

The first category is subject matter knowledge, which refers to the understanding of the facts and concepts of a subject discipline as well its substantive and syntactic structures. The former refers to the principles of organisation of a discipline and the latter refers to a set of rules determining truth and falsehood in that discipline.

The second category is pedagogic content knowledge, which refers to the representation of the subject matter through examples, analogies, illustrations, demonstrations and explanations to make it comprehensible to students. In order that the representations be effective, Shulman points out that teachers need to understand what makes a topic in a subject discipline easy or difficult, the preconceptions and misconceptions that students have and the strategies for dealing with them.

Shulman's third category is curricular knowledge, which refers to the knowledge of the program and the materials which have been designed for the teaching of a particular topic at a particular level.

Subsequently, Shulman and his colleagues added four more categories of teacher knowledge. These are: general pedagogic knowledge, which refers to general principles of teaching and learning which are applicable across subject disciplines; knowledge of educational aims; knowledge of learners; and knowledge of other content, which is content outside the scope of the subject that teachers are teaching. (See Wilson et al, 1987). Shulman points out that central to successful teaching are subject matter knowledge and pedagogic content knowledge.

The knowledge categories outlined by Shulman (1986) are by no means cut and dried, and they are not independent of each other. As many researchers have pointed out, in the actual analysis of the teaching act, these knowledge dimensions are often less distinct than they appear to be (see, for example, Grossman, 1990; Calderhead & Miller, 1986; Feiman-Nemser & Floden, 1986; Bennett, 1993). For example, how effectively a teacher can represent subject matter knowledge to students is inextricably linked to how well he or she knows the subject matter and the context including the students, as well as how far he or she has mastered the principles and skills of teaching in general (see the following section for

examples). However, as Calderhead & Miller (1986) point out, the categorisation is a useful analytical framework for thinking about teaching. Grossman (1990), drawing on Shulman's conception and other conceptions of teacher knowledge, such as Elbaz (1983) and Leinhardt & Smith (1985), proposed a model of teacher knowledge which collapsed Shulman's seven categories into four: general pedagogic knowledge, subject matter knowledge, pedagogic content knowledge and knowledge of context which subsumes knowledge of educational aims, students and other content; with pedagogic content knowledge being the central component. In her model, these categories are not discrete domains but are dynamically interactive (see Grossman, 1990, p. 5). We strongly identify with the dynamic relation between the knowledge domains and the centrality of pedagogic content knowledge portrayed in Grossman's model because the effective representation of subject matter knowledge is crucial to the work of teachers. Her reclassification of Shulman's seven categories into four provides a more manageable framework for making decisions about the kinds of information we should include in the database for teacher knowledge enrichment. It is therefore adopted in our delineation of the knowledge structure of ESL teaching, which will be described in the following subsection.

ESL Teacher Knowledge Structure

Based on Grossman's model, we perceive general pedagogic knowledge of ESL teaching as consisting of two dimensions: the management of resources and the management of learning. The former refers to the authenticity and appropriacy of the linguistic materials, whether the materials are accessible to the students, adequate for achieving the objectives, and whether there is a variety of materials. Management of learning refers to the organisation of learning, the involvement of students, the affective and motivational elements in teaching, and learner empowerment.

There are three dimensions to pedagogic content knowledge of ESL teaching:

- language processing and production skills, which encompass listening, speaking, reading and writing as well as the integration of these four skills;
- language learning strategies, which include strategies like risk-taking, self-monitoring, toleration of ambiguity and communication strategies;
- language teaching strategies, which include strategies like varying the degree of control in language practice activities, exploiting different activity types, adapting materials for students of different levels of ability, and distinguishing between accuracy-based and fluency-based activities.

As pointed out above, general pedagogic knowledge and pedagogic content knowledge are intertwined. For example, adapting materials to students' ability levels is closely related to the pedagogic consideration of whether materials are accessible to students.

