Developmental reading and writing disorders: courseware as a remedial tool

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Abstract

Many children, irrespective of language or nationality, show difficulties in the reading and writing areas (for dyslexia as a deficit reported in many different orthographies, see Aaron 1989a). As far as these deficits are concerned, the use of computers as a remedial tool is now taking off and there are a number of computer programs devoted to their treatment. The choice of suitable computer programs is undoubtedly very important in the setting up of effective remedial treatments. From data obtained from a long-term experiment held at an Italian Junior High School involving children with severe reading and writing problems who have been undergoing computer-based remedial treatment, we attempt here to draw some conclusions about the main criteria for evaluating software products suitable for the treatment of such problems. We will also attempt to show that if correctly chosen and adequately used, courseware can be considered an effective remedial tool in the realization of the human potential of children considered impaired in the field of reading and writing.

INTRODUCTION

A relatively high total number of children in their first years of school have difficulties with reading and writing. In many cases these difficulties represent a considerable obstacle to these children, leading them to refuse to apply themselves at school; they are also at times a real barrier to continuing with school.

This is also true for the Italian language, despite the fact that it can be considered a relatively ‘shallow’ or ‘transparent’ language (regarding the transparency of Italian, see Miceli, Silveri and Caramazza, 1985); that is, there is a fairly regular correspondence between grapheme and phoneme (for details of the characteristics of Italian, see Morchio, Ott and Pesenti, 1989).

The aim of this paper is to report on a long-term experiment which we have been conducting with Italian children who have specific difficulties in the areas of reading and writing and for whom remedial therapies have been adopted which focus on the use of computers and in particular of specific courseware. The promising results obtained with these programs have encouraged us to try to determine how computer-aided remediation can contribute to the solution of these problems, paying special attention to the characteristics the software has, or should have, for it to represent an effective treatment of these disorders.

WHICH READING AND WRITING DIFFICULTIES?

The term ‘reading and writing difficulties’ commonly means a series of problems which are typologically and etiologically very different but which all relate to the ability to both interpret and produce written texts autonomously.

Below we shall deal exclusively with the problems of coding and decoding written language, as these have been the focus of our diagnostic and remediation experiments. We shall deliberately leave aside those disorders which relate to reading comprehension, linguistic expression, lexical richness and the correct interpretation and production of syntactic links.

COMPUTERS AS AIDS TO REALIZING POTENTIAL

Within this area - the problems of coding and decoding written language - we shall be referring exclusively to those problems which can be defined as ‘specific’ to reading and writing (otherwise defined as dyslexia and dysgraphia), i.e. those which are not present at the same time as other cognitive, emotive, behavioral or attentional disorders (for definition of specific as opposed to non-specific problems, see Aaron 1989b).

Our decision to limit remediation to subjects who have specific problems in coding and decoding written language was made according to, on the one hand the need for a very accurate functional diagnosis of the type and the extent of the disorder, and, on the other the need for effective tools. Only on these premises is it possible, in our opinion, to set up a remediation experiment capable of allowing the generalization of the problem and the subsequent definition of strategies which can be generalized and used on a large scale.

WHICH TOOLS?

Computers in remediation

The use of the computer as a remedial tool presents many advantages, particularly compared with traditional tools, which are in general based on the constant presence of a teacher next to the impaired child.

The use of the computer in the remedial process is in itself a source of numerous advantages: it permits resource saving; it allows for greater flexibility; it provides a guarantee of uniformity while at the same time permitting the individualization of the work path; it makes it possible to obtain a detailed analysis of performance and to store it for the purposes of a comparative assessment of the various levels of ability acquisition.

In some cases, and for some specific disorders, computers can even be deemed as indispensable tools (on the advantages of the use of computers in this field, see Morchio and Ott, 1989).

Generally, when one speaks of the advantages of the use of computers compared to traditional methods, one tends to put particular emphasis on the element of ‘motivation’. For it seems that the mere fact of working with a computer makes the activity of recovery agreeable to the child, whereas otherwise it would be laborious, monotonous and demotivating.

Certainly in some respects this is true, but it is definitely not the computer alone which guarantees success in a field as special as that of remediation, where the tasks to be completed are by their very nature difficult and the activities to be carried out are often repetitive. In order to capture the child’s attention and consequently to obtain the best possible results, the computer on its own is not enough; it is also the quality and the specific characteristics of the work which the computer enables one to do, which play the most important role.

