Technology assisted speech and language therapy

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Summary Speech and language therapists (SLTs) are faced daily with a diversity of speech and language disabilities, which are associated with a variety of conditions ranging from client groups with overall cognitive deficits to those with more specific difficulties. It is desirable that those working with such a range of problems and with such a demanding workload, plan care efficiently. Therefore, the introduction of methodologies, reference models of work and tools, which significantly improve the effectiveness of therapy, are particularly welcome. This paper describes the first web-based tool for diagnosis, treatment and e-Learning in the field of language and speech therapy. The system allows SLTs to find the optimum treatment for each patient, it also allows any non-specialist user—SLT, patient or helper (relative etc.)—to explore their creativity, by designing their own communication aid in an interactive manner, with the use of editors such as: configuration and vocabulary. The system has been tested and piloted by potential users in Greece and the UK.

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1. Introduction

Emerging at the beginning of the last decade, the World-Wide Web (WWW) rapidly imposed itself as a new medium for interconnecting people throughout the world. Overstepping the initial publishing purpose, Web applications are currently evolving towards the setting-up of virtual working and communication spaces, intended for use by specific communities of users \cite{1}. Today the use of the WWW for telemedicine applications seems a compulsory solution, and has become a standardized infrastructure for giving access to sophisticated telemedicine applications from virtually any machine and operating system. Such a standardized communication platform guarantees accessibility and usability advantages to both customers (patients) and providers (physicians) \cite{2}.

SLTs traditionally work in face-to-face situations with clients (patients) either individually or in groups assessing and treating a wide variety of communication disorders. They see clients on a regular basis but rely on their recommended treatment being followed by relatives, caregivers or untrained helpers at home between therapy sessions. They are faced on a daily basis with a diversity of speech and language disabilities, which are associated with a variety of conditions. Therefore, the introduction of methodologies, reference models of work and tools, which significantly improve the effectiveness of therapy, are particularly welcome.

The introduction of new technologies in speech and language therapy is critical for two main reasons:

1. Shortage of SLTs: a significant problem in many geographical areas is the shortage of SLTs as in
most countries the profession is quite new. For this reason the population of rural areas faces the problem of limited or no professional assistance that in many cases leads to catastrophic results.

2. Carry over problem: one of the problems in any technology-assisted treatment is the carry-over aspect. The problem relates to whether there is any carry-over form of therapy for the patient outside the SLTs immediate working environment and outside of the patient’s home when they leave the house either occasionally (for vacation etc.), or permanently (work purposes etc.).

Given the rapid advances in technology in the later part of the 20th century, one might expect the heavy workloads faced by SLTs to have been at least ameliorated by the development of computer based teaching, treatment and diagnosis team work methods and aids to improve the therapeutic process. However, the use of visual speech aids (VSAs) that are currently employed by SLTs have proven to be problematic for a variety of reasons [3].

Existing VSAs are reported to suffer from:

- Very low usefulness in speech therapy sessions.
- Difficulty in handling a variety of caseloads (adults and children).
- Inability for remote and domiciliary use.
- Lack of standardization that does not allow their integration.

In addition, they do not address the problem of remote collaboration in cases where SLTs specializing in the treatment of different types of cases, could work as a team with patients and helpers, by associating and integrating different treatment methods.

The main objective of Telelogos is to offer an alternative approach to technology-assisted speech therapy. The Telelogos system enables users to work as a team accessing and using existing VSAs as well as other commercial systems and state of the art technologies. The second objective is related to the increase of the percentage of caseloads targeted as studies [3] have revealed that existing VSAs are being used in less than half of the caseloads, and that the mean caseload for which a VSA is applicable is between 20 and 40%. The Telelogos system has improved the existing situation by making the system applicable to at least 50–60% of the mean caseload and more than 70% of the caseloads targeted.

2. Conceptual system design

The Telelogos system is based on three main concepts: public awareness, reference and evaluation.

2.1. Public awareness

With the term public, we refer to physicians, academics, students and individuals that might be interested in, or face problems related to, speech language therapy and learning disabilities. The public awareness module deals with information related to speech and language therapy as well as learning disabilities. The system provides an in depth description of both fields by providing necessary information and knowledge to the public. All the information provided is scientifically acknowledged and was selected by groups of experts.

