Introducing Speech Recognition in Schools

A CALL Centre Project

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Special Educational Needs Innovation Grants Programme

FINAL PROJECT REPORT

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Aims

There is growing awareness in schools of the potential of Speech Recognition (SR) to provide access to the curriculum for pupils with SEN. However, approaches and success with SR vary widely. In some schools there are pupils using SR as their main means of writing and recording work, whereas in other schools staff have found SR difficult to implement with any success at all.

The aim of the CALL *Introducing Speech Recognition in Schools* project was to investigate best practice in schools where speech recognition was being used successfully, and develop and evaluate training materials to help staff and students to learn to use speech recognition productively.

A number of research reports and case studies on speech recognition were reviewed before designing the project: particularly, the reports from Elaine Donald at Perth High School (Donald, 1998); Martin Miles and colleagues (Miles, Martin & Owen, 1998), and in particular, the reports and case studies produced by the BECTa speech recognition project (BECTa, 2000).

Overview

The project started in February 2000 and the first six months were spent researching and writing the first draft of the Training Packs. A ten-lesson format was chosen, following from the SNOW Dragon Dictate training (Lubert & Campbell, 1998). With agreement from the local authority Education Departments in Stirling and Dumfries & Galloway Councils, we asked twenty-one Support for Learning departments in secondary schools to take part in the project. We chose these departments, rather than special schools or units, because the largest potential group of students who may benefit from using SR in Scotland are those with specific learning difficulties in secondary education. Secondary schools were targeted, rather than primary, because experience has shown that the programs often do not recognise speech patterns of primary school age children. Stirling and Dumfries & Galloway were approached because CALL has Service Level Agreements to provide assessment, support and training to schools in the authorities and therefore have worked with staff in many of the schools previously.

For each school, we planned to provide:
- an initial on-site session to install the software, train staff and discuss which students might benefit from being involved in the project;
- the option of a second visit to support staff when starting work with students;
- one copy of either IBM ViaVoice Millenium Pro 7, or Dragon NaturallySpeaking Preferred 4 or 5 (half the schools got ViaVoice, the other NaturallySpeaking);
- the CALL Training pack for the software;
- one high quality TalkMic or Plantronics microphone;
- support by telephone and email.

We asked each school to identify:
- one PC capable of running the speech recognition program, in a suitable location (for example, a Learning Support base or other area which was readily accessible to students when they needed to use the system);
- a lead member of staff to co-ordinate the project;
- up to three students to participate in the project.

In Autumn 2000 we visited the first school in Dumfries & Galloway, to install IBM ViaVoice and train staff. However, the school had just received new NGfL networked computers at the start of the session and the network software was not working properly. Despite considerable effort on the part of the CALL staff, the school technician, and Dumfries and Galloway IT services, we could not get the software to work. Ironically, the managed service provider was IBM and yet ViaVoice, an IBM product, would not work on the system! We approached IBM but they were unable to help. Given these problems, Dumfries & Galloway IT staff were understandably reluctant for speech recognition software to be installed on networked computers until the managed service software was functioning satisfactorily, and there was a possibility that this might delay the project. Therefore, we issued a general invitation to schools across Scotland, through the ICTSLS network, to take part in the project. (ICT for Support for Learning in Scotland is a group of centres and staff with specific responsibility for ICT, SEN and Support for Learning – see the Web Sites section at the end of the report). In the event, forty schools in nine local authorities took part in the project. Table 1 lists the schools who received training and software from CALL.

School	Local Authority	School	Local Authority
Alford Academy	Aberdeenshire	Corseford	Glasgow
Banchory Academy	Aberdeenshire	King's Park secondary	Glasgow
Ellon Academy	Aberdeenshire	Lourdes Secondary	Glasgow
Fraserburgh Academy	Aberdeenshire	St Thomas Aquinas Secondary	Glasgow
Mackie Academy	Aberdeenshire	Grantown Grammar	Highland
Mearns Academy	Aberdeenshire	Invergordon Academy	Highland
Mintlaw Academy	Aberdeenshire	Lochaber High	Highland
Peterhead Academy	Aberdeenshire	Tain Royal Academy	Highland
Port Letham Academy	Aberdeenshire	Thurso High	Highland
The Gordon School	Aberdeenshire	Hawick High School	Scottish Borders
Westhill Academy	Aberdeenshire	Jedburgh High School	Scottish Borders
Dalry High School	Dumfries & Galloway	Kelso High School	Scottish Borders
Douglas Ewart High School	Dumfries & Galloway	Selkirk High School	Scottish Borders
Dumfries High School	Dumfries & Galloway	Balfron High	Stirling
Stranraer Academy	Dumfries & Galloway	Bannockburn High School	Stirling
Balerno High School	Edinburgh	Dunblane High	Stirling
Broughton High School	Edinburgh	McLaren High	Stirling
St Thomas of Aquin's High School	Edinburgh	St. Modan's High School	Stirling
Ashcraig	Glasgow	Linlithgow Academy	West Lothian
Cleveden Secondary	Glasgow	St Margaret's Academy	West Lothian

Table 1:   Schools who participated in the project

In Stirling, there were fewer problems with networked computers. The network software in Stirling was built by Stirling ICT staff rather than being bought in from a managed service provider. The Stirling staff tested ViaVoice and NaturallySpeaking and established how the software could be installed on network machines. They modified the user profile so that the program could write to the C: drive so that changes to the user's voice file could be made. In the case of ViaVoice, it was also necessary to 'Enable the MS-DOS prompt' for the program to work.

The increase in the number of schools extended the project by three months but gave more and wider feedback for the project. In four areas (Highland, Aberdeenshire, Glasgow and Scottish Borders) we ran training events in the authority for staff from several schools, rather than visiting each school individually. At these courses, staff brought a computer from their school to the session so the software could be installed and checked, and they could train the system on the same machine they would later use with students. Given the problems with networked machines, the staff brought stand-alone computers to these days.

Following the first training day, the teacher(s) looked through the ten Training Sessions in the Pack and practised the exercises in each session to become confident with the system and the training. Once they had become familiar with the program and the training pack they had the option to contact CALL to arrange a second half-day training day. On this visit, we helped the staff go through the first Session with the student and attempted to resolve any problems or issues that had arisen with the program or its use in school.

We deliberately chose this relatively 'arms-length' methodology – providing a fairly small level of input to schools across different areas of Scotland - because we wanted to evaluate the Training Pack, and also because we wanted to gather a realistic picture of implementation in schools.

Throughout the project we gathered comments and suggestions from schools and modified the Training Pack. The first Packs were written for ViaVoice Pro 7 and NaturallySpeaking Preferred version 4 and then updated as new versions came out: the final books were for ViaVoice Pro 9 and NaturallySpeaking Preferred 5. Two of the schools used ViaVoice for Macintosh, and although we did not have time to create a Pack for the Mac program during the project, we intend to do so and will make it available through the CALL web site http://callcentre.education.ed.ac.uk.

Dissemination

700 copies of each book (for ViaVoice and NaturallySpeaking) were printed and the project funding enabled us to distribute around 500 to the Support for Learning Departments in all the secondary schools in Scotland, plus other contacts in schools and education authorities. The remaining 200 are available for purchase from CALL. The books are complemented by the *Introducing Speech Recognition in Schools* CD which has electronic copies of the books, together with support files, tutorial sheets, and other resources.

On 12th June, a seminar was held in the CALL Centre to report the results of the project. 75 participants discussed speech recognition and listened to presentations from the project team and four teachers who had been involved in the project. The PowerPoint show prepared by three of the teachers are on the *Introducing Speech Recognition in Schools* CD.

Evaluation

In order to evaluate the training pack and also gather information about the use of speech recognition in the schools, we asked staff to complete three data collection forms:

- Pupil Profile   with information about the students who would be using speech recognition
- School Record   giving details about the school and the computers to be used
- Evaluation Form   for staff and students to summarise the results and comment on the Training Pack and the speech recognition software.

The forms are given in the Appendices, and the results presented and discussed below.

Outcomes and discussion

1. Uptake by schools

Forty schools received training and speech recognition software from CALL. Twenty-three (57.5%) schools returned thirty two Evaluation Forms to CALL. Of the seventeen schools who did not return evaluations (and, we assume, did not use the program):

- 7 schools did not give any particular reason;
- staff changes or absences were cited as reasons by 5 schools;
- lack of time and other priorities, by 4 schools;
- technical problems, lack of access to computers, and a stolen laptop by 4 schools;
- the pupil finding a laptop more effective, by 1 school;
- the pupil leaving school, by 1 school.

This relatively low uptake was disappointing for the project team, given the effort that had gone into visiting schools and providing software and microphones. However, it does illustrate the practical difficulties of introducing speech recognition in schools; limited staff resources or changes, technical problems, and timetable restrictions will all effect any new initiative in schools.