For subject matter knowledge, we see knowledge about the English language as the major dimension. This includes knowledge about the language system, that is, phonetics and phonology, lexico-grammar and discourse-semantics. The presentation of linguistic knowledge was guided by our conceptualisation of the language system as a resource for creating meaning. This category is the concern of the grammar database, *TeleGram* (see Wu & Tsui, 1997).

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Figure 1. ESL teacher knowledge structure.

Contextual knowledge includes knowledge about the school, the students (including their academic and socio-economic background), and the wider educational context. Again, this component is inextricably linked with general pedagogic and pedagogic content knowledge. For example, knowledge of students is closely related to motivational and affective

elements of teaching and how to represent the subject matter to them. Figure 1 presents a summary of ESL teacher knowledge structure.

Since enriching teachers' subject matter knowledge is the main concern of another database, *TeleTeach* focuses largely on general pedagogic and pedagogic content knowledge, bringing in contextual knowledge whenever necessary.

Design of *TeleTeach*

This section discusses how *TeleTeach* is designed to help teachers construct knowledge about ESL teaching. First, there are five 'entry points' to the database: 'Skill', 'Level', 'Topic', 'Language focus' and 'ELT (English language teaching) theory'. The 'ELT theory' entry point gives teachers access to a set of overview files, which pertain to the pedagogic content knowledge of ESL teaching. These files cover the theoretical underpinnings of communicative language teaching, language skills, vocabulary teaching and the teaching of grammar. The other four entry points allow teachers to access the teaching materials in the database using any one entry point according to their needs, so that they can easily identify files which are relevant to their classroom teaching.

Figure 2. *TeleTeach* directory.

Teachers can access files on the teaching of specific areas. For example, an S2 (Grade 8: age 13 years) teacher who is looking for materials on vocabulary can click on either the 'Level' directory or the 'Language focus' directory. If the teacher clicks on the 'Language focus' directory, a sub-directory which consists of 'Structures', 'Functions' and 'Vocabulary' appears. Clicking on 'Vocabulary' reveals the 'Level' directory. Having chosen S1-S2 (Grade 7–8), a sub-directory of 'Vocabulary' appears consisting of 'Word fields', 'Word building' and 'Word relations'. This directory suggests to teachers that we can teach words in the same semantic field, we can help students to understand how words are built, and we can also show them how words are related. Under each of these three options are types, for example, types of word relations, which include synonyms, antonyms, hyponyms and collocations, and types of word building, which includes prefixes, suffixes, and compounds. By presenting this tree-like directory, we hope to help teachers construct a framework for ESL teaching (see Figure 2).

Each file includes information about the objectives of the activities, steps for teaching, worksheets, and sometimes samples of students' work that teachers sent in after they conducted the activities in their own classrooms. On the 'Objectives' and the 'Steps' screens, we have built in a number of icons, which, when clicked on, reveal further information on smaller pop-up screens. The 'Glossary' pop-up screens explain technical terms and aim to equip teachers with the metalanguage for ESL teaching. The 'Theory' pop-up screens provide the rationale or theoretical motivation for suggested steps. These cover management of resources and management of learning as well as language learning strategies and language teaching strategies. This pop-up screen allows us to break up explanations of theoretical motivations into digestible chunks to avoid information overload, especially for novice teachers.

The 'Adaptation' pop-up screens include suggestions on how the materials can be adapted for students of different abilities. These three kinds of pop-up screens cover the areas coming under general pedagogic knowledge and pedagogic content knowledge (See Figure 1). The 'Example' pop-up screens provide linguistic examples which are particularly pertinent to non-native speaker ESL teachers. The 'Additional notes' pop-up screens provide more detailed information about a given step and the 'Key' pop-up screens provide suggested answers. Figure 3 shows how clicking on the 'Glossary' icon reveals a pop-up screen containing a glossary and the rationale for information-gap activities (see Figure 3).

The explanation shown in Figure 3 is provided because many teachers have heard of information-gap activities and some have actually used them in their teaching. However, some do not really understand that it is essential to ensure that there is a gap between the information that each student holds so that a need for communication is created. Consequently, we often find a pair of students reading each other's worksheet when conducting the

activity, and an information-gap activity becomes an activity where language production is the end rather than the means to the end of communicating information to the other student.