2.2. Reference

The reference module consists of interactive country maps. Users that may wish to come in touch with a health care professional related to speech and language therapy as well as learning disabilities can select the area on the map that depicts the area of interest. The system provides a set of available professionals in the particular area with individual contact details.

2.3. Evaluation

This module involves tests and evaluation methods that can be utilised by therapists in office or remote sessions with patients. Once the tests have been performed, therapists can ubiquitously monitor patients’ performance and progress.

3. Telelogos system architecture

3.1. System architecture

Telelogos allows users to work as a team, and to access and use existing VSAs as well as other commercial systems and state of the art technologies. It allows SLTs to find the optimum treatment for each patient, by incorporating different treatment factors. In addition, it also allows any non-specialist user—SLT, patient or helper (relative etc.)—to explore their creativity, by designing their own communication aid in an interactive manner, with the use of editors such as: configuration and vocabulary. The first editor helps in identifying the communication elements (existing VSAs) that are
used in technology-assisted treatment and links them to the communication aid under creation. The vocabulary allows the creator to select the correct words for particular parts of the "would be" user display. With the use of a third editor: layout, the creator will be able to develop user friendly interfaces by linking elements from the previous two editors. Through the created communication aid the user-creator is able to analyse treatment information from different perspectives and with greater intelligence, as he/she will be able to access and integrate several types of VSAs and a variety of commercial systems (as shown in Fig. 1).

The link between the three editors and the underlying technology is depicted in the diagram below. As we can see form the diagram the system is composed of the three editors and the hardware infrastructure on which the system is functioning. The configuration editor is linked to external devices and VSAs. A remote user can access the system through the use of a network or the Internet and use any of the three editors.

3.2. System components

By components, we refer to the most important elements (modules) that constitute the functionality of the system. The Telelogos system consists of the following components (functions):

- Multilingual versions: due to the differences in language characteristics the system has been designed to support different language versions.

To date, two language versions have been developed: English and Greek. The English version provides information, SLT referrals and SLT tests concerning speech therapy and learning disabilities, while the Greek version provides the same material but only for speech therapy.

- Informational content: information concerning the fields of speech therapy and learning disability was provided by two professional associations. The information has been transformed into web style documents for effective and appealing use. Some of the material is available for public use while other for private use only.

- SLT and learning disability tests: these test are for private use by professionals. The tests cover a big spectrum of speech and language therapy as well as learning disabilities.

- e-Learning tool: It is used for long distance learning purposes in the field of learning disability.

- Database communication: patients’ details and test results can be stored on the server database. Reporting tools available can use the data stored on the server database to produce valuable reports that reduce costs and time.

3.3. Software selection

3.3.1. Active server pages (ASP) technology

In order for the system to behave in an interactive manner, we adopted ASP technology. It was in 1996 when Microsoft introduced a new technology with powerful application for web development [4]
under the name of active server pages (ASP) technology. ASP is a server-side scripting environment that can be used to create interactive web pages and build powerful web applications. When the server receives a request for an ASP file, it processes server-side scripts contained in the file in order to build the web page that is sent to the clients’ browser (Fig. 2). In addition to server-side scripts, ASP files can contain HTML (including related client-side scripts) as well as calls to COM components that perform a variety of tasks, such as connecting to a database or processing business logic.

3.3.2. Web server
The application is located on a central web-server with an accompanying central database. The Internet Information Server 4.0 (IIS) was adopted to provide web server. IIS defines the basic functionality that can be used to build Web applications. Active server pages and other Microsoft technologies have extended this basic functionality to create a rich environment for application development. The relationship between the IIS core functionality, ASP, and extended architectures is depicted in Fig. 3. The core functions, which IIS provides, include:

- Establishing and maintaining HTTP connections.
- Reading HTTP requests and writing HTTP responses.
- Modifying HTTP headers.
- Obtaining client certificate information.
- Managing asynchronous connections.
- Mapping uniform resource locators (URLs) to physical paths.
- Managing and running applications.
- Transmitting files.