2. Feedback on the CALL Training Pack

We asked staff to rate the support provided by CALL, and the Training Pack.
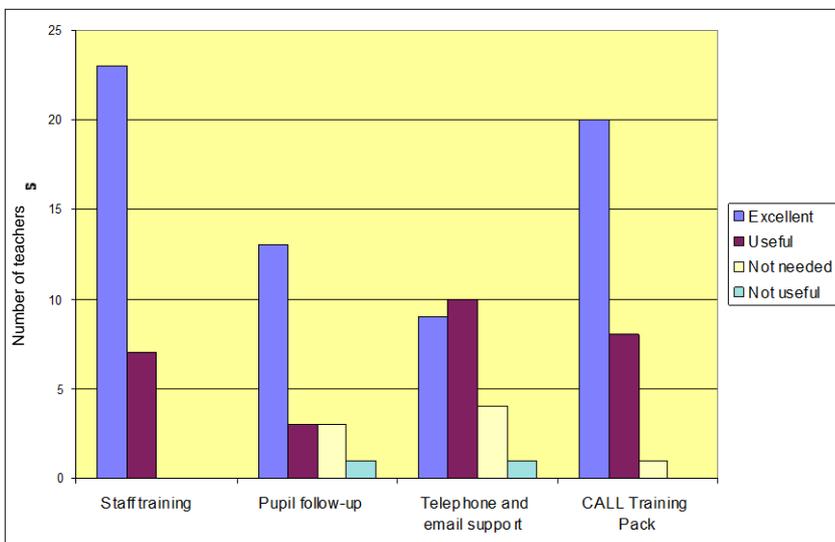
The responses show that the Pack was well received: 20 (69%) of the staff rated the Pack 'excellent'; 8 (28%) 'useful' and 1 (3%) 'not needed'.

The initial staff training was regarded as even more important than the Pack, and suggests that training is essential if schools are to successfully introduce speech recognition.

Figure 1: Feedback on CALL training, pack and support

The most common suggestion for improvements to the Pack was for material for students to work through independently, because the training was staff intensive. We responded to this by devising Student Tutorial sheets that are provided on the *Introducing Speech Recognition in Schools* CD.

3. Students involved in the project

Of the 32 pupils for whom Evaluations were returned, 26 were male and 5 female (one not recorded). Ages ranged from 13 to 16 with the majority of students (11) in second year of secondary school. Most (27 out of 32) of the students were described as dyslexic; 4 as having motor difficulties of a dyspraxic nature; 4 had handwriting difficulties due to cerebral palsy, arthritis or muscular atrophy, and one student had arthogryphosis with severe physical involvement. The students who took part in the project were chosen by staff in the schools, following training and advice from CALL.

School year	No. of students
S1 (age 12-13)	5
S2 (age 13-14)	11
S3 (age 14-15)	7
S4 (age 15-16)	7
S5 (age 16-17)	2
S6 (age 17-18)	-
Total	**32**

Nature of difficulty	No. of students
Dyslexia	27
Dyspraxia, effecting handwriting	4
Cerebral palsy, arthritis, or muscular atrophy, effecting handwriting	4
Severe physical involvement due to arthogryphosis	1

Table 2: School year, age and main difficulty of students

4. Effectiveness of the Training Pack

In general, the Pack was effective in helping staff to train students to use speech recognition. 32 students in 23 schools used the Training Pack:
- 23 (72%) students were reported to continue using speech recognition after going through the training;
- 1 (3%) was not sure;
- 8 (25%) did not intend to continue using speech recognition.

5. Reasons for not continuing to use speech recognition

Table 3 below gives the reasons why the 8 students did not intend to continue using speech recognition. 6 students said the main reason was that they had decided that other software (standard word processor, or word prediction) was more effective for them. This underlines the fact that speech recognition is just another writing tool, which suits some, but not all writers. One student could not complete the training because of a change of timetable; one student cited poor accuracy and technical problems. Other possible reasons for the lack of success are insufficient practice, problems with the technology (i.e. the program or the computer), and the skills of the student. Some of these issues are discussed later.

Reason for not continuing with Speech Recognition	Sex	Year	Difficulty
"Feeling that this project did not meet the pupil's needs fully. Have investigated other software which has improved writing skills and motivation."	Male	S2	Dyslexic
"The speech recognition was too unpredictable: sometimes good, sometimes poor. Her final session was in conditions more like what would normally happen and it did not work properly. However she now uses an HP Jornada for computer access and finds this beneficial."	Female	S4	Muscular atrophy

"Found it difficult and time consuming to produce accurate results. He preferred using his laptop. Pupil had difficulty speaking clearly and slowly enough for the system to give an accurate response. He got easily frustrated and often needed a break because of an illness and did not wish to continue with the training."	Male	S2	Specific learning difficulties
"Pupil felt the laptop was of more benefit to him and more convenient as he could use it in any room and did not have to come to the support base to complete writing tasks. It was difficult to identify time from the S3 curriculum for training, particularly as the pupil gets frustrated by the number of attempts needed to correct the numerous errors made."	Male	S3	Specific learning difficulties
"Only one lesson completed. A change of timetable meant I lost the free period I was using. Her visits to the base no longer suited the use of the PC."	Female	S1	Learning difficulties
"It is not helping him at all. He would rather word process than continue with the package. Only completed 3 sessions due to his speech: it was not a successful program. (He is a poor speaker, heavy accent, lots of pauses, comments during lessons etc)."	Male	S4	Cerebral palsy
"We have had problems with the program but also with the computer on which it was installed. Unfortunately it is out of commission at present and being repaired. Great difficulty with program's accuracy which led to frustration on part of pupil. 4 lessons completed but with very limited success."	Male	S1	Specific learning difficulties
"School not appropriate. Pupil now working on another computer program. If the program worked, home would be the best place for pupils to use this. An individual room in school is not often available. Computer kept crashing and was networked - less flexibility and the pupil was self conscious about others hearing him."	Male	S2	Dyslexic

Table 3:   Reasons for not continuing to use speech recognition

6. Effects of practice

Frequent and regular training, and practice, is essential if students are to be successful with speech recognition. Results from the CALL and other projects shows that the success or otherwise of introducing speech recognition in schools depends as much on school and staff resources, as on the skills of the individual student. The BECTa project (BECTa, 2000) concludes that success depends on the "Three T's" – the right Technology, sufficient Time, and suitable Training.

We asked staff to record how often they worked with the student on speech recognition, and Table 4 shows the results. It is clear that those students who say they will continue to use speech recognition had more frequent practice. 91% of the students who intend to continue using speech recognition received training once or more per week, in comparison to 37% of students who do not intend to use it.

| Frequency of SR sessions	% who won't continue	% who will continue
Every day	0%	0%
A few times per week	13%	26%
Once a week	25%	65%
Less than once a week	63%	9%

Table 4
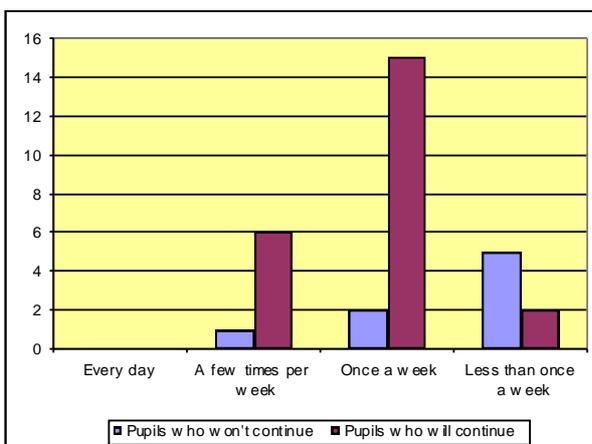
Figure 2

**Frequency of practice of students who will and won't continue with speech recognition
(Based on 23 students who will use SR and 8 who will not)**

Of course, other factors will have had an effect on the frequency – for example, 3 of the 8 students who decided not to use speech recognition gave up after 4 or fewer sessions because the accuracy was so poor. Nevertheless, there is no doubt that students will require regular practice to become successful with speech recognition. This may mean that the student's (or staff member's) timetable has to be altered while he or she is learning to use speech recognition, or that the student is given preferential access to a computer for the training period.

Six of the eight pupils who will not continue used NaturallySpeaking, which might suggest that it is less effective than ViaVoice. In fact, we do not believe this to be the case – the numbers are too small to be significant (8 students in 6 schools, 4 of which used NaturallySpeaking and 2 of which used ViaVoice) and we obtained other more reliable measures of the programs effectiveness (described below), which indicate that ViaVoice and NaturallySpeaking performed similarly.

7. Performance of ViaVoice and NaturallySpeaking

We chose to use ViaVoice and NaturallySpeaking because they were reputed to be the most effective programs available at the time. We did not use Dragon Dictate, despite its popularity with some writers and educationalists, because:
- Dragon Dictate is an older program, which may not be available for much longer.
- It requires significantly more initial training.
- We felt the primary advantage of the 'discrete' Dragon Dictate, compared with the newer 'continuous' programs, was that it forces students to say one word then check and correct it, which improves attention, word recognition and accuracy. By teaching students to dictate slowly, and check and correct each sentence, we hoped to achieve similar results.
- The continuous programs, once trained, have the potential to be faster and more accurate than Dragon Dictate.

We used ViaVoice Pro 7 rather than the cheaper 'Standard' version because it could dictate into most applications. Two schools also used ViaVoice for Mac USB. Dragon NaturallySpeaking 'Preferred' 4, and then 5, was used rather than the 'Essentials' or 'Standard' versions because it could dictate into most applications, and had text-to-speech to read back dictated text on screen.

In education generally, NaturallySpeaking seems to be more popular than ViaVoice, but we do not think there is much difference between them. In fact, when we look at the 'success rate' of students in the project, ViaVoice is better.