For files focusing on a particular grammatical structure or function, hyperlinks have been built in to *TeleGram*. These links enable teachers to access information on the particular grammar area that they need to teach, so that they can make effective use of the activities. These hyperlinks therefore provide teachers with the necessary subject matter knowledge for teaching (See Figure 1). The flexibility of the electronic medium and the non-linear presentation of information in hypermedia files allow teachers to access the database and take whatever pathways they wish. The provision of information through icons and hyperlinks allows the database to cater for teachers with a range of subject knowledge backgrounds and professional backgrounds, and whose needs are quite diverse.

Figure 3. A pop-up screen in *TeleTeach.*

Research Methodology

To find out whether the database achieves its dual purpose, namely to provide a teaching resource and a means of enhancing professional development, we investigated teachers' reactions to the database. The research questions that guided our investigation are now listed.

Research Questions

RQ1. How frequently was the database accessed, read and used by teachers?
RQ2. Did the database help teachers in their everyday teaching?
RQ3. Did the files, including the information provided in the pop-up screens, help to enrich teachers' knowledge of ESL teaching?

Data Collection

To address the above research questions, the data collected was confined to the 328 registered users from the 33 schools, since they had been using the network for more than a year. We collected both quantitative and qualitative data. The quantitative data consists of an evaluation questionnaire administered to these users (Questionnaire B, see Appendix for relevant items), and their file access logs which recorded each users' log-in time, files visited and log-out time. This was made possible by a computer program specially written and built into *TeleNex* when the network began operating. The quantitative data also consists of a case study of one of the participating schools, in which eight registered teacher users were asked to report on the icons and hyperlinks they clicked on, and to fill out another questionnaire (Questionnaire C, see Appendix) which tapped information on knowledge enrichment. The qualitative data consists of a follow-up interview with three teachers in that school.

To address RQ1, the file access logs of all users were obtained and the logs for a period of 2 months were selected for analysis. The file access logs provided information about the number of files that users visited and the frequency of file visits. However, the logs did not provide information about whether teachers had read the files in detail, nor did they tell us whether teachers had used the files in their teaching. (One apparent source of data was the duration of each file visit as indicated by the log-in and log-out time for each file. Upon checking with users, however, we discovered that it was not a reliable source of data for two reasons. First, a teacher may have printed out the file and read it in detail. In this case, the logging-in duration would be very short. Secondly, a teacher may have attended to something else in the middle of reading a file. In this case, the logging-in duration would be very long, but in fact only a small portion of the logging-in time was spent on file reading.)

To collect data on these two aspects, we selected one of the participating schools which had eight teachers registered as users for an in-depth study. (See Table I for a profile of these teachers.) These teachers were all female. Four of them had over 10 years' teaching experience, including the head of the English panel (the equivalent of the English Department in the United Kingdom) with 18 years' experience; two had 7 and 8 years' experience; and two had less than 3 years' experience. Five were graduates but only the head of the department was subject-trained. The

other four majored in business, economics and history. One of them was not professionally trained, and one was taking a teacher education course. Among the other three professionally trained graduates, however, only the head of the department was trained in the teaching of English. The three non-graduate teachers obtained their professional training in colleges of education and were trained in ESL teaching.

For each of the teachers, we first examined their file access log to find out which files they had visited. On the basis of this, we asked teachers to fill out a questionnaire consisting of two sections. The first section consisted of a list of files that each of them had read and they were asked to indicate the following for each file: 1) whether they had read the file on the screen or in print, and in detail or briefly; 2) whether they had used the files for teaching, and if they had, whether they had made any modifications to the file. If they had not used the file for teaching, they were asked to indicate their reasons for not using it, which included 'too difficult', 'too easy' (for students), 'could not fit into scheme of work', 'did not know how to use it', and 'not interesting'. The second section of the questionnaire asked teachers to indicate what prompted them to read the files – whether they were looking for materials for teaching, whether they read them in order to find out more about the teaching of a specific area, whether they were just attracted by the title of the file and wanted to find out what it was about, or whether they were just browsing to see if there were any interesting ideas for teaching. They were also given the option to specify other reasons for reading the files.