3.3.3. Database
The database used was MS SQL Server 2000. The database lies in the same location as the web server for reasons of performance and maintenance. It is used for storing patient records and information that are crucial for the evaluation of patients. More particularly, the database stores the patients’ history and demographic data, the images used during the performed tests via the system, and special characters that represent the International Phonetic Alphabet (IPA).

3.3.4. ActiveX data object (ADO)
To gain access to the information stored on the database server, the Microsoft technology called ActiveX data objects has been chosen. ADO provides a common programming model for any OLE DB data source; it is essentially a collection of objects that expose the attributes and methods used to communicate with a data source. ADO uses general OLE DB providers to access unique features of specific data sources; it also uses native OLE DB providers, including a specific OLE DB provider that allows access to open database connectivity (ODBC) drivers. Designed to replace the need for all other high-level data access methods, ADO can access relational, indexed sequential access method (ISAM), or hierarchical databases, or any type of data source—as long as there is an ODBC—compliant driver. ADO’s ease of use, speed, and low memory overhead make it ideal for server-side scripting. In fact, ADO is the recommended technology for data access for ASP applications. ADO can be called directly from server-side scripts or from business components.

3.3.5. e-Learning suite
Many institutions of higher education and corporate training institutes are resorting to e-Learning as a means of solving authentic learning and performance problems, while other institutions are hopping onto the bandwagon simply because they do not want to be left behind [5].

E-Learning is the online delivery of information, communication, education and training, which when designed carefully and properly, is definitely a useful tool in a system such as Telelogos. Learning through technology is gaining increasing importance nowadays, and since the learning process is
substantially regarded as a matter of pedagogy, technology is also playing an increasing role in the overall process. Learning through the use of new learning tools, could be more affordable, easier, amusing, convenient to all kinds of students. In addition the solution will incorporate a system that will bring together the different elements of E-Learning, in the three areas of content, services and technology.

Electronic learning is actually a computer-web-based learning that can include a wide set of applications. There are definitely a number of advantages and future benefits that can be derived through the use of an e-Learning software mechanism for both providers and users. The most obvious are, the reduction of cost from the providers’ point of view, while at the same time the user has the flexibility and availability to attend a course offered online. However, there are a lot of other benefits that we could refer to, for both the provider and the user of an e-Learning suite, but this is beyond the scope of this paper. The incorporation of such an educational tool in Telelogos will significantly add to the assets of the system and the service provided to its potential users. This implementation gives the providers the opportunity to offer, in an easy and inexpensive way, online courses with a wide range of knowledge within the field of speech and language therapy and learning disabilities.

4. System functionality

In this section, we describe the main functionality of the system by exploring the three conceptual modules (public awareness, reference and evaluation) as they were described in Section 3.

4.1. Public awareness

Public awareness is achieved by providing information and high-level advice in the fields of speech and language therapy and learning disabilities. The information content is directed towards parents and health professionals who wish to be introduced to these two fields as well as to be informed about recent advances and developments. There also exist redirection mechanisms to accredited resources for additional information.

4.2. Reference

The system provides the users with an SLT reference tool. The users can select SLTs in the geographical area they are interested (Fig. 4) by selecting the area on the country map. After the selection the system provides a list of SLTs located in the specified area. In Fig. 4 the areas colored in red have lists of accredited SLTs that parents and health professionals can refer to.

4.3. Evaluation

The evaluation module contains a series of tests for SLTs and experts in learning disabilities. These can be used only by accredited professionals and are password protected. In the next subsections we will briefly describe the tests that are available online.

**Fig. 4** Reference module.
4.3.1. Phonetic and phonological
This test allows the speech therapist to [6]:

- Make a reliable diagnosis regarding the phonological maturity of the child by recording his phonetic repertoire.
- Assess whether the phonemes used by the child correspond to his chronological age.
- Assess the constructive function of phonemes.
- Analyse the child’s phonological system and its functional adequacy.
- Record the phonotactic combinations which the child is able to produce, and.
- Intervene promptly when the development of the phonological system does not correspond to the child’s chronological age. The intervention aim is to promote the organisation of the child’s phonological system in accordance to the adult norm.

Based on phonological theory, speech therapists modify their way of interaction: the target takes on the form of integrating the phonological system of the child and not just enriching his speech with new phonemes.

