

# “Whole Language” System for the Technology Enhanced Learning of Handwriting and Reading

Gabor HROTKO

*jMind Consulting Ltd, 5-9 Színház u. Budapest, 1014, Hungary*  
Tel: +36703176050 Fax: +3613768169 Email: [Hrotko@t-online.hu](mailto:Hrotko@t-online.hu)

**Abstract:** Developing the Write&Read technology enhanced learning system we had the following objectives: full autonomy of learning, motivation, personalization. The system allows to learn handwriting and reading autonomously starting from the very beginning up to full acquisition of skills. For motivation the lessons are embedded in an animated series of fairy tales where an active role belongs to the student who is always helping the characters by handwriting and reading in difficult situations. An innovative IT based teaching technology of copying written and spoken words is magnifying learning efficiency. The system is adaptive, the teaching process is tailored to the personal abilities of the student thanks to an automatic switching between exercises with increasing difficulty. In the virtual environment the “whole language approach” is working very naturally to achieve reading comprehension. A special construction of repetition is helping the student to acquire higher-level reading skills.

## 1. Introduction

The main objective of the Write&Read (WR) project was to build a technology enhanced learning system for the most traditional discipline of education, the teaching of handwriting and reading. In the background of the project there is a patented invention proposing technical and methodological innovations to reform the teaching of literacy on the base of IT solutions such as flash animation, digital voice and image recording, multimedia, automatic speech recognition, automatic handwriting recognition. The result of the implementation is a new teaching technology where the curriculum is embedded in an animated story, the traditional methods of school teaching are improved and integrated using original IT methods. The basic idea was that by copying written and spoken language elements the students will learn the essence of writing and reading. This simple idea evolved into a sophisticated e-learning methodology offering the opportunity for everybody to learn literacy autonomously without the help of teachers, independently of languages, cultural backgrounds and pedagogical infrastructures, economic and social circumstances. The implementation of the system in several languages will open a perspective for the army of illiterates to step into the world of knowledge.

## 2. State of the art

A rampant activity is going on in the development of computational aids to help children in learning writing and reading. In the last decade a number of lively animated products have been issued to help and stimulate learning, while eliminating its monotony<sup>T1</sup>.

Start Write is a useful resource for teaching beginners how to write. While it sounds odd to have a computer program, which develops handwriting skills, Start Write lets instructors create customized practice sheets with guidelines which students can trace. It comes with

several different sizes and styles of fonts, clip art and a spell checker, as well as all the standard features of a word processor. Instructors can add arrows to show the direction of hand movement, type in dots, dashes or solid letters, and control the shading of the printed text. It will print lines and underlines and is very easy to use, with a simple Point and Click feature. There are template lessons included, and one can create phonics or spelling pages or even letters to a friend, depending on the level of the students. It also lets the user import graphics and pictures, for personalizing the printed page.

There are a large number of computerized aids helping children to learn reading. Probably the most sophisticated experiment was the “Watch-me! Read” program (WMR) developed by IBM<sup>ii</sup>. Using WMR, “...a child can read aloud from an electronic book accompanied by a computerized "pal" who provides assistance throughout the reading session. The "pal" recognizes mistakes and asks students to repeat words they have misread, reading words correctly to them if necessary. ... Because teachers often do not have the time to provide every child with individualized reading attention, WMR assists in addressing differences in reading experiences and language backgrounds through an engaging, book-based approach.” WMR may be a very useful aid to improve reading after acquiring a certain level of skills and experience.

The objective of the ambitious THRASS system<sup>iii</sup> was to reform the teaching of English writing and reading. Its central module contains 44 phonemes in 120 different written combinations. Choosing one of these combinations the student can hear its proper pronunciation. Inversely, when a phoneme is pronounced the student has to select one of its possible written forms. Reacting to the right choice its pronunciation is repeated and a sample word containing the selected written form is shown. Using the “Writing Module” pronounced sample words are to be typed by the student. In case of wrong typing the correct form is displayed. Finally, in the “Spelling Module” sample words are presented for spelling. The "Teaching Guide", explains how the THRASS multi-sensory resources (audio, magnetic, printed, software and video) are used in the ten-stage phonics program known as THRASS Whole-Picture Keyword Phonics. The program teaches children and adults about the building blocks of English words and the thinking processes, the metacognitive processes or, more formerly, the Phonographic Metacognition involved in reading and writing the five hundred basewords of written English. The guide is divided into eleven main sections, with one section for each of the THRASS 10 stages and a separate Photocopiable Section containing reference and assessment sheets, which if desirable, may be laminated. There was a strong criticism about THRASS<sup>iv</sup>, because in spite of the original intention it does not represent an autonomous pedagogical means but remains on the level of a teaching aid.