	Yes	No	Not sure	Success rate
Dragon NaturallySpeaking	11	6	1	61 %
ViaVoice	12	2		86 %

Table 5: Number of students who intend to continue with Speech Recognition, or not

The other factors involved (the small sample, student and staff skills, computer specifications, time spent using the software, pure luck) probably mean that these figures are not representative.

A better comparison is given by looking at the ratings given by staff in the evaluation forms. We asked staff and students to rate the programs on a 5 point scale of 'poor' (1), 'fair' (2), average' (3), 'good' (4) and 'excellent' (5). Figure 2 and Table 7 give the results.

Overall, staff did not report any significant difference in effectiveness between Dragon NaturallySpeaking and IBM ViaVoice. The averaged rating for NaturallySpeaking was 3.38 and ViaVoice was 3.42, i.e. both were between 'average' and 'good'. ViaVoice was rated as slightly more reliable, whereas the NaturallySpeaking initial training (which can mean reading 51 sentences if you have a fast computer, as opposed to 70 for ViaVoice) and method of correction are slightly easier.

Staff who worked with students who do not intend to use speech recognition scored the programs lower than those who found the programs effective. There did not appear to be any correlation between the scores given by staff, and the specification of the computer they used (Table 7). Schools were advised that they should use the newest machine available, with at least 128 MB RAM, but in practice a wide range of computer types and specifications was used.
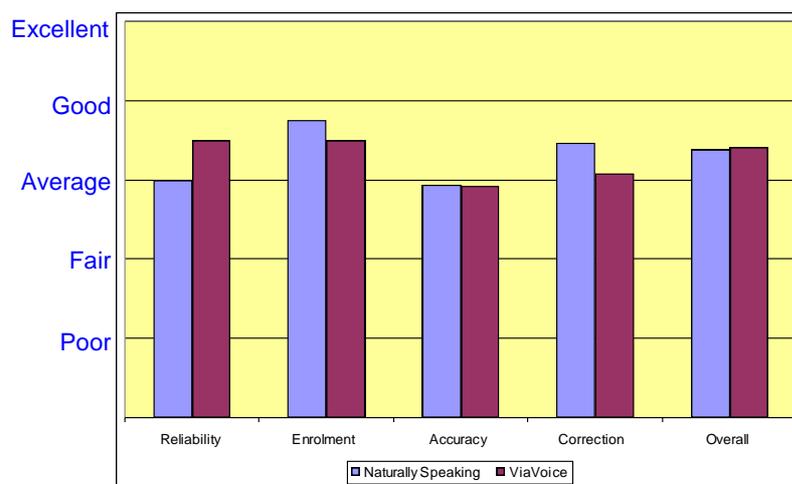
Figure 2: Average ratings, from staff, of the speech recognition programs (NaturallySpeaking was rated by 16 staff, ViaVoice by 12)

We also asked staff how the speech recognition program could be improved, and Table 6 gives the responses. The most common complaint is about poor recognition accuracy, although this may be due in part to students' indistinct speech. One teacher suggested it would be helpful if the program (ViaVoice) could be used to dictate answers into worksheets that had been scanned into the computer using WYNN.

Surprisingly, only one teacher mentioned using the programs on networked computers or transferring voice files between computers. However, when discussing how speech recognition could be taken forward in schools, staff identified this as a major barrier. Schools in Scotland now have networked computers with protected systems, and the speech recognition tested during the project often did not work properly on these, so that standalone machines were used instead. Secondly, users' voice files could not be easily transferred from one machine to another, which meant that the student was restricted to using a computer in a single location – usually the Support for Learning Base, or library. While it was possible to transfer voice files in several ways, none of the techniques were straightforward:

- ViaVoice voice files can be saved and then loaded again on another machine by copying across the network, or using floppy or zip discs or CD's.
- NaturallySpeaking files can also be copied, but the option is not built into the program so it is more awkward.

- A complete 'disc image' can be transferred from one machine to another (In Kelso High School, for example, the student trained the program on one computer and the network technician copied a complete image to another machine on the RM network. The student sat down at the second machine, and was able to open his voice file and dictate satisfactorily.)

These techniques are not satisfactory because the voice file must be manually transferred every time the program is used. If speech recognition programs are to be taken up widely in schools, they must be fully compatible with networked computers so that a student is able to access the program and his or her voice file at any computer on the network. Some recent developments may provide a way forward:
- KeyStone Roamer, from Words Worldwide, is a bespoke program for enabling students to access their NaturallySpeaking voice files anywhere on the network.
- IBM advertise an 'Enterprise' version of ViaVoice designed for networked computers.

Student	Difficulty	Continue with SR?	Program	Suggestions for improvement
1	Specific difficulties of a dyslexic nature	No	Dragon NS 4	*"Still more work needed to evaluate program to understand words and sounds"*
2	Muscular Atrophy and Asthma causing muscular weakness and tires easily	No	Dragon NS 4	*"Requires to be more consistent in recognition. "*
3	Specific learning difficulty	No	Dragon NS 5	*"Reduction in amount of time required for one program to recognise particular speech patterns."*
10	Arthogryphosis	Yes	Dragon NS 4	*"Need for more user control (not keyboard) as staff needed to press keys. Reminders on screen - student couldn't look up reference book when she forgot commands."*
11	Oligoarticular juvenile arthritis	Yes	Dragon NS 4	*"Voice commands often failed (even when forced)"*
13	Dyslexic, dyspraxic & dyscalculaic	Yes	Dragon NS 4	*"Adding a thesaurus. Word count - reward after dictating X words"*
17	Dyspraxia - laboured handwriting, tight pencil grip, writing speed slow, spelling erratic	Yes	Dragon NS 5	*"Any improvement in accuracy & correction of mis-recognised words would help frustrating days when it all goes a bit awry."*
20	Specific difficulty mainly with writing - very poor handwriting	Yes	Dragon NS 5	*"System by which pupil file can be moved to another machine. e.g. not have to redo training."*
21	Cerebral palsy - spastic diplegia; poor mobility; wheelchair user; handwriting poor	Yes	ViaVoice - Mac	*"Be more accurate with commands, e.g. Bold On, Bold Off"*
23	Mildly dyslexic, uses cerium lenses	Yes	ViaVoice - PC	*"Use with other programmes e.g.: scanning for reading using WYNN. To see page breaks in the SpeakPad."*
24	Dyslexic	Yes	ViaVoice - PC	*"Use with scanning programme. To see page breaks in the SpeakPad."*
26	Specific learning difficulty	Yes	ViaVoice - PC	*"I felt that it was quite user friendly on the whole – I'm not sure how it might be improved."*

Table 6: Suggestions for improvements to the speech recognition programs

Student	School	Continue with SR?	Program	Computer	RAM	Network?	Reliability	Enrolment	Accuracy	Correction	Overall
1	Bannockburn High School	No	Dragon NS 4	Dell Optiplex G1 Celeron 300	64	Network	2	4	3		3
2	Ashcraig	No	Dragon NS 4	HP laptop, PIII	128	Standalone	1	4	2	2	1
3	Fraserburgh Academy	No	Dragon NS 5	not known	-		3	1	1	1	3
4	Fraserburgh Academy	No	Dragon NS 5	not known	-		3	1	1	1	3
5	Mackie Academy	No	Dragon NS 5	RM, Celeron 433, Win 98	128	Standalone					
6	Mearns Academy	No	Dragon NS 5	not known	-		2	2	3	3	2
7	Ellon Academy	No	ViaVoice - PC	not known	-		1	1	1	1	2
8	Balfron High School	No	ViaVoice - PC	Dell Optiplex GX1 Celeron	64	Standalone	1	2	1	4	1
						AVERAGE	1.86	2.14	1.71	2.00	2.14
9	Selkirk High	Unsure	Dragon NS 4	Novatech laptop, AMD-K6	64	Standalone					
10	Corseford School	Yes	Dragon NS 4	Compaq Prosignia 320, Celeron 466, Win 98	64	Standalone	2	4	1	2	1
11	Jedburgh Grammar	Yes	Dragon NS 4	Tiny PIII 450, Win 98	?	Standalone	4	4	3	4	4
12	Jedburgh Grammar	Yes	Dragon NS 4	Tiny PIII 450, Win 98	?	Standalone	4	4	3	4	4
13	Douglas Ewart High School	Yes	Dragon NS 4	Elonex MCX-6300, Celeron 374	64	Standalone	4	5	4	5	5
14	Douglas Ewart High School	Yes	Dragon NS 4	Elonex MCX-6300, Celeron 374	64	Standalone	4	5	4	5	4
15	Douglas Ewart High School	Yes	Dragon NS 4	Elonex MCX-6300, Celeron 374	64	Standalone	4	5	3	4	4
16	Stranraer Academy	Yes	Dragon NS 4	Elonex 6333, Celeron 333, Win 98	64	Standalone	4	5	5	5	5
17	Grantown Grammar	Yes	Dragon NS 5	Evesham Celeron 600, Win 98	128	Network	2	5	4	4	4
18	Thurso High School	Yes	Dragon NS 5	Evesham Celeron 500	128	Standalone	5	3	4	4	5
19	Mackie Academy	Yes	Dragon NS 5	RM, Celeron 433, Win 98	128	Standalone	3	4	3	4	4
20	McLaren High School	Yes	Dragon NS 5	Dell GX1 330 Celeron, Win98	64	Standalone	1	4	3	4	2
21	Balerno High School	Yes	ViaVoice - Mac	iBook, MacOS 9.1.	64	Standalone	4	3	4	3	4
22	St Margaret's Academy	Yes	ViaVoice - Mac	IMac, MacOS 9.1	64	Network					
23	Linlithgow Academy	Yes	ViaVoice - PC	Dell Optiplex GX110 PIII	64	Standalone	4	4	4	4	4
24	Linlithgow Academy	Yes	ViaVoice - PC	Dell Optiplex GX110 PIII	64	Standalone	4	4	3	1	4
25	Hawick High School	Yes	ViaVoice - PC	RM PIII, Win 98	64	Standalone	4	2	4	4	4
26	Alford Academy	Yes	ViaVoice - PC	Compaq S710 PIII 866, Win 2000	128	Standalone	4	5	4	5	4
27	Broughton High	Yes	ViaVoice - PC	Siemens Scenic Celeron 500, Win NT 4	64	Network	4	3	2	2	3
28	Broughton High	Yes	ViaVoice - PC	Siemens Scenic Celeron 500, Win NT 4	64	Network	4	3	2	2	3
29	Dunblane High School	Yes	ViaVoice - PC	Dell Latitude laptop CpiR400GT, Celeron, Win 98	64	Standalone	4	5	3	4	4
30	Dunblane High School	Yes	ViaVoice - PC	Dell Latitude laptop CpiR400GT, Celeron, Win 98	64	Standalone	4	5	3	3	4
31	Dunblane High School	Yes	ViaVoice - PC	Dell Latitude laptop CpiR400GT, Celeron, Win 98	64	Standalone		5			
32	The Gordon Schools	Yes	ViaVoice - PC	Pentium II, Win 95	32	Standalone	4		4	4	4
						AVERAGE	3.67	4.14	3.33	3.67	3.81