The particular test consists of simple and composite drawings, which the child is asked to name, and evaluation sheets for the speech therapist. The speech therapist records phonetically the child’s speech by using the International Phonetic Alphabet [7] symbols. Then s/he analyses the productions of the child in relation to their phonological structure and processes. S/he records on the appropriate sheets the isolated phonemes and completes the phonetic repertoire, the phonetic distribution, the system of constructive phonemes and the phonotactic analysis. After the completion of the analysis, the speech therapist has at her/his disposal the phonological profile of the child in relation to its age. Therefore, the speech therapist knows whether there is a discrepancy between the stage of phonological development (the child has reached) and the child’s age.

4.3.1.1. Selecting appropriate pictures for the test. At this stage, the system provides a set of pictures. All the pictures can be selected to run an evaluation or, otherwise, particular pictures may be selected according to specific patient’s needs. Selecting pictures can be accomplished through check boxes (Fig. 5).

4.3.1.2. Viewing pictures and storing data. The pictures are hyperlinks to a page in which data manipulation takes place. The test involves a series of pictures that are presented to the patient. According to patient’s response the user (speech-language therapist, etc.) fills in the appropriate fields (see screen below). Special functions are available to help in completing those fields (Fig. 6).

4.3.1.3. Special functions. As it was mentioned above, throughout the evaluation process, special functions support the user in filling in the answers given by the patients. The screen below represents such a function. By simply clicking on the appropriate field a new window pops-up which actually is used to automate the process of completing the fields by clicking on the appropriate buttons (International Phonetic Alphabet). This tool is used in order to store data in the field labelled ‘Phonetic Transcription’ (Fig. 7).
4.3.1.4. Reports. The reports that can be generated are:

- Phonetic Transcription and Analysis Report.
- Syllable Initial Word Initial Report.
- Syllable Initial Within Word Report.
- Syllable Final Within Word Report.
- Syllable Final Word Final Report.
- Phonetic Index.

The Phonetic Transcription and Analysis report is illustrated on Fig. 8. The report consists of patient details, his/her Phonetic Transcription and Analysis results for the particular date of test.

4.3.2. Other tests included in the system

4.3.2.1. Preventive screening for speech and language disorder in children 4 years of age. This test is the customized version of the French test called ERTL 4 [8]. The test aims to indicate [9]:

- Insufficient modules or deficient modules (sensory, memory, comprehension),
- Delay or disorder of the child’s phonological ability (phonology, segmentation, rhythm).
• Disorder of language skills (vocabulary, morphology, syntax, semantics).
• Disorder of spontaneous oral communication (pragmatics, ability to adjust to the person to whom you are talking to).
• Voice disorders, rhythm problems (stuttering).

4.3.2.2. From spoken to written language: research into the development of phonological awareness. This is a Greek language test that was created within the context of Telelogos. Up-to-date research findings show that a basic prerequisite for the acquisition of reading and writing, apart from well-organised spoken language, is the development of phonological awareness.

Research studies that have been conducted in other languages [10—13] cannot be adjusted nor can they cover the peculiarities of the Greek language. This test aims at [14]:

(i) Constructing a development scale of meta-linguistic skills.
(ii) Creating a graded program of activities in order to facilitate the acquisition of reading and writing.
(iii) Planning a test for the evaluation of reading readiness in relation to phonological awareness for pre-school aged children (3;0, 6;6).

The findings of the research contribute to:

(i) Prevention, by pinpointing children that will face difficulties in acquiring written language. This can be achieved by taking into account

(ii) Early intervention, by providing the necessary therapeutic plans.

The test studies phonological awareness at three linguistic levels:

• Rime: it consists of subtests, which assess the skills of finding, selecting and producing rimes.
• Syllable: it consists of subtests, which assess the skills of blending, segmenting, locating, isolating and manipulating the initial and final syllable of a word.
• Phoneme: it consists of subtests, which assess the skills of locating, isolating, blending, segmenting and manipulating the initial phoneme of a word.