Several types of electronic storybooks are available for entertaining children and supporting teaching activities<sup>v</sup>. In the animated storybooks, like Mindstorms of Lego, children find themselves in a virtual futuristic world where they face challenging tasks to be solved in interactive working mode and in some cases the course of the story can be controlled by them. Practically the features of THRASS, WMR and electronic storybooks can be observed within the functionalities of the workstations produced by the leaders of the teaching aids market (e.g. Leapfrog, Riverdeep, Pearson). This kind of workstation help children of 5-8 years in learning writing and reading and they represent very useful means to introduce the world of literacy to children in an amusing and informal way.

A common shortfall of the described solutions is that they do not treat the teaching of writing and reading jointly, according the contemporary principles of education. Another common deficiency is that they only cover a certain phase of learning, they do not handle the whole process from the very beginning until the learner fully acquires handwriting and reading skills. A further problem is that the application of computerized teaching solutions

requires a significant modification of the curriculum and the appropriate preparation of teachers.

A general problem is that there is no product on the market that can help the students to learn literacy autonomously.

### **3. Characteristics of the WR system**

#### *3.1 General*

The student is working on a tablet PC equipped with a display and a pen for handwriting and a headset for reading exercises. An ergonomically suitable arrangement is designed for comfortable writing position. The system can teach students handwriting and reading starting from the very beginning up to the full acquisition of these skills. The use of the system does not require neither the help of a teacher nor the knowledge of computers.

#### *3.2 Motivation*

One of the most important elements of the learning technology is the motivating environment built to hide the obligatory character of teaching, to make learning an interesting game. In the school the students are not very much interested in the process and results of learning. Some of them may have positive influence of the parents or the teachers, others may be stimulated by the good guide of eminent students, the competitive spirit in the class. However, all these factors are occasional. Building the WR system it seemed obvious to use the computer not only as a means for teaching but also for the purposes of motivation, the more so, since children are fans of TV and electronic games. In the WR system the writing and reading exercises are embedded in a series of an animated fairy tale. Every scene is embedding a lesson with 4-5 object sentences. The story is going on in ABC-land where everything is concerned with letters, writing and reading can make miracle, bring to life the lifeless things, rebuild the ruined houses, cure diseases, feed the hungry and give thirsty to drink. The students are highly motivated because they actively participate in the story helping the characters in problematic situations by writing and reading the object sentences. They feel like a magician seeing that the meaning of written or read sentences is realized and the story takes a positive turn. The constrained nature of teaching disappears, the students are waiting for new adventures where they can help friends, the characters of the story. Thanks to this motivation the students acquire skills of handwriting and reading in an amusing way without any embarrassment.

#### *3.3 Innovative teaching technology*

IT allowed us to design and implement a new teaching technology, which transmits the methods of traditional school teaching in very efficient forms. For example functional teaching is working throughout, whole sentences of the story are used in every exercise. To get used to the abstraction of writing letters the students draw schematic pictures of birds, animals and different objects in the first lessons. Most importantly the traditional method of copying is made a central element of the e-learning technology. The copying exercises are technically arranged in the writing area of the display located under the animation. This area reminds 2 lines of the school textbook, in the upper line the object sentences are demonstrated, the students copy them to the lower line. Copying written and spoken samples the students feel are in a close cooperation with the story.

Basic forms of written copying are as follows:

- a) Overwriting the letters of the object sentence,
- b) Copying the letters of the object sentence,
- c) Writing the letters of the object sentence under dictation.

In the last form a machine voice is pronouncing the letter (phoneme) to be written. In our understanding this operation is also a copying action because hearing the sound the student recalls the requested letter and copies it by heart.

d) Writing words of the object sentence under dictation.

Basic forms of spoken copying are as follows:

a) Echo like copying of sounds. When the student is overwriting or copying a letter a machine voice is pronouncing its sound and the student is to repeat it.

b) Echo like copying of syllables. A machine voice is rhythmically pronouncing the syllables of the object word and the student is to copy them in the same rhythm.

c) Reading the letters of words. When the student is overwriting or copying a letter he/she has to pronounce its sound. In our understanding this operation is also a copying action because when writing a letter the student recalls the proper sound and copies it by heart.

d) Reading the syllables and words of the object sentence.

The copying phonics exercises teach students the relationships between the letters (graphemes) of written language and the individual sounds (phonemes) of spoken language. They teach students to use these relationships to read and write words.

### 3.4 *Evaluation*

An important element of teaching handwriting is the evaluation of letters written by the student. The algorithm measures the quality of the current letter and immediately demonstrates the result by colouring its surface. This gives a new motivation for the student who wants to get only the best colours. The quality check is working also in reading letters, syllables and words. In case of misreading the opportunity to repeat the reading operation is offered to the student before a correction is done by prompting.