Table 7: Staff scores for program reliability, sorted by students intending to continue with speech recognition, and by program

Key: 1: 'Poor'   2: 'Fair'   3: 'Average'   4: 'Good'   5: 'Excellent'

8. Effect of student skills

Before starting work with the speech recognition program on the CALL project, we asked staff to score student skills, on a 5 point scale from 'poor' to 'excellent', with respect to an 'average' pupil. Table 8 lists the students' age, school year, and skills. Those who did and did not intend to continue using speech recognition are separated into different groups, and the average scores calculated.

Figure 3 gives the average scores for the students across each of the skill areas, with separate bars for those who did and did not intend to continue using speech recognition, having tried it. The small numbers involved mean that the scores are not statistically significant, but they do illustrate some useful points for discussion.

Word processing and IT skills
The students had 'average' IT skills: clearly, it helps if students have some understanding of word processing, editing and file management before they start to use speech recognition (or any other ICT tool) for recording work.

Motivation
Motivation to use speech recognition tended to be 'good' or 'excellent', and there was little difference between successful and unsuccessful students: in fact, the latter were said to be more motivated on average. Learning to use speech recognition is hard work, and can be very frustrating, so staff and students need to be prepared to put in a lot of effort to get useful results.

Perseverance and ability to work independently
Staff chose students with whom to work with above-average perseverance and ability to work independently.

Oral communication
To use speech recognition, a student must be able to:
- think of what they want to say;
- compose their thoughts into written English sentences;
- speak reasonably clearly.

If a student has severe learning difficulties, and is not able to compose and speak clearly, speech recognition is unlikely to be successful. In our sample, those who were successful tended to have slightly better oral skills than those who were not successful. Several staff noted that students who were already skilled at using dictaphones found it easier to compose text before dictating to NaturallySpeaking.

From comments on the evaluation forms, 8 of the 32 students (Table 9) had accents or speech which were not sufficiently clear to give good accuracy, and this was a key factor for 5 of these students deciding not to use continue using speech recognition. 5 of the 8 students were in Aberdeenshire, 2 in Glasgow and 1 in Highland. Since only 2 other students in Aberdeenshire did not report problems with accents, this may suggest that Aberdeenshire accents, for example, are not recognised accurately by speech recognition programs. However, we suspect that the accent is not the main problem, and that a combination of volume, mumbling and slurring is the main issue. Local dialects may also cause difficulties – if words are spoken in a quite different way to 'standard' English (e.g. 'fit' for 'what', 'ken' for 'know') then the programs will not recognise the words unless you correct and train them individually.

Reading and literacy skills

All the students had reading, spelling and writing skills which were worse than average – hence their reason for evaluating speech recognition. Those who were successful had slightly better reading skills than those who were not. It is generally agreed that it helps if the student has some reading, or at least word recognition, skills. This is because the programs will always make mistakes, and so to write independently, the student must be able to spot the mistakes and correct them.

Having said that, students who are poor readers do use speech recognition successfully. Both ViaVoice and NaturallySpeaking Preferred have a text-to-speech facility to read back the text that has been dictated, and a 'playback' to play back a recording of what was actually said. By comparing the playback with the dictated text, a student can identify mis-recognitions. Also, ViaVoice has the option to save the recording of the student's dictation, so that a teacher or helper can correct it, or help the student to correct it later. Lastly, students and staff should accept that the dictated text will always contain some recognition errors – for example, people who use speech recognition to compose emails usually add a note asking recipients to allow for any recognition errors. The issue for schools is whether the error rate is acceptable, and whether the advantages of using speech recognition compared with the alternatives (handwriting, scribing, word processor etc) outweigh the disadvantages. It may be harder for a poor reader to be successful with speech recognition than a good reader but poor readers may well be more motivated to persevere than other students because they have few viable alternatives.
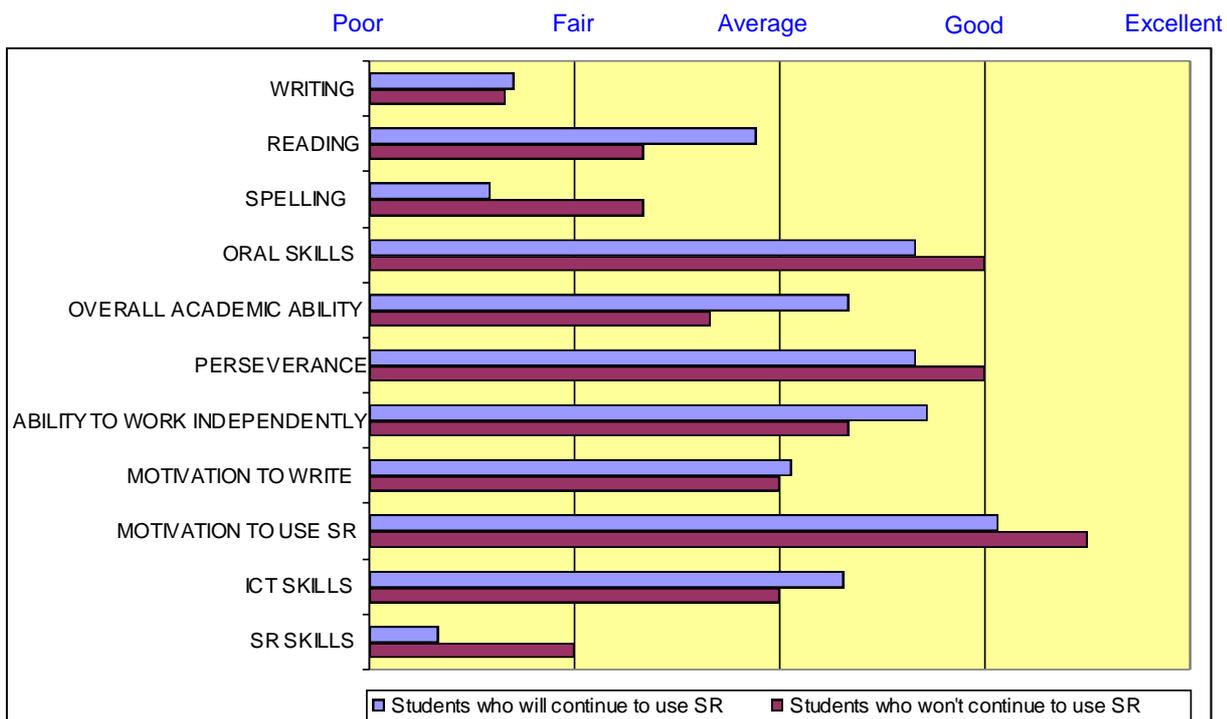

Figure 3: Average of student abilities, scored by staff

(Based on scores for 17 pupils who intend to continue with speech recognition and 3 who do not)