4.3.2.3. The life experiences checklist. The life experiences checklist (LEC) ([15]) is a ‘quality of life’ measure concerned with gauging the range and extent of life experiences enjoyed by an individual and, where appropriate, comparing it with that afforded the general population. It has been designed as a concise assessment instrument, which allows flexible administration with a wide range of client groups, including individuals with learning disabilities, and users of mental health services. Fields of application include quality assurance, programme planning, individual therapy and staff training.

The LEC was developed as a means of gauging for any individual the extent to which they enjoy experiences common to many other members of the population. In terms of the above discussion, as a measure of quality of life, it clearly concerns itself...
centrally with the activities and experiences of a client, and only tangentially with their subjective well-being (given the complexity of the concept, it indeed seems improbable that a satisfactory measure of all aspects of ‘quality of life’ will be provided by any single instrument).

The LEC has been designed as a flexible utility instrument for a range of differing circumstances. Applications may, however, be seen to fall within four broad areas: quality assurance, programme planning, individual therapy and staff training.

4.3.2.4. HoNOS-LD. Health of the nation outcomes scales for people with learning disabilities (HoNOS-LD) [16] is designed for use with people having a learning disability with mental health needs. Its primary aim is to measure change in an individual over two or more points in time as a measurement of outcome for therapeutic interventions. It is intended to measure the problems that a person may have and is not a comprehensive assessment but provides a global rating for that individual. HoNOS-LD is mainly designed to measure outcomes and not inputs. Clinicians may provide significant therapeutic input into the client’s care plan, but the instrument does not measure this. It is not meant to be a rating of disability alone. Thus the scale has items that are designed to measure functional ability and items measuring more transient phenomena that are more likely to change as a result of treatment.

4.3.3. e-Learning
Telelogos provides an e-Learning solution that comprises a valuable tool for Professionals and students that wish to follow a course in the fields of speech therapy as well as learning disabilities. The system maintains three types of users: tutors, students and administrators. A student has access to online subjects concerning his/her course (Fig. 9). The tutor session, involves the online preparation of a course, while the administrator role deals with system maintenance as well as user subscriptions.

5. System testing and evaluation
The process of system testing is a necessary and crucial process for any technological tool and provides an important insight for the system in question, which highlights its strengths and weaknesses and allows necessary alterations before actual use by its potential users. After the system release, Telelogos was evaluated to assess its capability to successfully meet user expectations. The feedback of the evaluation method (questionnaire) provided evidence on the effectiveness of the system by potential users who were introduced to the system for the first time.

The evaluation was expected to provide insight about the following:
• The effectiveness, efficiency and impact of Telelogos on end users, and;
• the achievements of the Telelogos in comparison to other comparable VSAs.

Effectiveness, efficiency and impact examines two important questions:
• To what extent have the objectives of Telelogos been achieved?
• Was the functionality of Telelogos appropriate?
While achievements refer to questions such as:

- How does Telelogos compare with similar systems?
- What were its major successes and failures?
- Does it fulfil the prerequisites to attract its target group?

For the purpose of the evaluation, the system was implemented and set-up in a clinical center that is located at Athens (Greece) and was accessed by potential users from Greece and the UK.

5.1. Participants

Twenty speech and language therapists who possessed personal computer (PC) equipment were selected by the evaluators and were initially contacted by e-mail, telephone or face-to-face appointment. The selection of the participants was thoroughly examined in order to have a representative sample. Therefore people from different theoretical backgrounds were carefully selected as evaluators-users. The small sample size enabled in-depth feedback to be received from all the participants, which otherwise would not have been possible. After the 20 selected therapists agreed to participate in the evaluation, they were given all the necessary instructions, asked to explore Telelogos and fill out the questionnaire provided to them within a specific period of time (3 weeks).

5.2. Questionnaire

The evaluation of the system was based on questions concerning characteristics such as user friendliness of the interface, functionality, system reliability and effectiveness. A questionnaire-containing both closed and open questions was prepared by the authors and was distributed to selected users to test the prototype system in practice. The terminology used in the questionnaires was explained for clarity.

Questions were divided into five sections:

- Personal background information relating to SLTs computer skills and Internet competence.
- Questions that concerned the interface of the system.
- Questions relating to the functionality of the system and its operational features.
- Questions considering the informational content provided through the system and comparisons to other similar tools.
- Questions revealing users overall impression from their experience.