To address RQ2, that is, whether the database helped teachers in their everyday teaching, we administered Questionnaire B to all users in participating schools. A total of 328 questionnaires were administered and 299 responded, with a return rate of 91%. In the questionnaire, amongst other questions, we asked users to indicate whether they found the database technically easy to access (Q. 7) since this is a prerequisite to using any database, and to evaluate the usefulness of the database in terms of whether it had helped them to improve their classroom teaching (Q. 30), whether it had given them insights into teaching (Q. 32), and whether they found it difficult to incorporate the materials and ideas into their daily teaching (Q. 33).

To address RQ3, that is, whether the files and the information provided in the pop-up screens and hyperlinks enriched teachers' professional knowledge, we conducted an in-depth study of teachers in the case study school by collecting data from the following:

From the list of files that each teacher had read, two were selected. Teachers were put in a computer laboratory where they could access the files to refresh their memory if necessary. To find out whether teachers had read the information given in the pop-up screens, they were given a printout of all the screens in the two files, and were asked to indicate the icons and hyperlinks that they had clicked on and read. This was necessary because it

was technically impossible at that time to log whether teachers had clicked on the icons and hyperlinks. They were also asked to indicate whether the amount of information given in the pop-up screens was too much, adequate or insufficient, whether they found the information helpful or not, and finally to indicate the reasons why they did not click on some of the pop-ups.

After completing the task, they were given a 15-item questionnaire (Questionnaire C) in which they had to rate on a Likert scale of five the extent to which the files they had read helped them to understand the following aspects of ESL teaching knowledge: a) the linguistic aspects of the files and how the activities help to achieve the linguistic objectives (Q. 1, 2); b) activity design and sequencing (Q. 7, 10, 11, 12, 13, 14; c) integration of skills, grammar and vocabulary (Q. 9); d) materials adaptation (Q. 5); e) integration with the existing curriculum (Q. 15); f) the management of ESL learning including setting up activities and motivating students (Q. 3, 4, 6, 8). The items in (a) to (e) pertain to pedagogic content knowledge whereas those in (f) pertain to general pedagogic knowledge. (It should be noted that pedagogic knowledge and pedagogic content knowledge are often inextricably intertwined. The organisation of students for learning is often determined by the subject matter being taught.)

Findings

RQ1: Frequency of Access and File Use

When this study was conducted, 79 files had been produced, covering nine domains in ESL teaching. The file access logs showed that out of the 79 files in the database, 77 had been accessed by teachers. The total frequency of visits was 1,032. In terms of absolute frequency, files on speaking skills ranked highest (266 visits), followed by writing files (181 visits) and integrated skills and grammar files ranked third (146 and 143 visits respectively). These four domains corresponded with the findings of the teacher needs questionnaire, which showed that these four areas were the areas with the highest percentages of teachers indicating a need for supplementary materials (see the findings of Questionnaire A).

The results of the case study showed that most teachers read the files on the screen, but they also read some in print. The number of files accessed ranged from 14 to 1, and the number of files used for teaching ranged from 7 to nil. There were variations in the number of files accessed and used for teaching. However, when we matched the frequency of file access and use to teachers' academic and professional background, we found that they were somewhat related, although we could not establish statistical relations because of the small sample (see Table I).

The three teachers who ranked highest in file access, files read in detail and files used for teaching were all university graduates. They had not studied English as a major subject in their undergraduate courses and were

not trained in ESL teaching. Two of them were the least experienced teachers, just going into the 2nd and the 3rd year of teaching respectively. When they were asked to indicate the reasons for reading the files, all eight teachers indicated that they were looking for materials for teaching as well as trying to find out more about ESL teaching. In addition to these two reasons, the head of the department gave two more: 'I was looking for suitable materials which lower form teachers in my panel (i.e. my department) could use' and 'I saw in a seminar how the poem (in the file) was recommended for primary students and I wanted to compare different ways of using the same poem'. In other words, besides obtaining materials for her own teaching, she was also looking for materials for her panel and for alternative ways of representing the same content.