Student	School	Continue with SR?	Age at start: years, months	Year	Difficulty	Writing	Reading	Spelling	Oral skills	Overall	Perseverance	Work independently	Motivation to write	Motivation to use SR	ICT skills	Speech recognition skills
1	Bannockburn High School	No	13,4	S2	Specific difficulties of a dyslexic nature	1	2	1	5	3	5	3	3		2	2
2	Ashcraig	No	15,4	S4	Muscular Atrophy and Asthma causing muscular weakness and tires easily	3	4	4	4	3	3	4	3	5	5	
3	Fraserburgh Academy	No	14	S2	Specific learning difficulty											
4	Fraserburgh Academy	No	14,1	S3	Specific learning difficulty											
5	Mackie Academy	No	12,3	S1	Record of needs	1	1	2	3	2	4	3	3	4	2	
6	Mearns Academy	No		S4	Cerebral Palsy											
7	Ellon Academy	No		S1	Specific learning difficulty											
8	Balfron High School	No		S2	Dyslexia											
					AVERAGE for students who will not continue with speech recognition	**1.67**	**2.33**	**2.33**	**4.00**	**2.67**	**4.00**	**3.33**	**3.00**	**4.50**	**3.00**	**2.00**
9	Selkirk High	Unsure	14,4	S3	Dyslexia	4	3	1	4	4	5	5	4	4	3	1
10	Corseford School	Yes	15	S4	Arthogryphosis		2	2	3	3	3	4	3	5	4	
11	Jedburgh Grammar	Yes	13,6	S2	Oligoarticular juvenile arthritis	4	4	4	4	4	4	5		5		
12	Jedburgh Grammar	Yes	14,8	S4	Specific learning difficulties affecting spelling and speed of writing	3	3	3	3	3	3	4	3	4	3	2
13	Douglas Ewart High School	Yes		S3	Dyslexic, dyspraxic & dyscalculaic	1	2	1	3	3	3	3	2			
14	Douglas Ewart High School	Yes		S2	Dyslexia											
15	Douglas Ewart High School	Yes		S2	Dyslexia	1	2	1	3	2	2	2	2		2	

Student	School	Continue with SR?	Age at start: years, months	Year	Difficulty	Writing	Reading	Spelling	Oral skills	Overall	Perseverance	Work independently	Motivation to write	Motivation to use SR	ICT skills	Speech recognition skills
16	Stranraer Academy	Yes	12,7	S1	Dyslexia											
17	Grantown Grammar	Yes	12,6	S2	Dyspraxia - laboured handwriting, tight pencil grip, writing speed slow, spelling erratic	1	4	2	5	4	4	4	3	4	3	
18	Thurso High School	Yes		S3	Dyslexia	1	2	1	5	5	5	4	5	5	5	
19	Mackie Academy	Yes	14,10	S3	Motor learning difficulties, dyslexic type difficulties	1	4	1	4	3	3	4	4	4	3	
20	McLaren High School	Yes	14,1	S3	Specific difficulty mainly with writing - very poor handwriting	1	3	1	3	4	4	3	1	5	4	
21	Balerno High School	Yes		S5	Cerebral palsy - spastic diplegia; poor mobility; wheelchair user; handwriting poor	1	3		4	3	3	2	3	2	1	1
22	St Margaret's Academy	Yes	14,11	S4	Dyspraxic, Very poor speller/writer											
23	Linlithgow Academy	Yes	12,9	S2	Mildly dyslexic, uses cerium lenses											
24	Linlithgow Academy	Yes	12,9	S2	Dyslexic											
25	Hawick High School	Yes	14,4	S3	Specific learning difficulty - dyslexia	1	2	1	2	3	2	3	1	2	2	
26	Alford Academy	Yes	13	S2	Specific learning difficulty	1	2	1	3	1	4	5	4	5	2	
27	Broughton High	Yes	15,2	S4	Dyslexia	1	4	2	4	4	5	5	4	4	5	
28	Broughton High	Yes	12,2	S1	Dyslexic	1	3	1	4	4	5	3	4	4	5	
29	Dunblane High School	Yes	14,6	S4	Dyslexia - affecting processing information & extended written work.	2	2	2	4	3	4	4	2	5	4	

Student	School	Continue with SR?	Age at start: years, months	Year	Difficulty	Writing	Reading	Spelling	Oral skills	Overall	Perseverance	Work independently	Motivation to write	Motivation to use SR	ICT skills	Speech recognition skills
30	Dunblane High School	Yes	15	S5	Dyslexia	3	2	2	3	3	3	3	4	4	3	
31	Dunblane High School	Yes			Dyslexic - information processing and commitment of ideas as extended written response.											
32	The Gordon School	Yes	12,10	S2	Specific learning difficulty of a dyslexic nature	2	5	1	5	4	4	4	3	3	4	
					AVERAGE for students who will continue with speech recognition	**1.71**	**2.89**	**1.59**	**3.67**	**3.33**	**3.67**	**3.72**	**3.06**	**4.06**	**3.31**	**1.33**

Table 8: Student skills prior to starting the speech recognition training
Key: - 'Don't know'   1: 'Poor'   2: 'Fair'   3: 'Average'   4: 'Good'   5: 'Excellent'

Student	School	Continue with SR?	Year	Difficulty	Program	Comments on accent and accuracy
2	Ashcraig (Glasgow)	No	S4	Muscular Atrophy and Asthma	Dragon NS 4	*"Requires to be more consistent in recognition. However to be fair the pupil that I used it with seemed to have an inconsistency in her voice (not noticeable until it mattered here) so perhaps with a different pupil things would have been different."*
3	Fraserburgh Academy (Aberdeenshire)	No	S2	Specific learning difficulty	Dragon NS 5	*"The main difficulty was the inability of the program to deal with the student's speed of talking and at times indistinct speech."*
4	Fraserburgh Academy (Aberdeenshire)	No	S3	Specific learning difficulty	Dragon NS 5	*"The program did not seem able to cope with initially with the local accent. There were also problems determining the correct pitch of the pupil's voice."*
6	Mearns Academy (Aberdeenshire)	No	S4	Cerebral Palsy	Dragon NS 5	*"The student has a heavy accent and his speech is not the clearest. He tends to speak quickly with lots of extra words "Oh! Eh? No? Whit? etc. This confused the package."*
7	Ellon Academy (Aberdeenshire)	No	S1	Specific learning difficulty	ViaVoice - PC	*"I probably picked the wrong pupil as it became clear how inarticulate and mumbled his speech was."*
10	Corseford School (Glasgow)	Yes	S4	Arthogryphosis	Dragon NS 4	*"The student had a strong accent which the software had difficulty in recognising at times. Her speech can be slightly slurred."*
17	Grantown Grammar (Highland)	Yes	S2	Dyspraxia	Dragon NS 5	*"Any improvement in accuracy & correction of mis-recognised words would help frustrating days when it all goes a bit awry. Changes in voice (cold / tiredness etc) can give an off day.*
32	The Gordon School (Aberdeenshire)	Yes	S2	Specific learning difficulty of a dyslexic nature	ViaVoice - PC	*"Had difficulty with a few 'small' words to begin with due to accent."*

Table 9: Instances where accents were reported to cause problems

9. Effect of speech recognition on student skills and work

We asked staff to estimate how student's skills had changed since starting the speech recognition training. A six point rating was used: 'Worse' (1), 'No change' (2), 'Improved slightly' (3), 'Improved moderately' (4), 'Improved significantly' (5), 'Don't know' (0). Table 10 gives the results, while Figure 4 has the scores averaged across all the students.

In general, students who intended to continue with speech recognition were reported as having improved in most areas. The biggest changes were in skills and motivation to use speech recognition itself. Most of the students who did not find speech recognition useful reported no change or a slight improvement in some areas, although several had less motivation to use speech recognition, as would be expected.
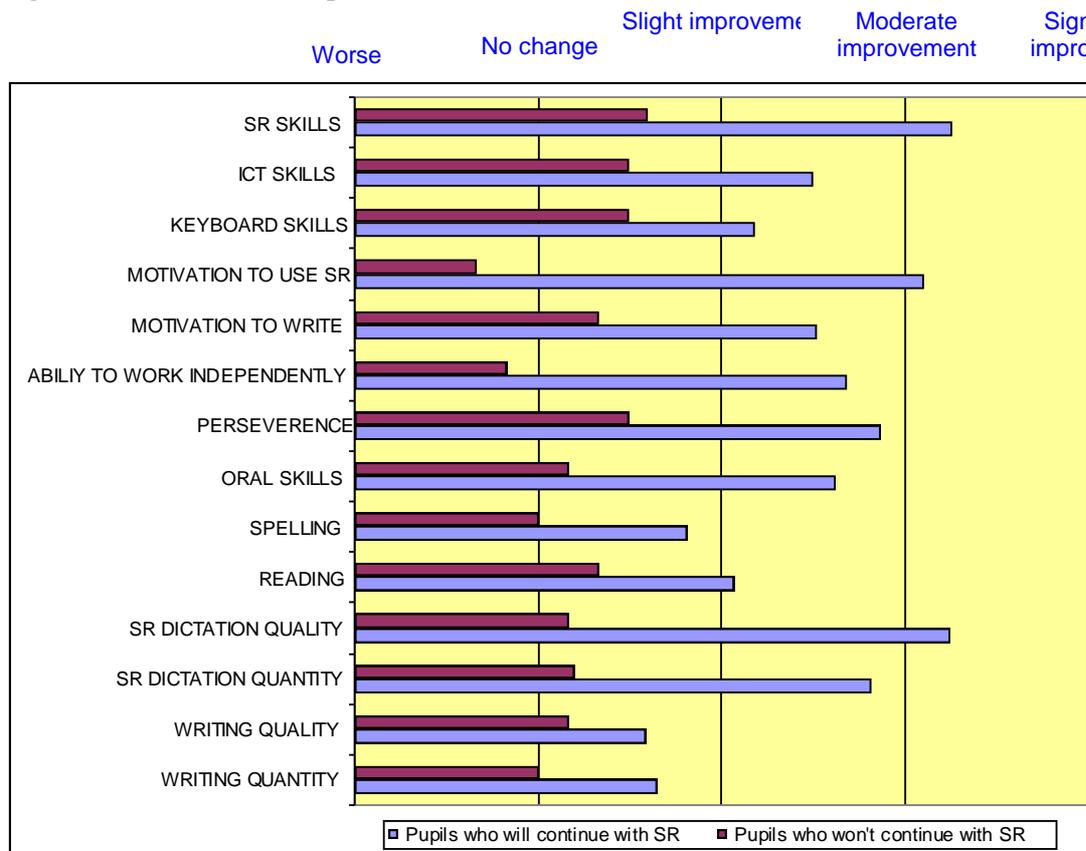
Figure 4: Mean changes in abilities reported by staff
(Based on 17 pupils who intend to continue with speech recognition and 6 who do not)

Other studies have measured increases in reading and spelling skills when using speech recognition: in a ten-week trial of IBM Simply Speaking with eleven children (Miles, Martin & Owen 1998), the reading age of the pupils increased by an average of 13.4 months (British Ability Scales Reading Test) and the average spelling age by 6.1 months (Schonell test). Table 10 does show some increases in writing, spelling and reading skills but overall, staff did not report the dramatic improvements in reading and spelling recorded by Miles and his colleagues.