The key elements in computer-aided remediation (as a whole already advantageous) is, therefore, the software. It is this which can qualitatively change the work (and consequently the results which can be obtained); its functional characteristics, its specific nature, its appropriateness to the problem, the degree of interaction it achieves, its capacity to involve and not to tire the user, and to make the work as varied, as lively and as interesting as possible.

Software in Remediation

The choice of the software to be used in the context of remediation is of fundamental importance, on which the result of the entire re-educational process can to a large degree depend. The parameters on which to base the choice of software may be various. It is particularly important to have a clear understanding of existing products so as to make a correct evaluation of the individual products, in particular with regard to the quality of communication and usability (regarding software evaluation criteria, see Olimpo and Ott, 1989).
The quality of communication has to do mainly with the features of facility and simplicity of interaction between user and machine; the capacity of the product to avoid repetitiveness and thus not tire the user to provide feedback and both appropriate and effective reinforcement. Basically, one can speak of good-quality communication if the software is capable of initiating a dialogue in which the user is motivated to work, is sufficiently autonomous in carrying out the activities and at the same time is given the right kind of guidance to complete the task at hand.

Usability is a question primarily of the features of ease of use of the product, its flexibility, its adaptability to various situations, and the possibility of modifying its contents in such a way as to present exercises which are of the same type but are still new and varied.

In order to make a functional choice, however, it seems to us to be of fundamental importance that the exercises proposed by the software are interpreted and used in accordance with a theoretical interpretative model (of the normal processes of reading and writing and of the specific disorders). The software should also be effectively integrated into a global remediation program.

**Existing products**

There are many products at present available on the market which can be used as tools of recovery in the case of specific reading and writing problems. However, they are not always designed specifically to treat these disorders but are often simply programs conceived for linguistic education and are sometimes aimed at the lowest school levels.

There is a basic lack of specific products conceived according to an exemplary theoretical model. As we have seen, it seems always necessary to operate with precise cognitive models and to try to assess the effective value of each individual product on the basis of a theoretical model, in order to insert it into the appropriate remediation procedure.

The existing programs are often very different from each other in terms of content but they can be distinguished typologically into two broad categories on the basis of the instructional strategy they use: 1) drill and practice; 2) word processing environments for the free production of texts.

Drill and practice exercises are often presented in the form of a game. The most sophisticated use graphics and sounds in a pleasant and fascinating way, but all of them, by their very nature, maintain a structure which is relatively rigid. The standard procedure consists of a question followed by a reply and subsequently possible feedback on the correctness of the reply. These drill and practice programs are in general quite rigidly directive and often place drastic constraints on the type of reading and/or writing modality. This means on the one hand that they are not very attractive for the young user, but on the other they are very functional in terms of the specificity of the recovery program.

The types of possible exercises are varied, ranging from recognizing letters, to cloze tests, to text reconstruction, to games such as crossword puzzles and the putting together and splitting up of words. One rarely finds relatively complete products comprising exercises of various types which would thus make it possible to alternate and combine the various activities. Often, another limit of these products is the unalterability of the contents, which, of course, drastically limits their usability. The free environments for the writing of texts, on the other hand, are much more flexible and make it possible to carry out more than one activity at the same time and in the same environment (free composition, summary, reconstruction exercises, etc.). In a certain way, therefore, they are much more ‘plastic’ and seem to be better adapted to various types of demands and, on the whole, to remediation which is composite and varied in content.

The main limit of these programs lies in the total lack of interaction, i.e. in the absence of any possible feedback or correction, elements which are of fundamental educational importance.

**The context and the activities**

The experiment which is reported here took place in close collaboration with the Don Milani Scuola Media (Junior High School), an experimental school in Genoa whose organizational structure provides remedial facilities expressly reserved for pupils who are pathologically late in acquiring the use of written language.

The subjects in question are identified at the moment of starting the remediation which is composite and varied in content.

The characteristics of the activity towards which the pupils chosen are directed can be summarized as follows:

* attention is concentrated on the physical aspects of the linguistic code, on the signifier;
* reading and writing abilities are exercised outside a significant context and are not tied to the learning of contents; the activity is thus aimed at instrumental linguistic competence;
* the exercises are to be seen as ends in themselves, i.e. with no aim other than learning to improve performance in the exercise.

These characteristics give the activity a necessarily repetitive, fragmented character and make it, as it were, ‘unnatural’ in that it is far removed from the usual methods of exploitation of reading and use of writing. In this sense, the proposed exercises bear the same relation to reading and writing as exercises to strengthen muscles do to practicing a sport.