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Table I. Case study teachers: profile, file access and frequency of use.

RQ2: Database Files and Classroom Teaching

The result of the evaluation questionnaire (Questionnaire B) administered to all users showed that 85% indicated that they found the files easy to use (Q. 7). 80% indicated that the files had helped them to improve their teaching (Q. 30); 89% indicated that the files had given them insight into teaching (Q. 32); and 64% indicated that they did not find it difficult to incorporate the materials or ideas into their daily teaching (Q. 33). It is worth noting,

however, that 36% of the teachers found it difficult to incorporate the materials into their teaching. This was borne out by the responses from the case study teachers. When they were asked to indicate reasons for not using some files after reading them, all of them, except for one teacher who did not give reasons, responded that they had no time to or could not fit the materials into their own scheme of work. Most of them also indicated that the materials were too difficult for their students. Only one teacher indicated that for one file, she did not know how to use the materials even after reading it.

RQ3: Database Files and Teacher Knowledge Enrichment

The results of the number of icons and hyperlinks that the case study teachers clicked on and read showed the following pattern. When they accessed the file, they would read the first screen, which is the 'Objectives' screen, and the hyperlinks most commonly clicked on were 'Worksheets' or the 'Additional notes' icon. If they found that the file was too difficult or easy for their students, or they could not fit it into their scheme of work, they would not click on the rest of the icons and hyperlinks. For files that they used for teaching, most of the icons and hyperlinks were clicked on and the information given was rated as 'helpful' or 'very helpful', and 'adequate'.

There were three teachers whose responses in this task departed from the pattern described above. Teacher C, who was the least experienced teacher, clicked on most of the icons and hyperlinks in the two files that she was asked to provide feedback on, especially the 'Theory' icons, the 'Additional notes' icons and the 'Example' icons, although she only used one of the files for teaching. Her feedback was that the information was insufficient, and not very helpful.

Teacher D, the head of the department, clicked on nearly all the icons and hyperlinks even though she did not use the files for teaching. Her rating of the information provided was 'very helpful', and she commented that 'teachers need quite a lot of time to go through *all* the pop-up screens in detail'. She also pointed out that 'many of the these pop-up screens could not be printed, though I find the advice/suggestions given *very very* useful indeed'.

Teacher B did not use either of the two files for teaching, yet she clicked on most of the icons and hyperlinks in one file, and clicked on all of the icons on the 'Objectives' screen, including the 'Theory', 'Adaptation' and 'Example' icons in the other file. Her rating of the information provided was 'adequate' and 'very helpful'.

The results of the 15-item questionnaire on knowledge enrichment showed that teachers found that the database enriched their ESL teaching knowledge. 12 items were rated above the mean score of 2.5 on a Likert scale of five, with one standing for 'very helpful' and five 'not helpful at all'. The items that were rated as most helpful with a mean score of 2.0 were

those coming under aspect (e) in Questionnaire C: how to use the files in relation to their existing curriculum. This was followed by those related to aspect (b), how to sequence activities, and (f), management of learning such as setting up activities and motivating students, all with a mean score of 2. The third highest, with a mean score of 2.2, were items coming under aspect (a), how activities helped to achieve the linguistic objectives of the files, and (c), integration of skills, grammar and vocabulary. The item that had the lowest rating was on aspect (d), the adaptation of materials for students of different abilities, with a mean score of 3.1.

The findings of the follow-up interviews with Teachers A, B, and C provide further insights into the findings reported above.