Student	School	Continue with SR?	Year	Difficulty	Writing Quantity	Writing Quality	Quantity with SR	Quality with SR	Reading	Spelling	Oral skills	Perseverance	Work independently	Motivation to write	Motivation to use SR	Keyboard skills	ICT skills	SR skills
1	Bannockburn High School	No	S2	Specific difficulties of a dyslexic nature	2	3	2	2	4	2	3	3	2	2	2	2	2	4
2	Ashcraig	No	S4	Muscular Atrophy and Asthma causing muscular weakness and tires easily	2	2	3	3	2	2	2	4	2	3	3	2	2	4
3	Fraserburgh Academy	No	S2	Specific learning difficulty														
4	Fraserburgh Academy	No	S3	Specific learning difficulty														
5	Mackie Academy	No	S1	Record of needs	2	2	2	2	2	2	2	2	2	2	2	2	2	2
6	Mearns Academy	No	S4	Cerebral Palsy	2	2	1	1	2	2	2	2	1	2	1	2	2	1
7	Ellon Academy	No	S1	Specific learning difficulty	2	2	3	3	2	2	2	2	2	3	1	4	4	2
8	Balfron High School	No	S2	Dyslexia	2	2		2	2	2	2	2	2	2	1	3	3	
				AVERAGE for students who will not continue with speech recognition	**2.00**	**2.17**	**2.20**	**2.17**	**2.33**	**2.00**	**2.17**	**2.50**	**1.83**	**2.33**	**1.67**	**2.50**	**2.50**	**2.60**
9	Selkirk High	Unsure	S3	Dyslexia														
10	Corseford School	Yes	S4	Arthogryphosis			1				3	3	1	1	1		2	3
11	Jedburgh Grammar	Yes	S2	Oligoarticular juvenile arthritis	3	3	2	4	2	2			3	3	3	3	4	5
12	Jedburgh Grammar	Yes	S4	Specific learning difficulties affecting spelling and speed of writing	2	2	3	3	2	2	2		2	3	3		4	4
13	Douglas Ewart High School	Yes	S3	Dyslexic, dyspraxic & dyscalculaic	4	4	4	4	5	5	5	5	5	5	5	5	5	5
14	Douglas Ewart High School	Yes	S2	Dyslexia	3	3	5	5	4	3	5	5	4	3	4	4	4	5
15	Douglas Ewart High School	Yes	S2	Dyslexia							3	2	3	4	3	3	3	4
16	Stranraer Academy	Yes	S1	Dyslexia	4	4	5	5	5	5	5	5	5	5	5	5	5	5
17	Grantown Grammar	Yes	S2	Dyspraxia - laboured handwriting, tight pencil grip, writing speed slow, spelling erratic	2	2	5	5				3	2	2	5	2	2	5
18	Thurso High School	Yes	S3	Dyslexia	2	3	5	5		3			5	5	5	4	5	5
19	Mackie Academy	Yes	S3	Motor learning difficulties, dyslexic type difficulties	1	2	5	5	3	3	3	2	3	5	5	3	3	4
20	McLaren High School	Yes	S3	Specific difficulty mainly with writing - very poor handwriting	2	2	3	3	2	2	3	4	2	2	3			5
21	Balerno High School	Yes	S5	Cerebral palsy - spastic diplegia; poor mobility;	2	2	2	2	2	5	2	2	4	2	5	2	3	3

Student	School	Continue with SR?	Year	Difficulty	Writing Quantity	Writing Quality	Quantity with SR	Quality with SR	Reading	Spelling	Oral skills	Perseverance	Work independently	Motivation to write	Motivation to use SR	Keyboard skills	ICT skills	SR skills
				wheelchair user; handwriting poor														
22	St Margaret's Academy	Yes	S4	Dyspraxic, Very poor speller/writer														
23	Linlithgow Academy	Yes	S2	Mildly dyslexic, uses cerium lenses	2	2	4	4	3	2	4	4	5	2	5	2	2	4
24	Linlithgow Academy	Yes	S2	Dyslexic	2	2	5	5	2	2	5	5	5	5	5	2	2	4
25	Hawick High School	Yes	S3	Specific learning difficulty - dyslexia	4	2			3	2	2	5	4	4	4	4	4	4
26	Alford Academy	Yes	S2	Specific learning difficulty	2	2	5	5	5	3	5	5	4	5	5	2	3	5
27	Broughton High	Yes	S4	Dyslexia														
28	Broughton High	Yes	S1	Dyslexic														
29	Dunblane High School	Yes	S4	Dyslexia - affecting processing information & extended written work.	4	3	4	5	2	2	5	5	5	4	5	4	5	4
30	Dunblane High School	Yes	S5	Dyslexia	4	4	4	4	3	2	2	4	4	5		4	4	4
31	Dunblane High School	Yes		Dyslexic - information processing and commitment of ideas as extended written response.														
32	The Gordon School	Yes	S2	Specific learning difficulty of a dyslexic nature	2	2	3	4	3	2	4	3	4	2	3	2	3	3
				AVERAGE for students who will continue with speech recognition	**2.65**	**2.59**	**3.82**	**4.25**	**3.07**	**2.81**	**3.63**	**3.88**	**3.68**	**3.53**	**4.11**	**3.19**	**3.50**	**4.26**

Table 10: Changes in student skills since starting the speech recognition training

Key:
1. 'Don't know'
2. 'Worse'
3. 'No change'
4. 'Improved slightly'
5. 'Improved moderately'
6. 'Improved significantly'

We also asked staff to test reading and spelling using standardised tests before and after going through the CALL speech recognition training. Only four staff actually tested five students' reading and spelling directly before and after the speech recognition training and the results were patchy: some students showed no or no significant change, while others showed huge improvement. Table 11 gives the results, but there are no conclusions that can drawn from the pattern of changes.

Chronological age at pre test	Tests used	Pre score	Post score	Time between pre and post	Score change between pre and post
Reading					
Student A 12 yrs 1 mth	Macmillan	10.3 comprehension 8.9 sentence	10.3 comprehension 12.3 sentence	4 months	0 comprehension 3.6 yrs sentence
Student B 12 yrs 1 mth	Macmillan	14.3 comprehension 12.0 sentence	15.0 comprehension 12.0 sentence	4 months	0.7 comprehension 0 sentence
Student C 14 years	Burt Reading	9.1	11.1	3 months	2 years
Student D 12 yrs 1 mth	Neale Analysis	12.0	11.9	12 months	- 3 months
Student E 14 yrs 1 mth	Cloze 3 Reading	9.7	10.4	10 months	9 months
Spelling					
Student A 12 yrs 1 mth	Schonell	9.8	9.9	4 months	1 month
Student B 12 yrs 1 mth	Schonell	8.6	10.6	4 months	2 years
Student C 14 years	Schonell	7.2	7.5	3 months	3 months
Student D 12 years 1 month	Burt-Inglis	6.6	8.3	12 months	1.9 years
Student E 14 yrs 1 mth	Young's Spelling	7.3	7.3	9 months	0

Table 11: Changes in literacy skills, measured using standardised tests

10. Reasons for using speech recognition

We asked staff why the students intended to continue using speech recognition, and for what subjects and learning tasks. The most common reasons to use speech recognition were: the speed at which text could be produced; the legibility and spelling accuracy; and independence. Students generally intended to use speech recognition for longer pieces of work in English or for projects and reports.