The success of the remediation procedure relies on the factors of quantity and intensity, as well as precision of aim. Timed reading, reading from right to left, reading unspaced or incorrectly spaced texts, anagrams, the reading of phrases with words or letters missing, together with the relevant writing tasks, are all situations which are reproducible with varying degrees of accuracy in paper media, but the modalities and operational possibilities which are exercised using such materials are by no means comparable with those exercised by means of a computer and appropriately chosen software. The replies or the manipulation of words and texts repeated several times in a graphically clear way, the immediate comparison between the starting datum proposed by the program and the solution offered by the user, the possibility of seeing the original writing corrected in actual time as the result of one’s own actions — these are some of the conditions which increase the efficiency of the exercises. To resort once again to the metaphor of physical education, using such instruments in remedial programs rather than other more traditional ones is like using specific, corrective gymnastic equipment rather than doing free exercises. If one then also thinks of the possibility of spreading the use of such instruments in schools, and not only on an experimental basis, efficiency should be seen in terms of the facility with which the exercised material can be prepared in advance and adapted to the operators.
THE INSTRUMENTS

The experiment we conducted was focused on the use of the computer and makes use primarily of educational software. Obviously, in the choice of the products to use we wanted to ensure that the material used fulfilled the criteria of theoretical and practical functionality referred to above. The software used always permits the contents to be altered in the sense that different exercises can be created on the model of the basic exercise, and those products were chosen which would respond to both types - open environments and drill and practice – since they have both demonstrated different types of value and adaptability. Fundamentally, however, the products were set within an exemplary theoretical model in such a way as to make possible a differential analysis of performances and a functional remediation program. We based our experiment on the theoretical interpretive model of 'two routes' (Figure 1: for details of the model, see Marshall, J.C. 1984).

![Two-route model for decoding written language]

This model states that there are two possible routes for the decoding of written language: the visual route, which operates in a global fashion, analyzing words as whole units; and the phonological route, which works in a sequential way on the basis of the system of grapheme-phoneme conversion and vice versa. The software used in our experiment was reorganized on the basis of:

- Speech:
- Sub-Word level
- Orthographic
- Phonological Conversion
- Sub-Word Level
- Orthographic
- Phonological Conversion
- Writing

The theoretical model so as to make it conform to our approach to the problem of 'reading and writing difficulties'. Specifically, we used both programs designed expressly for remedial purposes and programs mainly focused on other tasks, such as comprehension. Because of their flexibility, these last could usefully be employed to prepare exercises centred on the processes of coding and decoding. These are the characteristics common to the programs used:

* interweaving of reading and writing: the initial stimulus is always given by the suggestion to de-codify, followed by a task to be completed in writing; * possibility of grading and diversifying the activity and/or content by personalizing the remedial procedure and making it progressive;
* providing immediate feedback, by showing the error or rejecting the wrong solutions and, in parallel, providing suggestions about how to proceed;
* registering and quantifying (with various levels of precision) the results of the performances and the 'behavior' of the user.

Normally, in the time available, (about an hour and a half a week) the pupils alternate between the different working environments proposed. This is a further guarantee that their motivation and consequently attention is maintained and that they therefore do not become tired and too familiar with the exercises. As the subjects are about 11-13 years old and because the activity is structured in an extremely individual way, we have tried very carefully to avoid generating the sensation of isolation with regard to the machine (its requests, its pace) and of rendering the activity passive.

The close and intimate presence of the teacher (in a one-to-three relationship with the pupils) in this sense helps to minimize this problem, as well as to expedite the activation of knowledge processes (meta-cognition) regarding the nature and the specific object of the activity being carried out, the difficulties encountered, and the procedures set in motion by the subject. The experiment has shown that this type of involvement, while not actually resolving the problem, plays a very important part in the success of remediation. The teacher also has the task of regulating the intensity and duration of the commitment required. The direct contact with the pupils permits the analytical observation of the work and provides data for the programming of the following phases of the treatment.

CONCLUSIONS
The computer-aided remedial treatment of developmental reading and writing impairments seems to give on the whole very good results, at least as far as our experiment is concerned. One of the main problems of such a treatment appears to be the choice of the most fitting software products. We suggest therefore to evaluate first of all the different available products on the basis of their usability and of their quality of communication. We must however stress that the most important factor appears to be to use products designed or reorganized on the basis of a theoretical model, thus allowing a specific, not generalized, functional remedial treatment for each impairment.

REFERENCES