Both Teachers A and C, the two less experienced teachers, reported that the database was a source of knowledge enrichment and a source of practical ideas. Teacher A commented: 'I am a new teacher and I want to know more about teaching. I have had only 1 year of teaching experience'. She said that she clicked on most of the icons in the files and read the information provided on the pop-up screens in order to enrich her knowledge. She also felt that because she had no professional training, she had problems with teaching methods, and the textbook that she was using was described as 'backward'. *TeleTeach* was therefore a resource for getting new ideas. Similarly, Teacher C, who had been logging onto the network for 1 year, reported that she logged on because she was 'short of ideas'.

Teacher B told us that she could not use the files for teaching because she had to follow the syllabus; she read the files for herself. Despite the fact that she had been teaching for 7 years, she was still very diffident about her own teaching competence. She described herself as 'a boring teacher' and said that her teaching was 'quite straightforward', and that it was 'frustrating' because her students could not understand her. She did not feel that her confidence had grown with her teaching experience. In other words, this teacher's motivation for accessing the files is more for knowledge enrichment than for practical use.

For enrichment of knowledge, all three teachers focused on the ways in which the files helped them in terms of pedagogic content knowledge. Teacher C reported that what she found useful was how to represent her knowledge of the language to the students. She commented that knowing the language was different from teaching it. She said: 'For compound nouns, of course I know what it is, but [knowledge] for myself and teaching is different'. Similarly, Teacher A commented: 'I know what past tense is and I can explain it, but I am short of ideas for recycling or revising it'. She also pointed out that the files helped her to understand the rationale behind the design of certain activities like information-gap activities. They also helped her in the teaching of reading: 'Nobody had told me before to do something before and after reading. My teacher never used to do this. It helps me approach reading'. Both Teachers A and C said that the files helped to make their teaching more student-centered, there was less 'chalk and talk', and

their students learnt by doing things rather than listening to them all the time. They particularly liked the worksheets which got their students to do things with language. Teacher A added that the database had helped her in planning her lessons. Compared to Teachers A and C, Teacher B was unable to describe specifically the ways in which the database helped to enrich her knowledge, apart from the fact that she found the files helpful.

Finally, all three teachers commented on the difficulty level of the materials and adapting them for their own students. All of them said that some of the files were too difficult for their students. For example, Teacher C looked at files for S1 and S2 (Grades 7 and 8) for her S3 (Grade 9) students, and sometimes she had to adapt them. She found that some materials could be modified by teachers and some could not. Both Teachers A and C said that they had to modify the materials and that they liked the suggestions provided on the 'Adaptation' pop-up screens. Teacher A said: 'I like the alternatives and the adaptations provided on the pop-up screens. These are useful'. Similarly, Teacher C remembered particularly well the information about 'how to use the materials with more advanced and less able students'. In contrast, Teacher B did not seem to benefit from the suggestions given for adapting the files. She simply expressed frustration that her students were below standard and that they could not understand her, even when she followed the steps given in the files.

As well as knowledge enrichment, the database helped Teacher A, who had been logging onto *TeleNex* for 1 year, to build up her confidence as a teacher. She felt that her students listened to her more than they did in her 1st year of teaching. She had more 'face'. She further commented:

> During my 1st year of teaching, it's like I'm just going on by myself and then in the 2nd year, when I started to use *TeleNex* and I go into Teaching Ideas (i.e. *TeleTeach*), I got more – more supplementary worksheets, more games, more than I can think of – so it's rather a different experience for me between my 1st and 2nd year. ... I think that last year, when I started to learn how to use *TeleNex*, for me it's opened a new world for me – how to teach English.

Discussion

The Hypermedia Database, Teacher Needs and Teacher Background

The findings in this study showed that most of the files were accessed by teachers and the frequency of file visits reflected teachers' needs. The files on the teaching of speaking, writing, integrated skills and grammar were visited most frequently by teachers and they were all areas in which there was a lack of or inadequate coverage in existing textbooks. In other words, an awareness of teachers' needs and the existing curriculum is crucial to the

development of a database of this nature. This is further supported by the finding that one of the reasons for not using some of the files was that teachers could not fit them into their existing curriculum.