Student	Year	Difficulty	Program	Reasons to use speech recognition, and tasks
10	S4	Arthogryphosis	Dragon NS 4	*"It would provide a rest from using her chin control but everything depends on how competent she becomes."*
11	S2	Oligoarticular juvenile arthritis	Dragon NS 4	*"When her wrist is sore and struggling to write. English, social subjects and other areas requiring a lot of writing."*
12	S4	Specific learning difficulties affecting spelling and speed of writing	Dragon NS 4	*"For lengthy essays in English."*
13	S3	Dyslexic, dyspraxic & dyscalculaic	Dragon NS 4	
14	S2	Dyslexia	Dragon NS 4	*"Only way to produce work that can be read. Whenever extended writing is required."*
15	S2	Dyslexia	Dragon NS 4	*"Use VR a bit in English and history. But it did take a long time to correct mistakes."*

Student	Year	Difficulty	Program	Reasons to use speech recognition, and tasks
16	S1	Dyslexia	Dragon NS 4	*"Best way to produce work which can be read easily. As many [subjects] as possible where extended writing is required."*
17	S2	Dyspraxia - laboured handwriting, tight pencil grip, writing speed slow, spelling erratic	Dragon NS 5	*"To facilitate speed of output. Handwriting is slow / keyboarding faster, but not as fast as speech recognition. Initially to be used for extended pieces of writing in English."*
18	S3	Dyslexia	Dragon NS 5	*"Continue due to ease of use for English, social subjects & possibly notes for others e.g. science, graphics"*
19	S3	Motor learning difficulties, dyslexic type difficulties	Dragon NS 5	*"Finds it beneficial in report writing. Will also use for Oral Communication unit in Access 2 English, Access English, SVS , RME, Access social subjects"*
20	S3	Specific difficulty mainly with writing - very poor handwriting	Dragon NS 5	*"Help with writing difficulties. Mainly English."*
21	S5	Cerebral palsy - spastic diplegia; poor mobility; wheelchair user; handwriting poor	ViaVoice - Mac	*"Will continue because it should speed up writing and increase independence from scribe. Will use it in English Intermediate 2, Business management higher, History Higher."*
22	S4	Dyspraxic, Very poor speller/writer	ViaVoice - Mac	*"It is definitely the solution to his learning difficulties. English and subjects where there is extended writing requirements."*
23	S2	Mildly dyslexic, uses cerium lenses	ViaVoice - PC	*"Poor speller Any extended writing but mainly for Standard Grade Folio work"*
24	S2	Dyslexic	ViaVoice - PC	*"Spelling impacting on his vocabulary. Mainly English, Geography project."*
25	S3	Specific learning difficulty - dyslexia	ViaVoice - PC	*"Preferred method of producing passages of text. English"*
26	S2	Specific learning difficulty	ViaVoice - PC	*"Student thinks that he would use it because it is good fun sometimes. English only says the student."*
27	S4	Dyslexia	ViaVoice - PC	*"To see if it would help for extended writing for the move into S5 English subject."*
28	S1	Dyslexic	ViaVoice - PC	*"To help with extended writing with a view to possibly using at home in future."*
29	S4	Dyslexia - affecting processing information & extended written work.	ViaVoice - PC	*"To assist with redrafting long pieces of text - typing slow - spell check difficult. Use in mainly English."*
30	S5	Dyslexia	ViaVoice - PC	*"To assist with redrafting long pieces of text - typing slow - spell check difficult. Use in mainly English."*
31		Dyslexic - information processing and commitment of ideas as extended written response.	ViaVoice - PC	*"Keyboarding speed slow keen to dictate answers. Mainly English."*
32	S2	Specific learning difficulty of a dyslexic nature	ViaVoice - PC	*"Keen to continue and I personally want to finish the programme for doing homework tasks mainly to begin with."*

Table 12: Reasons given by staff for using speech recognition

Summary

1. 40 schools received training and speech recognition software in the course of the project. 23 (57.5%) schools returned Evaluation Forms to CALL. Of the 17 schools who did not return evaluations:
   - 7 schools did not give any particular reason;
   - staff changes or absences were cited as reasons by 5 schools;
   - lack of time, by 4 schools;
   - technical problems, lack of access to computers, and a stolen laptop by 4 schools;
   - the pupil finding a laptop more effective, by 1 school;
   - the pupil leaving school, by 1 school.
2. *The CALL Training Pack was well received by staff.* 20 (69%) staff rated the Pack 'excellent'; 8 (28%) 'useful' and 1 (3%) 'not needed'.
3. *The Pack was effective in training students to use speech recognition.* 32 students in 23 schools used the Training Pack. 23 (72%) students stated that they intended to continue using speech recognition after going through the Training Pack; 1 (3%) was not sure; 8 (25%) did not intend to continue using speech recognition. Of the 8 who did not intend to continue using speech recognition, 6 students said the main reason for not continuing was that they had decided that other software (standard word processor, or word prediction) was more effective for them. One student could not complete the training because of a change of timetable; one student cited poor accuracy and technical problems.
4. *Frequent and regular teaching is essential.* 91% of the students who intend to continue using speech recognition received training once or more per week, in comparison to 37% of students who do not intend to use it.
5. *Staff did not report any significant difference in effectiveness between Dragon NaturallySpeaking and IBM ViaVoice.* On a 5 point scale of 'poor' (1), 'fair' (2), average' (3), 'good' (4) and 'excellent' (5), the averaged rating of NaturallySpeaking was 3.38 and ViaVoice was 3.42, i.e. both were between 'average' and 'good'.
6. *The majority of the students who took part in the project were dyslexic.* Of the 32 pupils who participated, 26 were male and 5 female (one not recorded). Ages ranged from 13 to 16 with the majority of students (11) in second year of secondary school. Most (27 out of 32) of the students were described as 'dyslexic'; 4 as having motor difficulties of a dyspraxic nature; 4 had handwriting difficulties due to cerebral palsy, arthritis or muscular atrophy, and one student had arthogryphosis with severe physical involvement.
7. *In most cases, staff reported that student skills improved throughout the project.* Out of 32 pupils only one pupil's written work was reported as worse after using SR. In most areas – reading, spelling, perseverance, quantity and quality of work, motivation to write and to use SR, ICT skills – there was at least slight improvement.
8. *The most common reasons for using speech recognition were speed, legibility and accuracy of spelling, and independence.*
9. *The most common reasons for not using speech recognition for school work were: other ICT tools were judged to be more suitable; timetable/lack of access; and unsatisfactory accuracy.*
10. *The accuracy and ease of use of speech recognition programs has improved considerably in recent years.* Several teachers who had investigate and tested speech recognition programs two or more years ago commented that the programs had improved, and very few pupils had difficulty getting through the initial program training.

Web sites

BECTa (British Educational Communications Technology Agency)
http://www.BECTa.org.uk/inclusion/speechrecog/index.cfm. Information, reports and case studies from the BECTa Speech Recognition Project. An excellent place to start looking for information about speech recognition in schools.

British Dyslexia Association – http://www.bda-dyslexia.org.uk Information about dyslexia and downloadable information sheets on a wide range of related topics including the use of technology to support writing.

CALL Centre (UK) http://callcentre.education.ed.ac.uk. Electronic versions of this Pack plus other resources on speech recognition, plus information on a range of curriculum-based topics related to augmentative communication and assistive technology.

Comp.Speech FAQ http://svr-www.eng.cam.ac.uk/comp.speech/index.html . This is a site with answers to frequently asked questions regarding all aspects of computers and speech. Chapter 6 is devoted to voice recognition. Some of the information is quite technical, but the site contains a comprehensive guide to the many different packages available, with links to manufacturers' web sites, and a lot of useful background material, including material on health issues.

Computing Outloud (USA) http://www.out-loud.com This site brings together the thoughts of a number of speech recognition users on different programs, with useful information and tips.

Dragon Systems http://www.scansoft.com/naturallyspeaking Developers of DragonDictate and NaturallySpeaking. Support, hints and tips and advice.

IBM Software http://www-4.ibm.com/software/speech Information on ViaVoice and other IBM products. Support, hints and tips and advice.

ICTSLS (ICT for Support for Learning in Scotland) Local authority staff responsible for supporting ICT and Support for Learning.
http://callcentre.education.ed.ac.uk/Useful_Links/Scotland_ULA/ICTSLS_ULB/ictsls_ulb.html

Iansyst Ltd. http://www.dyslexic.com Specialist supplier for speech recognition in education. The site is regularly updated with comparative reviews and the latest pricing information. Lots of useful, comprehensive information on speech recognition.

LD On-Line (USA) – http://ldonline.org Massive collection of resources covering a wide range of SEN issues. The LD In Depth section contains a number of articles looking at strategies for introducing and using spellcheckers, word prediction, voice recognition and other supportive writing technologies.

The Literacy Centre (USA) http://www.the-literacy-center.com Deals with literacy and students with SEN; includes case studies and hints and tips on speech recognition.

Microphones.com (USA) http://www.microphones.com US microphone company – good for seeing which mics are currently recommended.

NCIP (National Center to Improve Practice in Special Education) (USA) – http://www.edc.org/FSC/NCIP Project which ran until 1998 to look at different aspects of the use of technology in Special Education. Site includes detailed articles and case studies on word prediction, organisational software, voice recognition systems, portable computers and other subjects.

SNOW (Special Needs Opportunities Window) (Canada) – http://snow.utoronto.ca Massive collection of material, including curriculum resources (e.g. on-line electronic books), lesson plans and guides to good practice (e.g. guidelines for introducing Dragon Dictate voice recognition).

Speak to Your PC (USA) http://www.microspeech.com/asktechguy/ Supplier site with details of software and accessories and useful information on how to use speech recognition systems.

Speaking to Write (USA) http://www.edc.org/spk2wrt This is an American project exploring the use of voice recognition technology to support secondary age students with disabilities. The site includes an archived discussion group, including contributions from the UK, where many educational and practical issues are discussed.

Typing Injury FAQ: Speech Recognition http://www.tifaq.com/speech.html Detailed reviews of most of the systems available and lots of links to other sites. People should be able to track down any information they want from this, or the Comp.Speech FAQ site.

VoiceUsers Mailing List (USA) http://voicerecognition.com/voice-users Details of a discussion group for people using VR systems, including an archive of previous discussions, can be obtained from this site.