### 3.5 *Reading instruction*

Technology enhanced learning of reading is based on fine transitions between exercises of increasing difficulty. Initially only spoken copying is taking place. When the student is overwriting the current letter its sound is demonstrated simultaneously and the student is to echo the sound. After numerous repetitions the inseparable connection between letters and sounds becomes fixed. Later the spoken copying goes on with syllables. A machine voice rhythmically pronounces the syllables of the word and the student is to repeat them in the same rhythm watching the written form in the meanwhile. The systematic use of this method helps the student to discover the clue of reading. The result will be cleared in exercises of higher difficulty modes. In the first reading mode the students are reading only letters by themselves. In the next mode the syllables are to be read autonomously and in the most difficult mode the students are reading entire words. In the WR technology enhanced learning system it is natural that the algorithm is checking the correct reading of letters, syllables and words and in case of misreading helps the student by prompting – pronouncing the correct sounds.

### 3.6 *Personalization*

The system is adaptive, the teaching process is automatically tailored to the ability and endeavour of the student because the learning progress is controlled by a feedback mechanism. Students acquire skills gradually, there are 5 levels of writing difficulty and 5 levels of reading difficulty with automatic transitions between them. The program evaluates every sentence written and/or read by the student and sets automatically the proper writing/reading mode for the next sentence according to the result of the previous one. When the evaluation discloses progress a more difficult mode will be set, in case of getting a “medium” mark the mode will remain unchanged. When the evaluation algorithm clears that the student had problems in writing or reading in currently finished exercise, it sets a

lighter mode for the next exercises. The mode can change from sentence to sentence, up and down and this gives a new motivation to the student to keep on writing and reading in higher-level modes.

The adaptive character of teaching appears also in the tolerance to speech impediments. When the student tries several times to make spoken copies of a specific phoneme and his/her impediment (e.g. lisp) hinders to pronounce it correctly the machine will accept the false pronunciation, according to the level of a built-in predefined tolerance. However the system may help to eliminate speech impediments by giving methodically more exercises on those specific phonemes showing not only the right pronunciation but also the animated pictures of the correctly working vocal organs.

In general, the process reminds teaching by a personal teacher who is sitting with the student, checking the quality of written or read words and sentences and helping when necessary according the progress of the student.

#### **4. The “whole language” approach may work**

The technology enhanced learning methodology of WR system described above may develop the basic literacy skills like writing ability, phonological awareness very efficiently. However, it is not easy to develop reading comprehension. If readers can read the words but do not understand what they are reading, they are not really reading. Text comprehension is the reason for reading. The aim of the whole language approach was to construct environments where reading skills evolve in a natural way. According to Kenneth Goodman “Whole language learning builds around whole learners learning whole language in whole situations” [1]. He believed that children should learn reading as they learnt to speak, heuristically, by semantic associations, trials and errors. Presently the method is not used anywhere since school teaching is lacking whole situations and semantic associations.

However, in the WR system this method started to work very naturally thanks to the virtual motivating environment and the IT based teaching methodology. The epic animated scenes with the audible texts are self-explaining. The sentences to read emerge in the plot of the story and they are in intellectual coherence and textual overlap with the previous sentences and with the situation in which they arise for reading. In this environment powerful semantic associations born facilitating the interpretation of written sentences. Understanding the situation the students will fully comprehend the spoken sentences. They learn to read by trials and errors, in case of mistakes the program helps them by prompting the correct sounds or words.

Although the WR technology enhanced learning system has a natural potential to realize the whole language approach, the reading comprehension is developing slowly. There is a long way from the phonological awareness to the reading comprehension. To help the progress we designed and implemented a special construction to build a learning environment richer in semantic associations. For this purpose a traditional pedagogical method, the repetition was introduced to help matching the spoken and written form of sentences. Repetition means that in a lesson the object sentence or its parts appear several times in spoken and written form, in different modifications, e.g. in the following sequence.

1. In a problematic situation of the scene the object sentence is presented in spoken form by one of the characters. It is organically connected with the plot of the scene, with its textual and pictorial context.
2. The object sentence is written by the student under dictation.
3. Finishing the writing exercise the sentence is read aloud by the student (helped by prompting) and its meaning vivifies in the animated story to solve the problematic situation and produce motivating emotions.

4. The lesson is going on with the next situation containing the next object sentence.
5. When the lesson ends its events are summed up by reading of its object sentences.
6. At home the student - using prepared paper worksheets - tells the parents what happened in the scene then writes and reads the object sentences with the help of parents.
7. At the beginning of the next lesson the last lesson is repeated in a narrative form and the reading of its object sentences takes place again.