The findings of the case study school showed that teachers who were less experienced and not trained in ESL teaching accessed the files more frequently and used more files for teaching than their more experienced and trained counterparts. This was borne out by the findings of the follow-up interviews, which showed that the three teachers who accessed the highest number of files were either less experienced or lacked confidence in their ESL teaching competence. These teachers used the database not only as a source of new ideas and teaching materials, but also as a source of professional knowledge enrichment. This is supported by the findings in the task on hyperlink and icon clicking given to the case study teachers and the findings of the follow-up interviews. Most of them accessed the database primarily for practical everyday teaching reasons, as evidenced by the fact that they would only read most of the pop-up screens if they were going to use the file for teaching. Teacher C, who was very much a novice teacher, clicked on most of the pop-up screens, irrespective of whether she was going to use the files for teaching. In fact, Teacher A, who was also less experienced, commented that she read one file purely for self-evaluation purposes. The follow-up interviews with Teachers A and C showed that both teachers saw the database not only as a source of new ideas and teaching materials, but also as a source of knowledge enrichment. The interview data also revealed that Teacher B, who was experienced but untrained in ESL teaching, read the files for her own knowledge enrichment rather than for classroom teaching. The relatively frequent accessing of files by the head of the department showed that the database was also used by her as a resource for helping her junior colleagues. Although the sample in the case study is too small to make any generalisations, the findings suggest that there is likely to be a relationship between file use and the teaching experience, professional training and self-confidence of teachers.

The Hypermedia Database and Teacher Knowledge Enrichment

The findings of the knowledge enrichment questionnaire showed that the items with a mean score of 2.2 and above mostly had to do with 'activities'. Setting up and sequencing activities, integration of skills and achievement of linguistic objectives through the activities all relate to the actual implementation of the activities in the classroom. Research on teacher thinking and planning showed that for most teachers, activities are the basic structural units of planning and action in the classroom (see, for example, Yinger, 1980; Calderhead, 1984). Sadro-Brown (1990) found that in daily teaching, teachers' decisions typically concerned activities, instructional methods and materials. In other words, 'activities' is something that teachers

can easily relate to. Pedagogic principles and pedagogic content knowledge realised through activities are likely to be taken on board by teachers.

The interview findings showed that the database was able to help the teachers interviewed to enrich their pedagogic content knowledge, as evidenced by the fact that both Teachers A and C pointed out the ways in which the files helped them to represent effectively what they know about the English language to students, and to make their teaching more student-centered. What is interesting is that this knowledge enrichment had the effect of teacher empowerment, in the case of Teacher A. It helped to build her confidence as a teacher.

The findings of Questionnaire C and the follow-up interviews showed that adapting materials to the ability levels of students is an area that teachers had difficulties with. This is supported by the finding reported previously that most teachers stated difficulty level as a reason for not using some of the files. In one case, even though the teacher read the suggestions given on the 'Adaptation' pop-up screen, she still did not use the file for teaching because it was too difficult. This is hardly surprising because the transformation of teachers' subject matter knowledge to make it comprehensible to students is one of the most difficult aspects of teaching. As Shulman (1986) points out, such a transformation requires an understanding of what makes a topic easy or difficult to students, as well as an understanding of their existing knowledge, preconceptions and misconceptions. However, this is very central to pedagogic content knowledge. This finding suggests that adaptation of materials is an area where more guidance should be provided in the database.

Conclusion

In this article, we have described a hypermedia database, *TeleTeach*, specifically designed to serve the dual purpose of helping teachers with their daily classroom teaching and enriching their professional knowledge. We have discussed the factors that need to be taken into consideration when designing a database of this nature and how they were taken into consideration when designing *TeleTeach*. Sample screens from the database have also been given to illustrate how the electronic medium was exploited. We reported an investigation into the effectiveness of the database in achieving its dual purpose. One of the limitations of this study is the small sample of teachers in the case study, which means its findings need to be taken cautiously. This limitation notwithstanding, the findings highlighted several aspects that need to be borne in mind when developing a database of this nature. First, an awareness of the teachers' needs and their existing curricular materials is essential. Secondly, teachers' primary concern is their everyday classroom teaching and any materials aimed at knowledge enrichment have to be tied in very closely with this concern. Thirdly, the enrichment of teachers' knowledge is more likely to take place if the

theoretical aspects of teaching are embedded in classroom practices that teachers can relate to. Fourthly, this kind of database is likely to be a useful source of support for less experienced, recently trained and untrained teachers.