Voice Recognition Software: Ensuring Effective Training And Usage http://www.worc.ac.uk/services/equalopps/VRproject.htm Project to develop and test good practice guides for speech recognition in Universities. Downloadable training resources.

Words Worldwide Ltd. – http://www.keyspell.com Information on Keystone, NaturallySpeaking and voice recognition systems.

Books, articles and papers

See the BECTa, iANSYST (dyslexic.com) and Words Worldwide web sites for some of these, and other articles and case studies.

Baumgarten, J. Alan, Barksdale, Karl & Rutter, Michael (2000) *Dragon NaturallySpeaking QuickTorial* Pub. South Western Educational Publishing.

BECTa (2000) *SEN Speech Recognition Project – Final Report*. BECTa. Available, with reports from schools at: http://www.BECTa.org.uk/technology/speechrecog/project/index.html

Donald, E. (1998) *Voicetext: Evaluation of System when used by Students with Special Educational Needs.* Perth High School, Perth, Scotland.

Donegan, Mick (2000) *Voice Recognition Technology in Education: Factors for Success* Ace Centre Oxford. ISBN 1 903303 00 1.

Donegan, Mick (2001) *Ready for Happy Talking?* **Special Children** January 2001 pp 28 – 32;also http://www.keyspell.com/Speechproducts/speechproducts.htm

Fulton, Susan (1998) *The Essential Simply Speaking Gold* Pub. Science and Humanities Press.

Fulton, Susan (1999) *Begin Dictation Using ViaVoice Gold* Pub. Science and Humanities Press.

Gandhi, Parmod et al (2000) *Dragon NaturallySpeaking Complete* Pub. InSync Software Ltd.

Icke, Nancy, Perella, Rachel & Temple, Cheryl (2001) *You can Talk to your Computer, but will it Listen?* **Closing the Gap** August/September 2001 pp 1, 20, 21.

Kambeyanda, Dona, Singer, Lois & Cronk, Stan (1997) *Potential Problems Associated with the Use of Speech Recognition Products* **Assistive Technology** Vol 9.2 pp 95 101.

Kelway, Peter (1996) *Speaking to Text* Interactive June 1996 pp 34 – 37.

Kotler, Ava-Lee & Thomas-Stonell, Nancy (1997) *Effects of Speech Training on the Accuracy of Speech Recognition for an Individual with a Speech Impairment* AAC Vol. 13 (2) pp 71 – 80.

Kambeyanda, Dona, Singer, Lois & Cronk, Stan (1997) *Potential Problems Associated with the Use of Speech Recognition Products* Assistive Technology Vol 9.2 pp 95 – 101.

Litten, M. *Usable Voice Recognition Software: The Mark College Experience!* Dyslexia Review, Vol. 13 No. 2. Also http://www.keyspell.com/Speechproducts/speechproducts.htm

Lubert, J. & Campbell, S. (1998) Speech Recognition for Students with Severe Learning Disabilities From the Trillium Speech-to-text Project: A Manual for Implementing Dragon Dictate. SNOW. http://snow.utoronto.ca/best/special/lessons/manual2.html.

Miles, Martin, Martin, Di & Owen, Jim (1998) *A Pilot Study into the Effects of Using Voice Dictation Software with Secondary Dyslexic Students*. Devon LEA.

Nisbet, P.D. (1999) *Supportive Writing Technology.* CALL Centre, University of Edinburgh. ISBN 1 898042 13 6.

Rahamim, Lesley (1997) *Talking with Computers* Special! Autumn 1997 pp 57 – 59.

Savison, Rosemary & Springett, Lindy (2002) *When Writing means Talking.* In Dyslexia Contact. BDA, 98 London Road, Reading RG1 5AU.

Tam, Cynthia & Kotler, Ava-Lee (1995) *Assessment Criteria for Using Voice Recognition Systems as Writing Aids* **Closing the Gap** December 1995 pp 14 17.

Wetzel, Keith (1996) *Speech-Recognizing Computers: A Written Communication Tool for Students with Learning Disabilities?* Journal of Learning Disabilities, Vol. 29 (4), pp 371 380.

Wilson, A. (2000) *Speech Recognition Systems.* CALL Information Sheet 15. CALL Centre, Edinburgh.

Appendices

Appendix 1

Introducing Speech Recognition in Schools

Initial Pupil Record

To be completed before the
pupils starts the speech
recognition training

This form collects information about the pupil at the start of the project. Please complete one form for each pupil taking part in the project and store it in your project folder.

1. **Name:**

2. **School**

3. **Date of birth:**   **School year (S1 etc):**   **Gender:**

4. **Form completed by:**   **Date completed:**

5. **Skills**

    5.1. Complete the chart with respect to an 'average' pupil of the same age as the pupil taking part in the project.

	Poor	Fair	Average	Good	Excellent
Writing					
Reading					
Spelling					
Oral skills					
Overall academic level					
Perseverance					
Ability to work indepedently					
Motivation to write					
Motivation to use speech recognition					
Keyboard skills					
Word processing & ICT skills					
Ability to use Speech recognition (if already tried)					

    5.2. It would be very helpful if you could give recent age equivalent reading and spelling scores, if you have them.

	Score	Date Tested	Test used:
Reading age			
Spelling age			

5.3. Please also attach representative samples of the pupil's work, that has been:
- Handwritten
- Typed (by the pupil)
- Dictated to a scribe.

Please say whether the work was a first draft, whether completed with help, etc

6. Record of Needs

	Yes	No
Does the pupil have a Record of Needs?		

7. What methods does the pupil use for writing at the moment, or has used previously?

	Currently in use	Has been tried, but was not helpful	Comments / reasons for success or lack of success
Handwriting			
Dictation to scribe			
Tape recorder			
Handheld spellchecker (Franklin etc)			
Laptop computer (which?)			
Desktop computer (where?)			
Software to support writing (spellchecker, word predictor etc)			
Speech recognition program			
Other			

8. Timetable

	Yes	No
Does the pupil have an adapted timetable?		

If yes, how many hours per week?

	No. of hours per week
Adapted timetable	

9. Learning support in class

	Yes	No
Does the pupil receive learning support in class?		

If yes, how many hours per week?

	No. of hours per week
Learning Support teacher	
Auxiliary / SLA	

10. Where do you expect the speech recognition program to be used? (Tick all that apply)

	Location
Classroom	
Learning support base	
Computer lab	
Home	
Other (please state)	

11. When do you expect the pupil to use speech recognition?

Every day	A few times per week	Once a week	Don't know

12. Does the pupil use a computer at home?

Yes	No	Don't know

Appendix 2

Introducing Speech Recognition in Schools

School Record

1. School: School roll:

2. Number of pupils receiving Learning Support:

3. Number of pupils with a Record of Needs:

4. Number of learning support teachers (full time equivalent):

5. Number of LS assistants (full time equivalent):

6. Please rate the ICT skills and experience of you and your colleagues:

	Poor	Fair	Average	Good	Excellent	Don't know
Word processing & ICT skills in general						
Skill and experience with ICT for pupils with SEN						
Skill and experience with speech recognition						

7. Which computers are currently in use in the Learning Support / SEN / Pupil Support Base?

	Number and type of of machines in use (e.g. A7000, Pentium PC etc)
BBC	
Acorn	
PC	
Macintosh	

8. Computer(s) to be used for the speech recognition program(s) – see next page for details.

	Computer 1	Computer 2	Computer 3
Name and approximate age of machine (e.g. Dell GX110 desktop, 1 year old)			
Operating system (e.g. Windows 98, NT etc)			
Processor (eg. Pentium III 500, Celeron 300 etc)			
Memory (RAM)			
Sound card (if known)			
'Standalone' or 'networked' computer? (If networked, please say the type of network (e.g. RM Connect, ICL, IBM etc)			

Finding out about your computer

The operating system is shown when the computer first starts up – it will display 'Windows 98', or 'Windows NT', or another version of Windows.

The processor inside the computer can often be found in the manual or order. When the computer is first switched on, before 'Windows' screen appears, you will also see the processor type and speed, and the amount of RAM available. Or, click on **Start > Settings > Control Panels** and then double click on **System**.

Look in the bottom right hand corner and you will see the operating system, the processor type, and the amount of RAM in the computer.
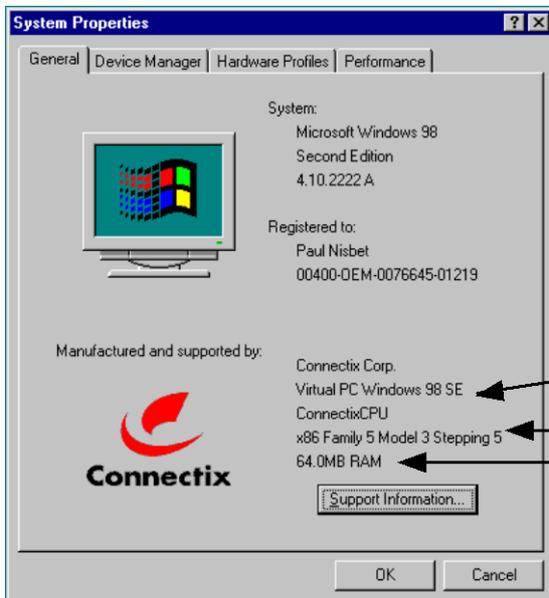
Then click on the **Device Manager** tab, and then double click on **Sound, video and game controllers.** The sound card will be listed – in this case it is a Soundblaster 16 compatible.