5.3. Criteria used

In order to evaluate users acceptance and perspective of Telelogos, the assessment combined a set of different criteria such as usefulness in therapy sessions, user friendliness, accuracy of feedback, range of uses, portability of the system, affordability etc. The focus was mainly on layout and vocabulary editors’ use with some high level use of the configuration editor. However, it is worth mentioning here that the users’ computer skills were a critical factor that highly affected the answers given. Thus, questions regarding user competence associated with the exploration of the World-Wide Web, as well as questions about their “computer” habits were also included in the evaluation form and they were taken into consideration by the authors for further analysis of the results.

5.4. Results

Based on the feedback from the evaluation, Telelogos met users’ expectations thus satisfying their requirements and needs in terms of function, content and presentation. The majority of the users that participated in the evaluation process pointed out the efficacy of the system both in technical and user interface terms. The evaluation has shown that the predefined users’ requirements have been met successfully, and that the system is able to increase the efficiency of users’-therapists’ work. All users—evaluators noticeably reported consistency in style and, on average, seemed satisfied. The speed of the system, in terms of response to user requests was characterized “normal” by 70% of evaluators, “fast” by 15% of them and was characterized “slow” by 15%.

Users’ feedback regarding the operations and handling of Telelogos was satisfactory. More than half of the users involved in this evaluation (70%) characterized Telelogos, as user friendly, easy to navigate with no particular log-in or other operational failures. Naturally critical factors were the individual computer competence and familiarity with Internet applications, which effect users answers to these features.

Additionally, the responses showed that most users reported to have a good and clear understanding of the content and the design of the system. Omissions in terms of content were not reported and the usefulness of the information obtainable via the system was evident since 65% of the users reported that it was “very” useful to them and 35% “somehow” (Table 1).

The table below (Table 2) illustrates the percentage of Telelogos usage in relation to the disorders
of the adult and child client groups that SLTs refer to. The lion’s share belongs to voice disorders and disfluency in both children and adults, followed by speech and language delay and other disorder types. Learning disability and hearing impairment follow in terms of potential usage of the system, and neurological types and other disorders are next in sequence.

Useful conclusions can be derived by comparing the results of Table 2 above with those derived from recent similar studies [3], as represented in Table 3 below. The initial target of Telelogos was to achieve higher percentages of usage for those types of disorders presented in the shaded cells of Table 2. This target was successfully achieved. These types of disorders cover 89% of the total children caseload and 84% of the total adult caseload.

Users’ feedback from the evaluation reveals that Telelogos can receive higher percentages of use in all disorder types compared to the results of previous reported studies. Estimations show that Telelogos usage can reach 94% of the total children caseload and 95% of the total adults caseload. On the contrary the total use of other VSAs included

### Table 1 User interface evaluations

<table>
<thead>
<tr>
<th>Telelogos</th>
<th>Very fast</th>
<th>Fast</th>
<th>Normal</th>
<th>Slow</th>
<th>Very slow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed (%)</td>
<td>Very</td>
<td>15</td>
<td>70</td>
<td>15</td>
<td>Not at all</td>
</tr>
<tr>
<td>Usefulness (%)</td>
<td>65</td>
<td>35</td>
<td>20</td>
<td>11</td>
<td>Not at all</td>
</tr>
<tr>
<td>Display (%)</td>
<td>67</td>
<td>20</td>
<td>11</td>
<td>14</td>
<td>Not at all</td>
</tr>
<tr>
<td>Accuracy of feedback (%)</td>
<td>72</td>
<td>14</td>
<td>11</td>
<td>14</td>
<td>Not at all</td>
</tr>
<tr>
<td>Value of feedback (%)</td>
<td>75</td>
<td>14</td>
<td>11</td>
<td>14</td>
<td>Not at all</td>
</tr>
<tr>
<td>User Friendliness (%)</td>
<td>68</td>
<td>32</td>
<td>14</td>
<td>11</td>
<td>Not at all</td>
</tr>
<tr>
<td>Range of uses (%)</td>
<td>65</td>
<td>32</td>
<td>14</td>
<td>11</td>
<td>Not at all</td>
</tr>
<tr>
<td>Portability (%)</td>
<td>100</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Affordability (%)</td>
<td>100</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