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Note

[1] Some of the registered users were tertiary teachers. They were excluded from this study.

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APPENDIX

Questionnaire A.
Teachers' Needs Questionnaire Findings

No. of questionnaire administered: 328
No. of respondents: 299

Part 2. Teaching Materials and Teaching-Related Questions

A. To what extent do you agree with the following statements about your teaching situation?		
Q. 17	I have quite a lot of freedom to select my own teaching materials	82.7%*
Q. 18	The textbook(s) and materials that I am using are insufficient	69%
Q. 19	I feel that I need a wider variety of activities or materials than those provided in the textbooks or materials that I am using	95.4%
Q. 20	The textbook(s) that I am using are too difficult for my students	26.3%
Q. 21	The textbook(s) that I am using are too easy for my students	8.2%
Q. 22	I would like to see more detailed explanations of the rationale behind the activities in the textbooks	86.4%
Q. 23	I often make adaptations to activities to textbooks/materials	81.8%
Q. 24	I would like some guidance on adapting and producing materials	94.2%
Q. 25	I often use supplementary resource materials in my teaching	90.9%
Q. 26	There is no time for supplementary materials in my scheme of work	28.2%
Q. 27	It is difficult to find supplementary materials of the right level for my students	61%
Q. 28	It is diffcult to find supplementary materials that can be used in a class of about 40 students	60%
Q. 29	Looking for supplementary materials in resource books is too time-consuming	77.3%

* The percentages are those who indicated 'strongly agree' and 'agree'.

Part B

How would you rate your need for more materials in the following areas to supplement the textbook(s) or materials that you are using?					
33.	Listening	80%**	34.	Writing	95.4%
35.	Speaking	93.7%	36.	Reading	78.2%
37.	Integrated skills	98.2%	38.	Vocabulary	73.7%
39.	Pronunciation	83.6%	40.	Communicative grammar	90.9%
41.	Communicative games	94.5%			

** The percentages are those who indicated 'very needed' and 'needed'.

Questionnaire B.

No. of questionnaire administered: 328
No. of respondents: 299

7.	I find the teaching ideas and grammar files in *TeleNex* easy to use
30.	*TeleNex* has helped me to improve my classroom teaching
32	The teaching ideas and grammar files have given me insights into teaching
33.	I find it difficult to incorporate the materials or ideas in the databases into my daily teaching

Questionnaire C.
Knowledge Enrichment Questionnaire Findings

Please indicate how far the files that you have read have helped you to gain a better understanding of the following aspects of language, teaching and language teaching		Mean score
1.	The linguistic aspects covered in the files	2.5
2.	How the activities helped to achieve the linguistic objective(s) of the activities	2.2
3.	Various ways of organising the students when conducting activities, e.g. pair work, groupwork, etc.	2.1
4.	How to make the lesson more student-centred	2.1
5.	How to adapt the materials for students of different abilities	3.1
6.	How to set up activities so that everybody knows what to do	2.2
7.	The importance of ensuring that students have the necessary language and background knowledge to conduct the activity	2.4
8.	How to motivate students to participate in the activities, e.g. making it fun, introducing competitive elements	2.4
9.	How to integrate the teaching of skills, grammar and vocabulary	2.2
10.	The difference between accuracy-based and fluency-based activities	2.7
11.	The importance of varying the degrees of control when designing activities	2.6
12.	How to sequence activities, e.g. reading an advertisement before writing a letter of application	2.1
13.	Various ways of sequencing teaching procedures, e.g. presentation-drill-practice	2.0
14.	The importance of contextualising language items	2.4
15.	How to use supplementary materials in relation to your textbook/scheme of work	2.0