This arrangement allows the whole language methodology to start working! Recalling the last scene the students remember every aspect of it, especially the problematic situations. They know very well the object sentences, after all they have done several exercises on them. Now, before reading an object sentence a preparation phase helps easier reading. The problem situation connected with the object sentence is demonstrated and retold by the narrator. In his spoken text some expressions are bringing to mind the words of the object sentence in advance. Then the object sentence appears in written form as a target of reading. The students can half read it and half guess its meaning using all the earlier accumulated knowledge of the sentence and the emerging semantic associations. As K. Goodman wrote they predict, select, confirm and correct themselves searching for the meaning. With other words they guess, make hypothesis about the content of the sentence then check the guessed version. In this process of “trial and error” besides image reading deciphering is often used by the students to read some words. The program helps by prompting when misreading takes place.

## **5. Implementation**

In fact the project had a clearly research character. We designed and developed a new method of IT based learning for writing and reading, wrote the curriculum, the scenario of the story and integrated them together. New IT solutions and means have been developed such as the presentation and sequential control of exercises, interaction between the exercises and the animated story, evaluation of writing and reading quality, evaluation of the student’s progress and personalisation of teaching. There were also a number of practical means to develop, like prompting in reading, showing the difference between a letter written by the student and its ideal version, the missing roundhand Hungarian font, etc. One of the most difficult things was to compile simple object sentences for writing and reading exercises, which serve at the same time for solving critical situations. Presently, in test applications we observe some practical problems to be corrected, e.g. the optimal time gap between pronunciation of syllables, the optimal distance parameters of the light point leading the pen of the student, etc. The experience of the test applications will be used to develop the final commercial version of the program.

In test applications we use two different hardware solutions for writing: tablet PC and ordinary PC equipped with a digitizing tablet. The use of tablet PC gives better writing results because the work of hand and eyes is not separated in space.

Presently the system is implemented in Hungarian. The methodology allows to implement the system in any languages with modifications requested by the nature of the object language and its teaching traditions.

Problems of dissemination:

In Hungary the official interest to use such a technology enhanced learning tool for teaching is low. For the majority of teachers it will be also difficult to accept the application.

Leading companies producing technology enhanced learning means to help teaching of handwriting and reading are not interested to accommodate a product from an unknown source even if it is more intelligent than their own.

A further problem of spreading is the high price of tablet PC-s providing better results in learning handwriting.

## 6. Test applications

Test applications have just started in Budapest in K classes of private schools for 6 years old children. After the first 9-10 lessons the results are impressive, children like to learn in the motivating environment and have a quick progress in writing and phonics. They write good quality strokes in requested sequence. After writing and pronouncing a significant number of letters and syllables they are becoming experienced in matching the written and spoken form.

Some children learning in the first class also use the system to improve writing skills and phonological awareness. The whole language approach is helping them to develop reading comprehension.

Predictable areas of early applications:

- Children of the Hungarian minority in the surrounding countries loosing Hungarian literacy (and identity),
- Functional illiterates,
- Handicapped children, children with dyslexia,
- Private schools, individual use.

## 7. Concusion

In summary it can be stated that a completely new learning system has been developed allowing students to learn handwriting and reading in an amusing way without the help of teachers or parents. One of innovative features of this automated system is that the teaching process is personalised, tailored to the abilities of the student. Another new achievement is that the virtual motivating environment allowed to apply first the so called “whole language approach” for the development of higher level reading skills.

The whole system consists of 40 lessons what can be passed in 2 months, provided a one-hour per day learning schedule. The experimental use of the system started, the results are very promising according the opinion of teachers and parents. The experimental stage should be expanded to have an overall picture about the applicability and efficiency of the system, its advantages and disadvantages.

The implementation of the system in other languages will allow to acquire literacy in countries where the education system is underdeveloped. The vast number of illiterates in the world (about 900 millions) and even in some developed countries (e.g. 30-40 millions in the USA) gives reasons to set a high priority to the further development and distribution of these type of systems.

Companies are invited to participate in the development of various national versions of the WR system.

## References

- [1] Goodman, K. (1986). What's whole in whole language. Portsmouth, NH: Heinemann Educational Books.

---

<sup>i</sup> e.g. see [www.mrsalphabet.com](http://www.mrsalphabet.com), [www.bbc.co.uk/schools/4\\_11/literacy.shtml](http://www.bbc.co.uk/schools/4_11/literacy.shtml)

<sup>ii</sup> see [www.ibm.com/ibm/ibmgives/grant/education/programs/reinventing/watch.shtml](http://www.ibm.com/ibm/ibmgives/grant/education/programs/reinventing/watch.shtml)

<sup>iii</sup> see [www.thrass.co.uk](http://www.thrass.co.uk)

<sup>iv</sup> (see [www.rrf.org.uk/](http://www.rrf.org.uk/))

<sup>v</sup> see a survey in [www.literacyandtechnology.org/v3n1/chenferdigwood.htm](http://www.literacyandtechnology.org/v3n1/chenferdigwood.htm)