### Table 2 Usage of Telelogos by type disorder according to user groups

<table>
<thead>
<tr>
<th>Disorder type</th>
<th>Client group</th>
<th>Adult (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Children (%)</td>
<td>Telelogos use (%)</td>
</tr>
<tr>
<td>Hearing impairment</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Voice disorders and disfluency</td>
<td>24</td>
<td>51</td>
</tr>
<tr>
<td>Learning disabilities</td>
<td>13</td>
<td>16</td>
</tr>
<tr>
<td>Cleft palate and physical disabilities</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Speech and language delay and disorder</td>
<td>17</td>
<td>20</td>
</tr>
<tr>
<td>Neurological</td>
<td>35</td>
<td>17</td>
</tr>
<tr>
<td>Others</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>
Table 3 Usage of VSAs by type disorder

<table>
<thead>
<tr>
<th>Disorder type</th>
<th>Client group</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Children (%)</td>
<td>Adult (%)</td>
</tr>
<tr>
<td></td>
<td>Case load (%)</td>
<td>VSA use (%)</td>
<td>Case load (%)</td>
</tr>
<tr>
<td>Hearing impairment</td>
<td>3</td>
<td>32</td>
<td>5</td>
</tr>
<tr>
<td>Voice disorders and disfluency</td>
<td>24</td>
<td>45</td>
<td>4</td>
</tr>
<tr>
<td>Learning disabilities</td>
<td>12</td>
<td>3</td>
<td>17</td>
</tr>
<tr>
<td>Cleft palate and physical disabilities</td>
<td>—</td>
<td>—</td>
<td>4</td>
</tr>
<tr>
<td>Speech and language delay and disorder</td>
<td>53</td>
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<td>60</td>
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<td>Neurological</td>
<td>8</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>Others</td>
<td>8</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Fig. 10 Telelogos compared to other VSAs.

in previous studies can reach up to 66% of the total children caseload and only 27% of the total adults caseload.

Fig. 10 provides valuable insight for the evaluation of the system in comparison to other VSAs available in the market. Various attributes such as usefulness, display, user friendliness, portability, affordability, accuracy of feedback and range of use were the key points that users were asked to consider when comparing Telelogos to other VSAs. The predominance of Telelogos is evident as it provides the only Internet solution currently in use.

According to users’ evaluation, three criteria proved to be the main assets of Telelogos: portability, affordability and user friendliness. Telelogos rates in respect to those attributes were more than satisfactory and undoubtly have precedence over the other VSAs in question. In terms of portability, all other VSAs received extremely low rates, in the range of one to four, while in contrast they rated Telelogos with a mean rate of eight. This is due to the fact that Telelogos provides a solution to the carry-over problem (“transfer” therapy outside the SLT’s working environment), which afflicts SLTs when using technology-assisted treatment.

6. Conclusions

The evaluation results were very promising and demonstrated user satisfaction. The efficacy of the system both in technical and user interface terms is more than satisfactory. Regarding the functionality of the system, users reported that it proved extremely helpful because it contains a multitude of useful information that can be easily accessed thus reducing dramatically the time required for data retrieval.

In conclusion, we can say that Telelogos contributes to the improvement of:
(a) Health services quality.
(b) Speech and language therapy services quality.
(c) Information technology advancements.

Telelogos provides great potential in supplementing traditional delivery of services and channels
of communication in ways that extend therapists' ability to meet the needs of their patients. This leads to enhancement of access to information and resources, empowerment of patients to make informed healthcare decisions, streamlined organizational processes and transactions, and improved quality, value, and patient satisfaction. The implementation of Telelogos holds great potential for facilitating communication, fostering dynamic collaboration, increasing employee productivity and enhancing satisfaction. Interactive communication processes can supplement traditional delivery systems, extending the patient/provider interaction beyond the clinical visit. Web-enabled processes are available to users regardless of time and distance, offering increased convenience and ease of use. Knowledgeable consumers are better able to stay healthy, manage their healthcare needs, seek services, and make informed healthcare choices.

References


